APPENDIX A

Standard Operating Procedures

A.1 HW-0000-G-001 Demilitarization by Detonation

Copy #1

SOC NEVADA LLC
HAWTHORNE ARMY DEPOT
STANDING OPERATING PROCEDURE

ITEM: Ammunition and Explosives

OPERATION: Demilitarization by Detonation

DODAC: Various

EST. DAILY PROD. RATE: Various

PACKAGED: 1.1

ORGANIZATION SYMBOL: HWAD-PP&PE

FIRE SYMBOL: 1

SOP: HW-0000-G-001 DATE 02/10/11

UNPACKED: 1

REVISION DATE

FIRE SYMBOL: 1

CHANGE 1 DATE

CHEMICAL: N/A

AUTHORITY: W52P1J-11-D-0002

UNCONTROLLED DOCUMENT

PREPARED BY: Terri Trujillo, ext. 7998 — 6/20/11 Date

REVIEWED BY: Process Engineering — 6-20-11 Date

SUBMITTED BY: Suzanne Lahre, ext. 7262 — 6/20/11 Date

Current Document For Reference Only

CONCURRENCES – OPERATING CONTRACTOR:

Manager, PP&PE — 6/20/11 Date

Manager, ES — 6-23-11 Date

Manager, QA — 6/22/11 Date

UXO Tech III — 22JUN11 Date

Manager, Safety — 6-23-11 Date

Manager, APOD — 6-21-11 Date

Industrial Hygienist — 6/23/11 Date

Director, Base Operations — 6-23-11 Date

Approval, General Manager — 6-27-11 Date

Director, M&L Services — 6-22-11 Date

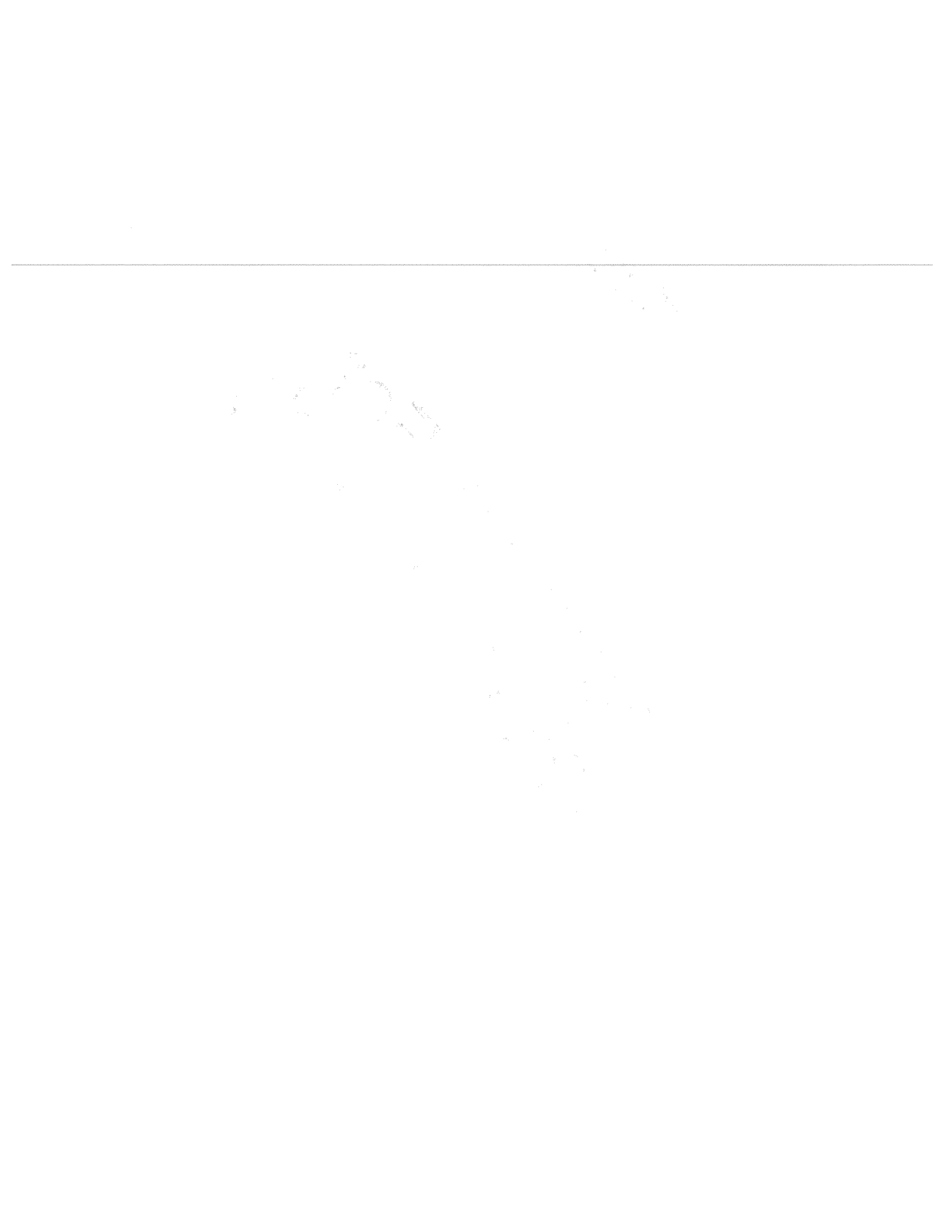
CONCURRENCES – ADMINISTRATIVE CONTRACTING OFFICERS STAFF

Chief, Ammunition Surveillance — 27 June 11 Date

S & OH Specialist — Not required SR Date

Environmentalist — Not required SR Date

Approval, Depot Commander/ Assigned Representative — Not required SR Date



SOC NEVADA LLC
HAWTHORNE ARMY DEPOT
STANDING OPERATING PROCEDURE

ITEM: Ammunition and Explosives	OPERATION: Demilitarization by Detonation
DODAC: Various	EST. DAILY PROD. RATE: Various
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~~FIRE SYMBOL: 1~~	~~SOP: HW-0000-G-001 DATE 02/10/11~~
UNPACKED: 1	REVISION DATE
FIRE SYMBOL: 1	CHANGE 1 DATE 06/27/11
CHEMICAL: N/A	AUTHORITY: W52P1J-11-D-0002

PREPARED BY: _____
Terri Trujillo, ext. 7998 Date

REVIEWED BY: _____
Process Engineering Date

SUBMITTED BY: _____
Suzanne Lahre, ext. 7262 Date

CONCURRENCES – OPERATING CONTRACTOR:

Manager, PP&PE	Date	Manager, ES	Date
Manager, QA	Date	UXO Tech III	Date
Manager, Safety	Date	Manager, APOD	Date
Industrial Hygienist	Date	Director, Base Operations	Date
Approval, General Manager	Date	Director, M&L Services	Date

CONCURRENCES – ADMINISTRATIVE CONTRACTING OFFICERS STAFF

Chief, Ammunition Surveillance	Date	S & OH Specialist	Date
Environmentalist	Date	Approval, Depot Commander/ Assigned Representative	Date

TABLE OF CONTENTS

Supervisor's Statement....1

Operator's Statement....2

Acronyms....3

Index of Operations....4

Remarks....6

References....6

Process Flow Plan....7

Safety Requirements For New Bomb Demolition Ground Operations....8

Security Requirements For New Bomb Demolition Ground Operations....13

First Aid Instructions....14

Nevada State Highway 359 Map....52

New Bomb Demolition Grounds Map....53

Appendix A: Various Pit Layouts....A-1

Attachment I: Hazard Analysis and Risk Assessment....I-1

SUPERVISOR'S STATEMENT

SOP_____ **REVISION**_____**CHANGE**_____ **DATE**_____

1. The Supervisor will sign this statement:

   a. When first assigned as supervisor of the operation.

   b. When an approved change is made to the SOP.

   c. On the 10th day following the start of the operation.

   d. At least once per quarter during continuing operations.

   e. After absence from the job in excess of 15 consecutive workdays.

2. I have personally reviewed each of the operational steps of this SOP and have no question in my mind that the operation can be performed safely, efficiently, and in compliance with environmental restrictions noted in this SOP. I have verified to my satisfaction that operators have been trained and are capable of performing their part of the operation in a safe and efficient manner and have instructed them to follow this SOP without deviation.

SUPERVISOR'S PRINTED NAME: _____

SUPERVISOR'S NAME / SIGNATURE	DATE

OPERATOR'S STATEMENT

SOP_____ REVISION_____CHANGE_____ DATE_____

1. The Operator will sign this statement:

   a. When first assigned to the operation.

   b. When an approved change is made to the SOP.

   c. On the 10th day following the start of the operation.

   d. At least once per quarter during continuing operations.

   e. After absence from the job in excess of 15 consecutive workdays.

2. I have read, or have had read to me, and understand the general and specific safety and environmental requirements, the personnel and explosive limits, and the work description and inspection requirements necessary to accomplish my operation. I have been thoroughly trained in, and am familiar with, my part of the operation and I agree to abide by these instructions throughout my assignment to the operation.

NAME / SIGNATURE	DATE	OPERATION NUMBER

DZHC 45-E

ACRONYMS

ACO – Administrative Contract Officer
APOD – Ammunition Process Operations Division
AR – Army Regulation
ATR – Ammunition Transfer Record
CCTV – Closed Circuit Television
CIIC – Controlled Item Inventory Code
CPR – Cardiopulmonary Resuscitation
DOD – Department of Defense
DODAC – Department of Defense Ammunition Code (8 digit)
DODIC – Department of Defense Identification Code (4 digit)
DZHC – Day and Zimmermann Hawthorne Corporation
DOT – Department of Transportation
EPA – Environmental Protection Agency
ES – Environmental Services
FM – Field Manual
GSR – General Safety Requirements
HC – High Capacity
HWAD – Hawthorne Army Depot
HWY – Highway
IAW – In Accordance With
ICM – Improved Conventional Munitions
M&L – Munitions & Logistics
NDEP – Nevada Division of Environmental Protection
NEW – Net Explosive Weight
NSN – National Stock Number
(O) – Operator's function
PCP – Pentachlorophenol
PWP – Plasticized White Phosphorus
PRO – Property Reutilization Office
PP&PE – Production Planning and Process Engineering
QA – Quality Assurance
QASAS – Quality Assurance Specialist Ammunition Surveillance
QATIP – Quality Assurance Training and Inspection Plan
(QC) – Quality Check for operators
(S) – Safety Check for operators
RT – Rough Terrain
SOP – Standing Operating Procedure
TM – Technical Manual
UXO – Unexploded Ordnance
WP – White Phosphorus

INDEX OF OPERATIONS

OPER	SITE	TOTAL EXPL. AT SITE	DESCRIPTION	PAGE
1	Nevada State Highway 359	N/A	Road Closure Procedures	15
2	New Bomb	N/A	Open and Prepare New Bomb Demolition Grounds	19
3	New Bomb	40,000 lbs.	Verify Documentation and Unload	23
4	Pit Area	40,000 lbs.	Preparation of Pit and Placement of Explosive Materials	26
5	New Bomb	40,000 lbs.	Set Up Initiating System	31
6	New Bomb	40,000 lbs.	Detonate Charge	36
7	Pit Area	40,000 lbs.	Inspection of Pit Area and Unexploded Munitions	39
8	Pit Area	40,000 lbs.	Misfires	42
9	Pit Area	40,000 lbs.	Low Order/Partial Detonation	44
10	New Bomb	N/A	Disposition of Materials	46
11	New Bomb	5,000 lbs.	Clean-Up	49
12	New Bomb	5,000 lbs.	Close Range	50

The maximum Pit Limit is 4,000 lbs. NEW, with no more than 10 pits used per day.

The NEW for the storage magazines at New Bomb is limited by the Table of Distances for Storage of Explosive Materials in ATF P 5400.7 55.218. (See Table below)

§ 55.218 Table of distances for storage of explosive materials.

Quantity of Explosives		Distances in feet							
Pounds over	Pounds not over	Inhabited buildings		Public highways with traffic volume 3000 or less vehicles/day		Passenger railways--public highways with traffic volume of more than 3,000 vehicles bay		Separation of magazines	
		Barricaded	Unbarri-aded	Barricaded	Unbarri-caded	Barricaded	Unbarri-caded	Barricaded	Unbarri-caded
0	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	258
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290

REMARKS:

The purpose of this procedure is to cover the general routine demilitarization of conventional ammunition and explosives and the occasional treatment of reactive waste at the New Bomb Demolition Grounds. The procedure consists of road closure operations, general New Bomb Demolition Grounds operations, safety, meteorological requirements, opening range, setup of demolition pits, misfires/partial detonation, inspection and cleanup of area.

This procedure does not include the demilitarization of HC or Colored Smoke, WP or PWP, except for emergency demilitarization requirements.

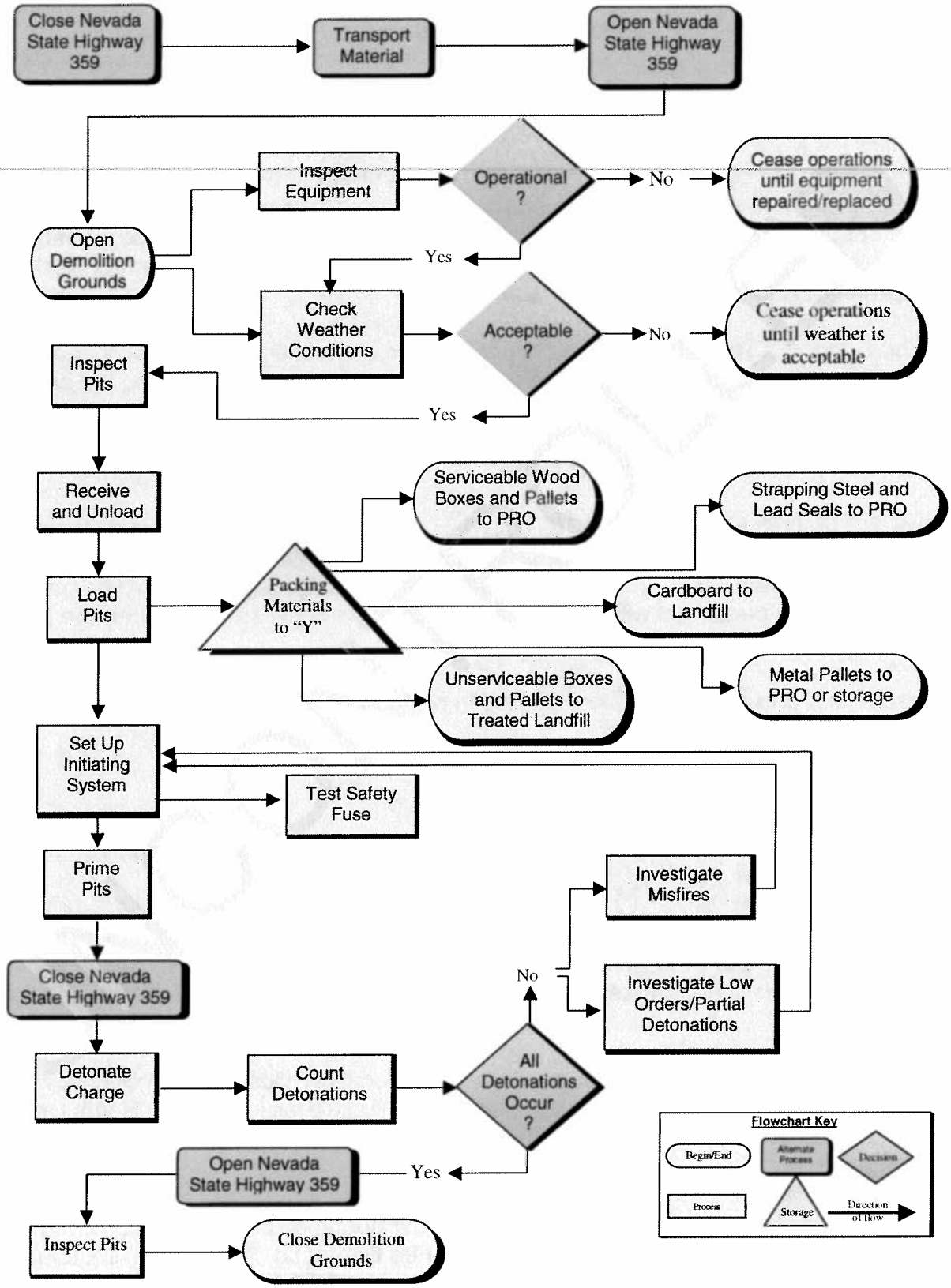
The receipt and outloading operations of this SOP will be IAW HW-0000-L-002.

REFERENCES:

ATF P 5400.7 (09/00)
AMC R-755-8
AR 385-63
DOD 4145.26-M-1
SB 742-1
FM 5-250
TM 9-1300-277
TM 9-1375-213-12
DOD 4160-21-M
AMC-R 700-107
AMC R 385-100
DOD 4160-21-M-1
MIL-STD-882D
DA PAM 385-64
TM 43-0001-28

CHANGE 1: Adds miscellaneous changes.
Page i: Adds Signature Line for Supervisory UXO Tech III.
Page 2: Adds updated Operator's Statement to SOP.
Page 3: Adds to Acronyms List.
Page 6: Adds Change 1 to SOP.
Page 9: Changes wording in Safety Requirement 10c.
Page 11: Deletes 'Explosive, C4' from 'Demolition Initiation Item' list.
Page 13: Adds wording to Safety Requirement 22a.
Page 15: Added 'Transients' to 'Explosive/Personnel Limits'.
Page 19: Added 'Transients' to 'Explosive/Personnel Limits'.
Page 20: Changes wording in Step 3c of Operation 2.
Page 51: Adds new Step 4a4 to Operation 12.

PROCESS FLOW PLAN



SAFETY REQUIREMENTS FOR NEW BOMB DEMOLITION GROUND OPERATIONS

1. Adhere with all safety and security requirements listed in The General Safety and Security Requirements (SOP HW-0000-A-001) pertaining to the performance of this procedure.

2. Warning signs are posted around New Bomb Demolition Grounds to restrict the area from public access and to assure proper segregation of activities.

3. During demilitarization by detonation operations, the number of people in the area exposed to the hazard must be kept to a minimum. The number of personnel engaged in the disposal by detonation operations will be no fewer than two and operations will be arranged so that not all of the personnel are exposed to an incident. Under no circumstance will an operator work without another operator in close proximity with visual contact.

4. All personnel, including transients, will sign logbook and contact the Supervisor, or designated representative with demil certification, immediately upon arriving. Upon leaving the area they will sign out. **No one is authorized to sign another person in or out!**

5. All personnel will wear approved safety glasses with side shields while working in the pits.

6. **PROCEDURE IN THE EVENT OF ELECTRICAL STORMS** - When an electrical storm approaches the range, the Supervisor, or designated representative with demil certification, will secure the job and the range. Trucks loaded with ammunition or explosives will be positioned in the loading area. All personnel will be evacuated to the personnel safety shelter, the New Bomb Demolition Grounds Office, or out of the New Bomb area.

7. Tools, machinery, and other equipment utilized in performing explosive operations will be specifically approved for the purpose.

8. Smoking and spark/flame producing devices:

   a. Smoking is permitted only in the designated smoking area. Smoking is not permitted in vehicles at any time.

   b. Matches, lighters, and similar devices will not be transported through the New Bomb Demolition Grounds area. Personnel are specifically ordered not to carry matches or other spark producing devices. Strike anywhere-type kitchen matches are prohibited at all times in all locations.

   c. The Supervisor, or designated representative with demil certification, will obtain a written authorization from the Fire Chief for the use of safety matches in the New Bomb Demolition Grounds area. The safety matches will be kept in an M2A1 can, painted red and marked "Safety Matches".

9. In case any casualty, mishap, or accident should occur during disposal operations, the operations will be immediately suspended and reported to the Fire Dept. (ext. 7911), the Director of Munitions and Logistics Services (ext. 7244), Manager of APOD (ext. 7300), Manager of Safety (ext. 7842), and ACO Representatives. Operations will not be resumed until approved by higher authority.

10. Emergency response equipment:

    a. A first aid kit will be issued. The first aid kit will be readily available in the work area at all times when work is being performed.

    b. A vehicle will be available to transport casualties that may occur during demilitarization/ disposal of specific munitions.

    c. A minimum of two people who have had Red Cross First Aid Certification training (or equivalent) and have a current certification will be on-site at all times during demolition operations.

    d. Radio communications between the pit area and the New Bomb Demolition Grounds Office will be available during all demolition operations.

11. When the fire hazard is high (as determined by the Supervisor, or designated representative with demil certification/Fire Marshall) because of unusually dry weed growth, operations will not be undertaken unless properly manned mobile fire fighting equipment is standing by in a safe location.

12. Each person working or visiting the New Bomb Demolition Grounds will maintain vigilance, both visually and audibly, to assure no aircraft are in the New Bomb Demolition Grounds' airspace. If an aircraft is sighted in the New Bomb airspace, initiation of detonations cannot take place until verification that the aircraft is clear of the New Bomb airspace. If possible, the aircraft identification number or other identifying characteristics such as color, jet, propeller, military or private, etc., will be recorded. Aircraft that violate New Bomb airspace will be reported immediately. Military aircraft will be reported to Fallon Base Operations at (775) 426-2419. Private aircraft will be reported to the Reno Air Service Station at (775) 784-5321. In all cases, notify ACO staff at ext. 7020.

13. A current, approved permit must be posted at New Bomb Demolition Grounds Office. Compliance with the requirements of the permit is mandatory.

14. The handling or disposition of ammunition, explosives, or other hazardous materials, which are not specifically identifiable, will not be undertaken without authorization from the Safety Office and written approval from the Commanding Officer or designated representative and the General Manager or designated representative.

15. In all demolition operations, the effects of preliminary trial runs with reduced quantities of explosives will be evaluated to determine the optimal explosive quantities for detonation, prior to a maximum quantity of explosives being authorized for detonation.

16. The CCTV system will be used to monitor and record ALL detonations. If the detonations are normal, the videotape may be used for subsequent recordings. Unusual events (i.e., low order, misfires, etc.) will have the inspection of the pit(s) and resolution of the incident monitored and recorded. Appropriate HW and ACO personnel will retain the recording for review. In the event the CCTV is inoperable, operations may still be carried out, but extreme caution will be exercised when investigating post-firing results.

17. All motorized vehicles, including pick-ups, vans, heavy equipment, etc., at New Bomb will have their wheels chocked.

18. All individuals at New Bomb will be responsible for the enforcement of all safety regulations and for the safety of all personnel and operations in the New Bomb Demolition Grounds. If there is any question about procedures or safety, operations will be deferred until competent authority has been consulted and proper approval/authority obtained. Improvised methods of detonation are strictly prohibited.

19. The following table contains a list of the equipment and gages used in operations. The quantity needed is dependent upon the procedure.

EQUIPMENT AND GAGES	NSN/SPECIFICATION	QUANTITY
Backhoe	Commercial	1 each
Bulldozer	Commercial	1 each
Camera, closed circuit television	Commercial	2 each
Driver, fence post	Commercial	As required
Dumpster	Commercial	As required
Equipment, video recording	Commercial	2 each
Extinguisher, fire	Class 5/10 BC	5 each
Forklift, rough terrain	6000 lbs.	1 each
Front end loader	Commercial	As required
Grader	Commercial	As required
Sign, Begin Work Zone, #NWZ-1	Commercial	2 each
Sign, Double Penalty in Work Zone, #NWZ-3	Commercial	2 each
Sign, End Work Zone, #NWZ-2	Commercial	2 each
Sign, Flagman Symbol, #W20-7A	Commercial	2 each
Sign, Reduce Speed Ahead, #R2-5A	Commercial	2 each
Sign, Road Closed Ahead, #W21-4 (MOD.)	Commercial	2 each
Sign, Road Work Ahead, #W21-4	Commercial	2 each
Sign, Prepare to Stop, #NPS-1	Commercial	2 each
Sign, Speed Limit 55, #R2-1	Commercial	2 each
Sign, Speed Limit 70, #R2-1	Commercial	2 each
Sign, 30 Minute Delay Possible, #NDP-1 (MOD.)	Commercial	2 each
Sling, lifting	PS-0007-NBOMB	As required
Station, Meteorological	Commercial	1 each
Trailer, with tractor	Commercial	As required
Truck, pickup	Commercial	1 each
Vest, flagman's, green	Commercial	As required

20. The following table contains a list of the demolition initiator chain used in operations. The quantity needed is dependent upon the number of detonations.

DEMOLITION INITIATION ITEM	NSN/SPECIFICATION	QUANTITY
Cap, blasting, non-electric	Commercial	As required
Cord, Booster, ¾ lb. Block	Commercial	As required
Connector, detonation cord, plastic/metal	Commercial	As required
Cord, detonation	Commercial	As required
DELETE		
Fuse, Safety	Commercial	As required
Lighter, fuse	Commercial	As required

21. The following table contains a list of tools and supplies used in operations. The quantities required will be dependant upon the procedure. It is not necessary to list those tools that are commonly used in most operations (e.g., strapping, cutters, hammers, screwdrivers, etc.), unless they must be spark-proof. Before introducing common tools and/or supplies onto the line, notify PP&PE to authorize use. Form DZHC-41-E will be used to authorize use of common tools and supplies pending subsequent change or revision to the SOP.

TOOLS AND SUPPLIES	NSN/SPECIFICATION	QUANTITY
Box, special cap carrying	Local Fabrication	As required
Brush, stencil, fountain type	H-B-621	As required
Brush, 3" paint, for enamel or oil base	H-B-420	As required
Cardboard stock	Commercial	As required
Cartridge, respirator, paint type	Commercial	As required
Checklist, Meteorological Weather Station Inspection	Form DZHC-104-E	As required
Checklist, New Bomb	Form DZHC-101-E	As required
Checklist, Pit Log	Form 284-E	As required
Container, for dunnage	Commercial	As required
Container, for scrap metal	Commercial	As required
Container, sealable, for lead seals	Commercial	As required
Coveralls, Flame Retardant	Commercial	As required
Crimper, bench/cutter	Commercial	As required
Crimper, blasting cap, M2	MIL-C-43438	As required
Cutter, steel strapping	GGG-C-835	As required
Filter, organic-vapor ctg.	Standard type	As required
Flag, red, danger, 3' x 5'	Commercial	As required
Glasses, safety, with side shields	Commercial	As required
Gloves, leather palm	Commercial	As required
Hammer, claw, non-sparking	GGG-H-86	As required
Hammer, sledge 3 lb., non sparking	Commercial	As required
Hearing protection	Commercial	As required
Ink, stencil, black	A-A-208	As required

TOOLS AND SUPPLIES	NSN/SPECIFICATION	QUANTITY
Kit, first aid	Commercial	As required
Knife, electricians, pocket	GGG-K-484	As required
Log, HWAD New Bomb AP-9711-1134 Open Detonation Contemporaneous	Form DZHC-223-E	As required
Machine, stencil cutting, 1/2"	Commercial	As required
Mattock, with axe bit	Commercial	As required
Measure, tape, 12 ft.	Commercial	As required
Operator I.D. Stamp	Local Fabrication	As required
Pad, stencil	Commercial	As required
Paint, enamel, gray/sand color	Commercial	As required
Pallet, curb	Local Fabrication/Com.	As required
Palletainer, cardboard lined	Commercial	As required
Pens/pencils	Commercial	As required
Pliers, cutting, diagonal	GGG-P-468	As required
Pliers, electrician	Commercial	As required
Pliers, slip joint, 8"	GGG-P-471	As required
Pry bar, non-sparking, 18"	GGG-B-101	As required
Radio, vehicular	Commercial	As required
Radio, portable	Commercial	As required
Rake, garden type	Commercial	As required
Respirator, dust	Commercial	As required
Respirator, with cartridge, half-face mask	Commercial	As required
Sealer, strapping, assorted sizes	MIL-S-43180	As required
Seals, steel strapping, assorted	ASTM-D-3953	As required
Shield, face	L-F-36	As required
Shovel, non-sparking	Commercial	As required
Shovel, round nose	Commercial	As required
Spacers, wood, 2"x1", 2"x2", or 4"x1", cut to length	Local Fabrication	As required
Stakes, wood, pointed, 2"x4"x36"	Local Fabrication	As required
Stencil board	A-A-1733	As required
Strapping, steel, assorted sizes	ASTM-D-3953	As required
Stretcher, steel strapping	MIL-S-17743	As required
Table	Local Fabrication	As required
Tape, measuring	Commercial	As required
Tape, plastic, electrical	Commercial	As required
Thinner, Enamel	Commercial	As required
Timing device (stop watch)	Commercial	As required

22. The M42 and M46 grenades derived from the ICM projectiles are packed in fiberboard boxes with stretch net. If the pack is damaged upon receipt, the load will be inspected to assure all grenades are intact in the boxes.

    a. If all grenades are not intact in the box(es), proceed IAW General Security Requirements of SOP HW-0000-A-001. When retrieving dropped grenades, a trained munitions handler will visually inspect the grenade to assure the slider is in place and not extended. If the slider is extended, evacuate the area and notify the Supervisor, or designated representative with demil certification, to mark location of the grenade. Notify UXO, Division Manager, Safety, and PP&PE. Wait until notified by UXO that it is safe to return.

    b. Damaged boxes will be repaired or replaced, as needed, and packed in their original configuration prior to continuing operations.

SECURITY REQUIREMENTS FOR NEW BOMB DEMOLITION GROUND OPERATIONS

1. Two drivers for each conveyance will be accompanied by a security guard for movement of CIIC Category I material to and from the New Bomb Demolition Grounds. One driver will be accompanied by a security guard for movement of CIIC Category II material to and from the New Bomb Demolition Grounds.

2. Ammunition/explosives in the pit areas will not be stored overnight at the New Bomb Demolition Grounds unless a security guard is posted.

3. Initiating systems, consisting of safety fuses, detonation cords, fuse lighters, and blasting caps, may be stored in magazines at the New Bomb Demolition Grounds.

4. Explosives not used in the preparation of shots may be stored overnight in the BATF magazines, per AFT P 5400.7 (Dtd 11/2007). The amount to be stored will not exceed 36 boxes at 50 lbs each (total explosive amount equal to one full pallet) or up to 36 boxes until the magazine is full and meets the following conditions:

    a. Explosive materials within a magazine will not be placed directly against interior walls and must be stored so as to not interfere with ventilation.

    b. Containers of explosive materials will be stored so that markings are visible, and so that containers can easily be counted and checked upon inspection.

5. **ALL EXPLOSIVES WILL BE REMOVED FROM EACH NEW BOMB TEMPORARY STORAGE SHED AT THE END OF EACH WEEK.**

6. In the event that there is a large quantity of high explosives remaining after the pits have been prepared, such as in a test shot for new items (i.e., more than 36 boxes), the supervisor will contact storage support and arrange for the powder truck to return that day to remove excess explosives.

FIRST AID INSTRUCTIONS

HEAT EXHAUSTION

SYMPTOMS:	TREATMENT:
Profuse sweating without evaporation (cooling) effect	Remove patient from heat source
Skin usually cold or clammy	Loosen tight clothing
Face becomes ashen or gray	Remove excess layers of clothing
May feel weak, dizzy, or faint	Lay the patient down
May experience nausea and/or headache	Urge patient to drink at least one liter of water
Pulse may be rapid	

HEAT EXHAUSTION NOT TREATED CAN LEAD TO HEATSTROKE. UNTREATED HEAT STROKE CAN AND WILL LEAD TO DEATH.

Heat stroke, though the least likely of the heat related illnesses, is the most serious.

HEAT STROKE

SYMPTOMS:	TREATMENT:
No sweat	Cool entire body by any means available
Hot dry flush skin	Move to shade
Rapid rising temperature	Remove clothing
Pulse strong and rapid	Apply wet towels, clothing, or rags
Becomes unresponsive	Act with speed and vigor - the faster proper treatment is started and executed - the quicker the patient is likely to respond and recover with no ill effects
Pulse becomes weaker as patient progresses into deeper unresponsiveness	
Some moisture may collect on portions of the body but sweat glands have ceased to function	

PREVENTION OF HEAT EXHAUSTION/STROKE:

REMEMBER!
Cool the entire body by any means available.
Drink plenty of fluids.
Do not overwork the sweat producing mechanism.
Wear loose clothing.
Rest frequently

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 1

Site: Nevada State Highway 359

SOP: HW-0000-G-001

REVISION

CHANGE 1

OPERATION: Road Closure Procedures

EXPLOSIVE/PERSONNEL LIMITS: N/A | **TRANSIENTS: N/A**

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

Nevada State Highway 359 will be closed to through traffic during detonations and, as needed, to transport ammunition and explosives to and from the New Bomb Demolition Grounds.

1. Highway Closure for Transportation of Ammunition and Explosives, as Required.

   a. (O)(S) Assure traffic control teams marking the highway are trained to do so and are wearing reflective vests prior to the start of operations.

   b. (O) The Supervisor, or designated representative with demil certification, will direct the traffic control teams, dressed in safety vests, and the communications coordinator to the designated locations to halt traffic during transportation of ammunition and explosives.

   c. (O) The traffic control teams will assure they have all road signs and stop signs before departing.

   d. (O) Set up warning signs on Nevada State Highway 359 at the designated locations as marked on the pavement of Nevada State Highway 359 and Figure 1-1.

   e. (O) Once signs are in place, the traffic control teams will move into position at mile marker 10 (South of New Bomb entrance) and at mile marker 24 (North of Old Bomb Road, Gate 131) on Nevada State Route 359. The Supervisor, or designated representative with demil certification/coordinator will be positioned midway (where radio/cellular telephone access is available) between the two traffic control teams and will relay information/instructions to/from the traffic control teams.

   f. (O) After the traffic control teams are in position, they will inform the Supervisor, or designated representative with demil certification/coordinator, via radio/cellular telephone, that they are in position. The teams will then standby prepared/ready to halt all non-emergency traffic that may approach their location.

g. (O)(S) Storage personnel will notify Supervisor, or designated representative with demil certification/coordinator at least five minutes prior to entrance onto Nevada State Highway 359, who in turn will release this information to the traffic control teams to stop traffic.

h. (O)(S) Once all trucks are received at the New Bomb Demolition Grounds, the Supervisor, or designated representative with demil certification/coordinator will notify flag personnel to release the traffic. The traffic control teams will gather all road signs, as needed, and go to the New Bomb Demolition Grounds Office.

2. Highway Closure Prior to Detonation.

a. (O)(S) Assure traffic control teams marking the highway are trained to do so and are wearing reflective vests prior to the start of operations.

b. (O) Upon completion of the roll call, the New Bomb Demolition Grounds Supervisor, or designated representative with demil certification, will direct the traffic control teams, dressed in safety vests, and the communications coordinator to the designated locations to halt traffic during detonations.

c. (O) The traffic control teams will assure they have all road signs and stop signs before departing.

d. (O) Set up warning signs on Nevada State Highway 359 at the designated locations as noted in Figures 1-1 or 1-2, as needed.

e. (O) Once signs are in place, the traffic control teams will move into position South (toward California) at mile marker 10, and North (toward Hawthorne) at either mile marker 13 or 24 on Nevada State Route 359. The coordinator will be positioned midway between the two traffic control teams with the New Bomb Demolition Grounds Office, and will relay information/ instructions to/from the Supervisor, or designated representative with demil certification, and the traffic control teams.

f. (O) After the traffic control teams are in position, they will inform the coordinator, via radio/ cellular telephone that they are in position. The teams will then standby prepared/ready to halt all non-emergency traffic that may approach their location.

g. (O) The communications coordinator will inform the New Bomb Demolition Grounds Supervisor, or designated representative with demil certification, via radio/cellular telephone, that the two traffic control teams are in position. He/she will then standby prepared/ready to relay any/all communications between New Bomb Demolition Grounds personnel/QASAS.

h. (O)(S) The New Bomb Demolition Grounds Supervisor, or designated representative with demil certification, will notify the communication coordinator and/or road guards ten minutes prior to engaging/activating the firing chain to stop all traffic. The road guards will stop traffic and ensure that there are no vehicles or pedestrians on the roadway to be closed by visual inspection and through radio communication. The communications coordinator or road guard will then inform the demolition grounds Supervisor, or designated representative with demil certification, that the area is clear and give the "all clear" for the activation of the firing chain.

i. (O) After detonations and clearance of any detonation fallout on the highway, the flag personnel will be notified by coordinator/Supervisor, or designated representative with demil certification, to release the traffic and the traffic control teams will gather all road signs and return to the New Bomb Demolition Grounds Office, as needed. Warning signs may remain on Nevada State Highway 359 when not in use, if placed face down off roadway.

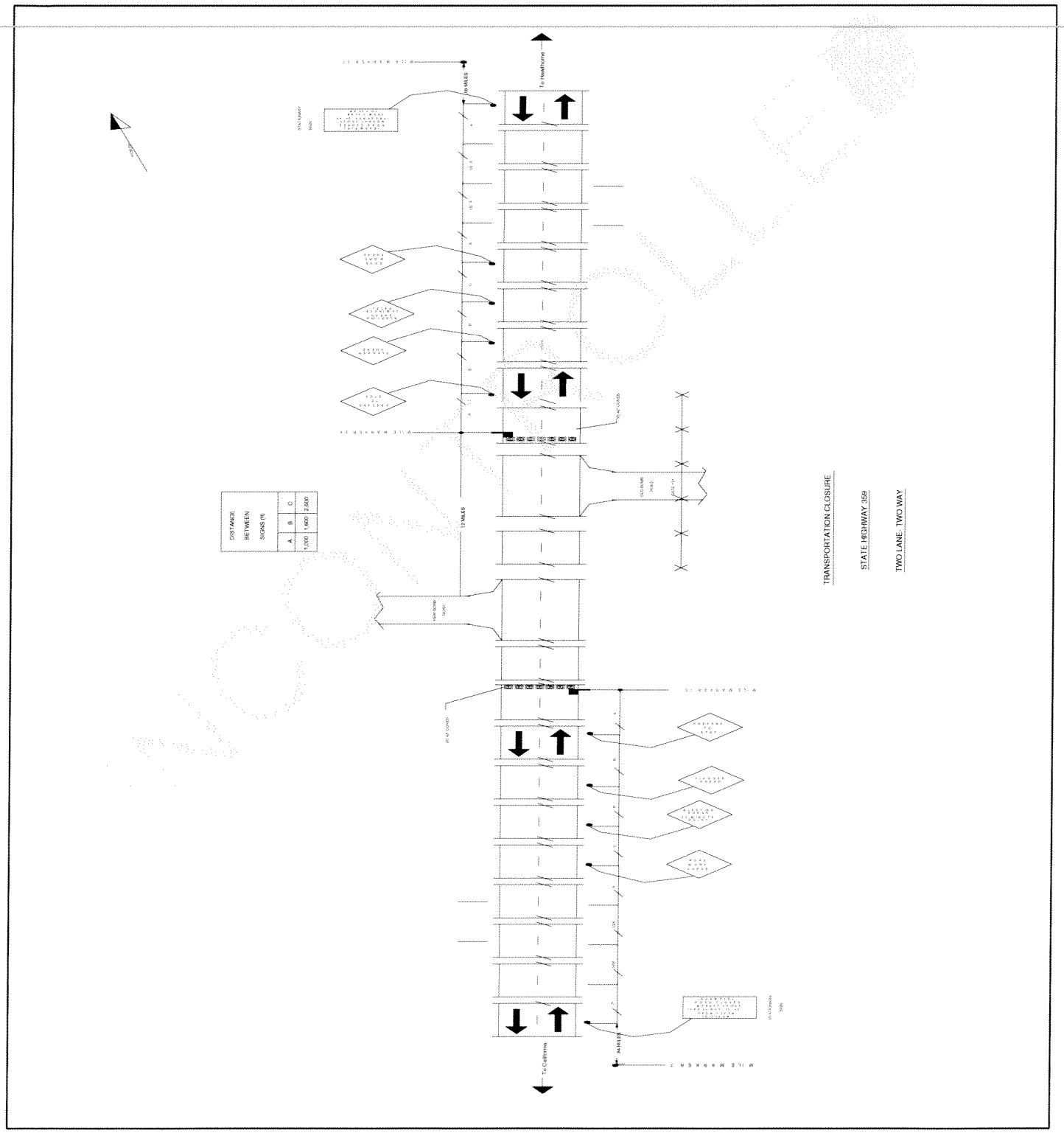


Figure 1-1

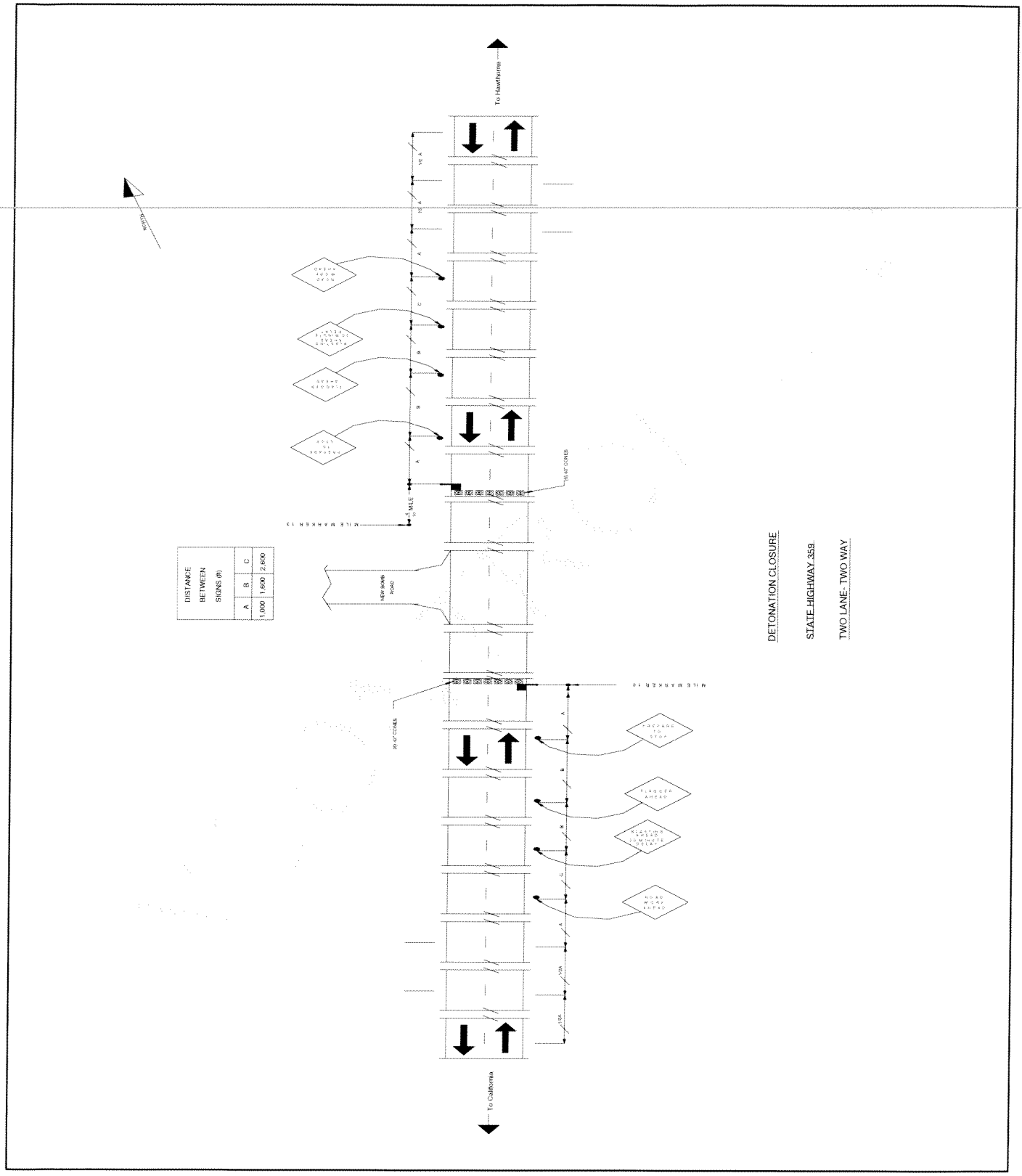

To Hawthorne
To California
DETONATION CLOSURE
STATE HIGHWAY 359
TWO LANE - TWO WAY
DISTANCE BETWEEN SIGNS (ft)
A 1,000
B 1,500
C 2,600
NEW BOMB ROAD
MILE MARKER 13
MILE MARKER 14
NORTH

Figure 1-2

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 2

Site: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE 1

OPERATION: Open and Prepare New Bomb Demolition Grounds

EXPLOSIVE/PERSONNEL LIMITS: N/A **TRANSIENT: N/A**

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Opening of New Bomb Demolition Grounds.

   a. (O) Unlock the gate.

   b. (O)(S) Attach the red (DANGER) flag to the halyard and run it up the flagpole at the New Bomb Demolition Grounds road entrance.

   c. (O) Unlock the New Bomb Demolition Grounds Office.

2. Inspect Equipment.

   a. (O)(S) Verify that radio communications between vehicle radios and the New Bomb Demolition Grounds Office are available. A serviceable operating radio will be available at the pit at all times when explosive operations are being performed.

   b. (O)(QC)(S) Check fire fighting equipment and the first aid kit (containing a minimum of: band aids, gauze, roll bandage, breathing barrier for CPR, exam/medical gloves, antiseptic wipes, and eyewash) to assure all required items are available. Note the location of the water tanks (portable is usually located near the Range Office and the permanent tank is located above the range – see the New Bomb Demolition Grounds Map).

   c. (O)(QC) Assure the CCTVs are serviceable.

   d. (O) Before opening the New Bomb Demolition Grounds for operations, the Supervisor, or designated representative with demil certification, will assure the Meteorological Weather Station is turned on and operating properly. Complete the METEOROLOGICAL WEATHER STATION INSPECTION CHECKLIST (Form DZHC-104-E) after completion of inspection.

   e. (O) The Supervisor, or designated representative with demil certification, will assure communications are available with the Fire Department, via telephone, at ext. 7107 (ext. 911 in an emergency) and via radio on Channel 3.

3. Check Weather Conditions.

   a. (O)(QC) Assure meteorological requirements have been met.

      (1.) Probability of an electrical storm does not exceed 50%.

      (2.) Probability of a thunderstorm does not exceed 50%, and no thunderstorm is occurring, is in the direct vicinity, or is approaching within three miles of operations.

      (3.) Probability of precipitation does not exceed 50% and no precipitation is occurring during operations.

      (4.) Visibility is more than one mile (i.e., fog, blowing snow, sand or dust storms).

      (5.) The cloud cover does not exceed 80% at a ceiling of 2000 feet or more.

      (6.) Surface wind speed is more than three miles per hour and less than 20 mph with gusts up to 30 miles per hour.

   b. (O) Operations may be conducted during the following conditions:

      (1.) At the discretion of the Supervisor, or designated representative with demil certification, the operating procedures up to, but NOT including, the SETUP of the INITIATION SYSTEM may be performed when no electrical/thunderstorms are present in addition to Step 3a.

      (2.) The average time for all on site quantitative measurements of wind speed must be for a minimum of five minutes.

   c. (O) Complete the weather data on the WEATHER DATA STATISTICS – OPEN DETONATION FORM (Form AMC-R 2887-R-E) IAW AMC-R 755-8, Appendix B.

   d. (O)(S) Evaluate the hazards and safety precautions and brief all personnel.

   e. (QC) Assure the current approved State of Nevada Division of Environmental Protection Permit is posted in the New Bomb Demolition Grounds Office and the site is in compliance.

   f. (QC) Assure the current Hazardous Material/Waste Contingency Plan is available in the New Bomb Demolition Grounds Office. The First Responder Personnel must be familiar with, and trained in, Proper Response Procedures.

4. Inspect Pits.

   a. (O)(QC) Assure the New Bomb Demolition Grounds are clear of unauthorized personnel. Refer to the Site Plan.

   b. (O)(S) Inspect the pits and areas around the pits for any hazards, i.e., smoldering embers, residual heat, explosives, or unexploded munitions. Notify the Supervisor, or designated representative with demil certification, if any of the aforementioned is found. Refer to Special Requirements.

5. Prepare Pits.

   a. (O)(S) Dry grass, leaves, and other extraneous, combustible material will be removed from within a radius of 200 feet from the point of destruction for each pit.

   b. (O) Using earthmoving equipment, the Equipment Operator will prepare a pit approximately four feet deep. Pits will be separated by a minimum of 75 feet, to prevent sympathetic detonation.

   c. (O) The Equipment Operator will groom the roadways to clear excess debris.

   d. (O) The Equipment Operator will groom the pit area to prevent debris from falling into the pit and upon the operators in the pit.

SPECIAL REQUIREMENTS:

1. **ONLY THE NEW BOMB DEMOLITION GROUNDS SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, IS AUTHORIZED TO GIVE CLEARANCE FOR OPENING THE NEW BOMB DEMOLITION GROUNDS AND DETONATION OF CHARGES.**

2. **DETONATION IS PERMITTED BETWEEN 9:00 A.M. AND 3:00 P.M., MONDAY THROUGH FRIDAY, ONLY. EXCEPTIONS WILL BE COORDINATED WITH THE ACO STAFF.**

3. **ALL PERSONNEL ARRIVING AT NEW BOMB DEMOLITION GROUNDS WILL REPORT TO THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, AND SIGN IN (PERSONNEL LOGBOOK). ALL PERSONNEL LEAVING THE NEW BOMB DEMOLITION GROUNDS WILL SIGN DEPARTING TIME IN THE PERSONNEL LOGBOOK.**

4. **PRIOR TO PREPARATION OF THE PIT AREA AND/OR DELIVERY OF ANY EXPLOSIVE MATERIAL TO THE DETONATION PIT AREA, THE AREA WILL BE CAREFULLY INSPECTED FOR THE PRESENCE OF DANGEROUS OBJECTS OR PROHIBITED FOREIGN MATERIAL. THE DETONATION PIT AREA WILL BE INSPECTED TO ASSURE THAT THE GROUND IS NOT DANGEROUSLY WARM AND IS FREE FROM GLOWING, SMOLDERING, OR BURNING EMBERS AND RESIDUE. NO PIT WILL BE USED TWICE DURING THE SAME DAY.**

5. **DURING REGULAR SAFETY MEETINGS, ALL PERSONNEL EMPLOYED AT THE NEW BOMB DEMOLITION GROUNDS WILL BE GIVEN OVERALL REFRESHER INSTRUCTIONS REGARDING OPERATIONAL AND SAFETY PROCEDURES AND ANY ADDITIONAL INSTRUCTIONS DEEMED NECESSARY BY THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION.**

6. **ASSURE THE RED DANGER FLAGS AND GATES ARE SECURED ON A DAILY BASIS.**

7. **CHECK RADIO(S) DAILY TO ASSURE SERVICEABILITY.**

8. PP&PE PERSONNEL WILL NOTIFY THE FOLLOWING AT LEAST 24 HOURS PRIOR TO THE FIRST DAY OF OPERATIONS:

   A. SAFETY OFFICE, EXT. 7842.

   B. QASAS OFFICE, EXT. 7400.

   C. THE FIRE CHIEF, EXT. 7107.

9. METEOROLOGICAL DATA WILL BE RECORDED VIA DATA LOGGER DURING THE PERIOD OF FIVE MINUTES PRECEDING THE INITIAL DETONATION TO ONE HOUR SUBSEQUENT TO THE FINAL DETONATION ON A MINUTE-BY-MINUTE BASIS.

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 3

SITE: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Verify Documentation and Unload

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 17 **TRANSIENTS:** 10

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Vehicle Operator Check In.

   a. (O) When explosive laden trucks arrive at New Bomb Demolition Grounds, the gate at the entrance to the grounds will be closed after the trucks enter.

   b. (O) The truck driver will sign the personnel logbook in the New Bomb Demolition Grounds Office and indicate their time of arrival. Trucks with ammunition or explosives will not park within 200 feet of New Bomb Demolition Grounds Office.

2. Verify Documentation and Unload Conveyance.

   a. (O) Truck driver will turn documentation of his/her truckload into the New Bomb Demolition Grounds Office upon arrival at the range.

   b. (O) The Supervisor, or designated representative with demil certification, will direct approved explosive loaded trucks to the demolition pit(s) for unloading.

   c. (O)(S) When a truck has been positioned for unloading, the engine will be shut off, the wheels will be chocked, and the brakes will be set to prevent vehicle movement.

   d. (O)(QC) The designated personnel will inspect the load on the truck to assure the material identification matches the description of the shipping documents and ATRs, will assure the material count is correct, and will assure the material is actually scheduled for destruction. **Any discrepancy in the count will halt operations** until reconciled IAW SOP HW-0000-A-001.

   e. (O) Items not scheduled for demilitarization will be returned to storage.

f. (O) A designated representative will verify the quantity and lots on the ATR(s) are correct, apply his/her initials next to the listed quantities and lot numbers on the ATR(s), and give ATR(s) to the Supervisor, or designated representative with demil certification, for final signature.

g. (O) A Uniform Hazardous Waste Manifest (EPA Form 8700-22) will accompany all items shipped to the New Bomb Demolition Grounds for treatment (excluding donor and priming material). The Supervisor, or designated representative with demil certification, will inspect the shipment and verify the quantity on the Manifest.

(1.) If the quantities match, the Supervisor, or designated representative with demil certification, will immediately sign and date the manifest indicating that the materials have been received on that day.

(2.) If a discrepancy exists between the two, a notation must be made in Block 19 of the Manifest. The Supervisor, or designated representative with demil certification, will sign Block 20 and return the Manifest to PP&PE for delivery to Environmental Services.

(3.) If for any reason operations are canceled and the manifest has been received, a notation must be made in Block 19 indicating reason for operation cancellation and return of material to the storage area for temporary storage. The Supervisor, or designated representative with demil certification, will sign Block 20 and return the manifest to Environmental Division on that same day.

h. (O) Complete the HWAD NEW BOMB AP-9711-1134 OPEN DETONATION CONTEMPORANEOUS LOG (Form DZHC-223-E) with all pertinent data listed therein.

i. (O) Using a rough terrain diesel forklift, unload required quantity of explosive loaded items, donor charges, and demolition blocks. Position them as directed. A spotter will be used at all times while unloading explosives from the conveyance at New Bomb to ensure fork tines do not penetrate any explosive container/item. Explosive loaded items and donor material will be spotted at least ten feet from a pit and at least ten feet from each other.

j. (O)(S) Continuous inspection for special hazards will be observed, i.e., loose/exposed powder/explosives. Any hazards not covered in the daily briefing will be reported to the Supervisor, or designated representative with demil certification.

CONTAINERS OF EXPLOSIVES WILL NOT BE OPENED IN A PIT UNTIL THE TRUCK(S) HAS BEEN WITHDRAWN FROM THAT PIT.

3. Truck Departure.

a. (O) Trucks will be removed from the demolition pit area as soon as practical after unloading.

b. (O) The truck driver will return to the inert area for reloading, as necessary.

c. (O) Upon completion, the truck driver will return to the New Bomb Demolition Grounds Office, sign out in the logbook, and then depart from area.

SPECIAL REQUIREMENTS:

1. IF ANY UNUSUAL CIRCUMSTANCES ARISE, THE OPERATIONS WILL BE HALTED AND THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, AND THE SAFETY OFFICE (AT EXT. 7842 OR 7931) WILL BE NOTIFIED.

2. BLASTING CAPS ARE TO BE STORED SEPARATELY IN AN APPROVED MAGAZINE.

3. FORKLIFT OPERATORS WILL HAVE A GUIDE WHEN REMOVING EXPLOSIVES FROM THE TRUCK TO ASSURE THE FORK TINES ENTER FORK POCKETS OF PALLET BEING REMOVED AND DO NOT COME IN CONTACT WITH THE CONTAINERS OR PULL THE CONTAINERS FROM THE TRUCK.

4. DIESEL POWERED ROUGH TERRAIN FORKLIFT OPERATORS WILL WEAR APPROVED HEARING PROTECTION.

5. PERSONNEL WILL STAY CLEAR OF ALL MATERIAL HANDLING EQUIPMENT BEING OPERATED.

6. THE EARTH MOVING EQUIPMENT WILL NOT OPERATE IN A PIT UNTIL THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, HAS CHECKED THE PIT FOR HAZARDOUS CONDITIONS.

7. PRIOR TO DELIVERY OF ANY EXPLOSIVE MATERIAL TO THE NEW BOMB DEMOLITION AREA, THE AREA WILL BE CAREFULLY INSPECTED FOR THE PRESENCE OF DANGEROUS OBJECTS OR PROHIBITED FOREIGN MATERIAL.

8. WHEN DANGEROUS MATERIAL IS FOUND OR CONDITIONS ARE NOT SAFE, THE NEW BOMB DEMOLITION AREA WILL NOT BE USED UNTIL SAFE CONDITIONS HAVE BEEN RESTORED.

9. NO PIT WILL BE USED TWICE DURING THE SAME DAY.

10. NO ONE IS PERMITTED TO RIDE IN THE BED OF THE TRUCK.

11. AMMUNITION WILL NOT BE DISASSEMBLED OR BROKEN DOWN IN THE DETONATION PIT AREAS, EXCEPT UNFUZED ITEMS REQUIRING REMOVAL OF THE FUZE WELL PROTECTOR FOR PRIMING.

12. EXPLOSIVE MATERIAL USED FOR PRIMING WILL BE CAREFULLY INSPECTED AND DETERMINED USABLE PRIOR TO DELIVERY TO THE DETONATION AREA.

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 4

SITE: Pit Area

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Preparation of Pit and Placement of Explosive Materials

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 17 **TRANSIENTS:** 4

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. The Supervisor, or designated representative with demil certification, will assure that unauthorized and non-essential personnel are cleared from the New Bomb Demolition Grounds and complete the New Bomb Checklist (Form DZHC 101-E).

2. (O)(S) Assure that the red (DANGER) flags have been attached to the halyards and run up the flagpoles at the New Bomb Demolition Grounds road entrance to the canyon (pit areas).

THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, WILL DETERMINE THE QUANTITY AND POSITIONING OF ITEMS TO BE DESTROYED IN EACH PIT. THE MAXIMUM PIT LIMIT IS 4,000 LBS. NEW (INCLUDING DONOR CHARGE). THE 4,000 LB. NEW LIMIT IS DEPENDENT ON FRAGMENTS STAYING WITHIN NEW BOMB DEMOLITION GROUNDS BOUNDARIES. REFER TO APPENDIX A FOR TYPICAL LAYOUTS OF ITEMS TO BE DETONATED.

3. Using non-sparking hand tools (shovels), level the pit to accommodate items.

4. Placement of Explosive Items in Pit.

IF BOXES HAVE LEAD SEALS, REMOVE USING DIAGONAL PLIERS AND PLACE SEALS INTO A SEALABLE CONTAINER. PROCESS IAW SOP HW-0000-A-001 WHEN THE CONTAINER IS FULL.

   a. (O) Cut steel strapping, as required, and remove top cover or boxes from pallet, as applicable.

   b. (O) Remove explosive items from boxes, as applicable. Move explosive items into pit, as required.

c. (O)(QC)(S) The designated representative will perform an inventory of the items in the pit and the containers derived to assure no munitions are left in the containers.

(1.) The items in the pit will be listed on a Pit Check Sheet (Form DZHC-284-E) which will include, as a minimum, the NSN/DODIC, nomenclature, quantity of items per container, quantity of derived containers, and the signature of the operator(s) performing the inventory.

(2.) Any discrepancies in counts will be investigated immediately and noted on the Pit Check Sheet.

(3.) Once all pits are loaded, the Supervisor, or designated representative with demil certification, and QA personnel will verify the quantities on the Pit Check Sheet (Form DZHC-284-E), match the quantities listed on the transfer documents, and fill out a Multi-Use Discrepancy Report (HWAAP 479), as required.

(4.) The Supervisor, or designated representative with demil certification, will retain the Pit Check Sheet (Form DZHC-284-E).

d. (O) When detonating thick wall bombs, mines, or warheads, the nose and/or base fuzewell or charging well and/or cavity must be primed using demolition explosives and detonating cord.

e. (O) When detonating items with exposed primers, the items will be placed in the pits with the primers facing away from the hillside to protect primers from falling rocks, if possible. If the exposed primers cannot be positioned in the above manner, the primers will be protected with cardboard.

5. Placement of Donor Material in Pit.

a. (O)(S) If bulk explosives are to be opened or removed from their containers, spot a pallet of the bulk explosives a minimum of ten feet from the material to be detonated. If bulk explosives are to remain intact in a sealed container upon placement on/around the material, the ten-foot minimum distance is not required.

b. (O) Position the required donor charge on the material to be detonated. Ordnance items and/or donor explosive material may be used as donor, dependent upon trial test results that indicate acceptable and proper placement.

- **IF NECESSARY, TWO TO THREE INCHES OF DIRT MAY BE PLACED ON TOP OF DONOR MATERIAL TO PREVENT FIRES AND PREMATURE DETONATIONS. THIS WILL BE DONE ON A CASE BY CASE BASIS WITH THE ENVIRONMENTAL OFFICE'S PERMISSION.**
- **ON THE DAYS THAT DIRT IS ADDED, IT WILL BE NOTED ON THE CONTEMPORANEOUS LOG AND THE ENVIRONMENTAL OFFICE WILL BE NOTIFIED.**

6. Transfer Derived Materials.

   a. (O) Using operator's identification stamp, operator will stamp interior and exterior of each empty container certifying container is free of explosives. Containers with lids designed for removal during normal handling will have lids removed and unitized separately. (NOTE: This operational step may be performed in the pit area or at the New Bomb Y-site).

   b. (O) Using a RT diesel forklift, move derived containers (curbed pallets and pallets) to the material staging area for inspection once cleared by pit crew.

7. Placement of Demolition Charge.

   a. (O) Using the assigned truck, transfer the required amount of demolition charge material to each pit, as directed by the Supervisor, or designated representative with demil certification.

   b. (O) When using commercial boosters, the det cord is cut to length (approximately a two foot pigtail) and the one end is slid through the entire length of the booster, from the top to the bottom. The end is then reinserted through the second hole in the bottom of the booster. Cinch the cord tight by pulling on top end of the det cord pigtail. **Do not use excessive force!** Refer to Figures 4-1 through 4-4. If det cord cannot be inserted through the booster, the det cord will be wrapped tightly around the booster three times.

Figure 4-1
Step 1: Det cord pigtail with booster

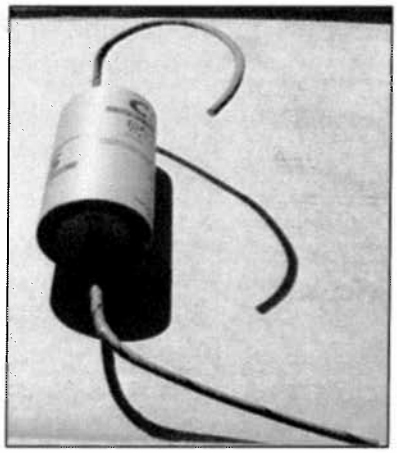


Figure 4-2
Step 2: Pigtail inserted through booster

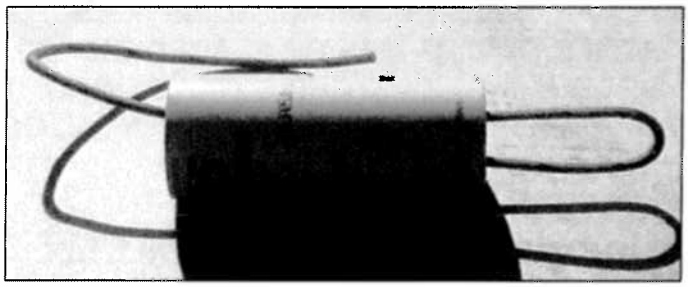


Figure 4-3
Step 3: Reinsert pigtail into second hole in booster base

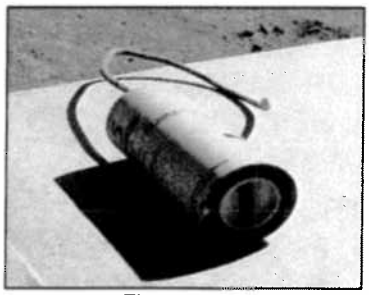


Figure 4-4
Step 4: Cinch pigtail

c. (O) Detonation cord branch lines will be joined to the ring main by using a detonation cord connector or girth hitch with extra turns. Refer to Figures 4-5 and 4-6. The ring main will extend a minimum of six feet outside the pit for connection to the initiating system. Refer to Figure 4-7. At least six inches of the running end of the detonating cord is left beyond the detonation cord connector or clove hitch.

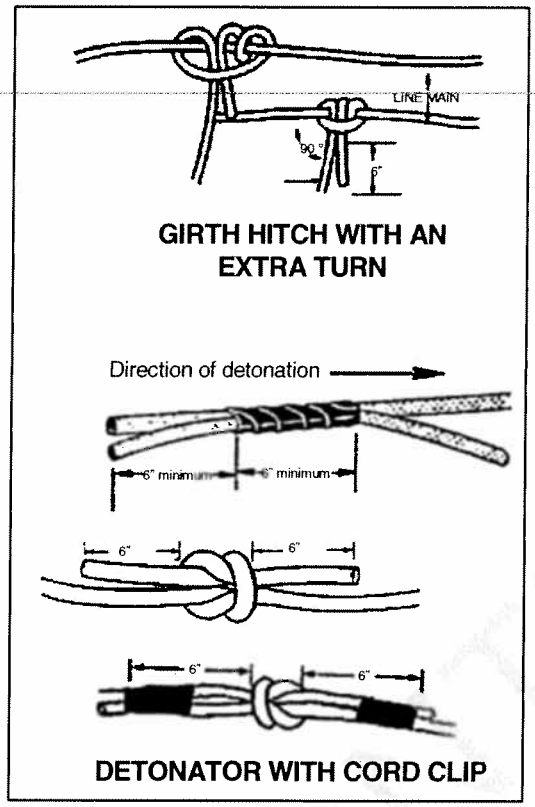


Figure 4-5
Connect Branch Line with Main Line

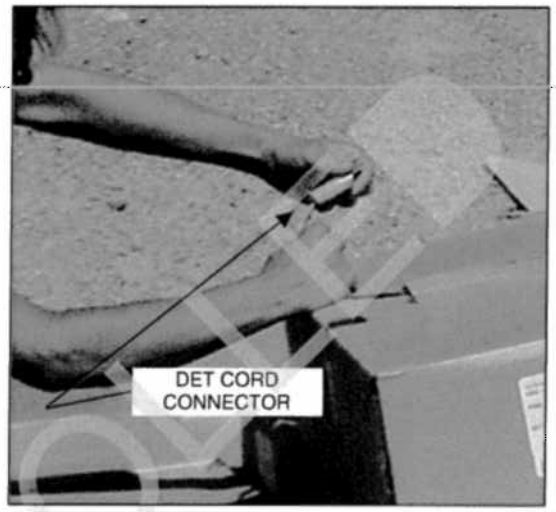


Figure 4-6
Connect Branch Line with Main Line

d. (O) Avoid sharp bends or kinks to the detonation cord. Handle with care and do not contact sharp edges. Lie detonation cord lines as straight as possible, but do not stretch taut. Branch lines should not cross the main line.

Figure 4-7

e. (O) Boxes of explosives containing the demo charge/booster must be flipped upside-down to prevent the demo charge/booster from being extracted from the box during detonation.

8. Transfer.

a. (O) Relocate assigned truck, vehicles (i.e., front-end loader, RT diesel forklift, etc.), and hand tools to next pit or location as directed by the Supervisor, or designated representative with demil certification.

b. (O) Proceed with disposition of material as instructed in Operation 10.

SPECIAL REQUIREMENTS:

1. THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, WILL PERSONALLY DIRECT BOTH THE PLACEMENT OF EXPLOSIVE MATERIAL TO BE DESTROYED AND THE EXPLOSIVE CHARGES USED AT THE START-UP OF JOB.

2. THE PREPARATION OF EXPLOSIVE MATERIALS FOR DEMOLITION WILL BE IAW THE PROVISIONS OF THIS OPERATING PROCEDURE. NO VARIATIONS OR DEVIATIONS FROM THIS PROCEDURE WILL BE PERMITTED WITHOUT SPECIFIC WRITTEN AUTHORIZATION FROM THE GENERAL MANAGER OR A DULY DESIGNATED REPRESENTATIVE.

3. THE NET EXPLOSIVE WEIGHT FOR EACH PIT WILL NOT EXCEED 4,000 LBS (TO INCLUDE DONOR MATERIAL).

4. IN OPERATIONS INVOLVING EXPLOSIVES MUNITIONS, SECURITY REQUIREMENTS WILL BE A MINIMUM OF THE TWO PERSON RULE WITH VISUAL CONTACT AS WELL AS CLOSE PROXIMITY.

5. DO NOT LEAVE OPERATION UNATTENDED WHILE PRIMING OPERATION IS IN PROGRESS.

6. PROJECTILES WITH LIVE FUZES INSTALLED WILL NOT BE HANDLED BY THE FUZES ALONE; LIFT BY THE BODY OF THE PROJECTILE.

7. FLAME RETARDANT COVERALLS WILL BE WORN BY PERSONNEL DURING THE PLACEMENT OF THE DEMO CHARGE/BOOSTER.

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 5

SITE: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Set Up Initiating System

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 3 **TRANSIENTS:** 1

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Clear and Secure Range.

   a. (O)(QC)(S) The Supervisor, or designated representative with demil certification, will assure that unauthorized and non-essential personnel are cleared from range.

   b. (O)(QC)(S) Assure the red flags are properly displayed and the entrance road gate is locked or guarded. Gate keys will be maintained by the fire department for fire fighting and emergency medical assistance and by the Supervisor, or designated representative with demil certification. Emergency personnel will not enter New Bomb Demolition Grounds without permission of Supervisor, or designated representative with demil certification.

2. Test Safety Fuse (performed at a remote site away from the pit area).

   a. (O)(QC) At the beginning of each day's operation, and whenever a new coil is used, the safety fuse burn rate will be tested IAW the Manufacturer's recommendations.

   b. (O)(QC) Using a cap crimper, or bench crimper/cutter, cut a six-inch length from the free end of the safety fuse. Assure the fuse is cut squarely with a sharp clean knife or cutter. A slant cut is more liable to cause failures to ignite the fuse.

   c. (O) Then, taking a three-foot section, insert the fuse in the open end of the tube of the fuse lighter, pushing it in slowly and carefully, until it stops. **DO NOT INSERT FUSE INTO THE FUSE LIGHTER UNTIL THE FUSE IS TO BE IGNITED.**

   d. (O) Remove the SAFETY CLIP.

e. (O) Hold the lighter tightly in one hand and with the other hand give a firm pull on the white safety cap to ignite the fuse.

f. (O) Compute the burn rate per foot to assure an adequate safe separation.

3. Prepare Safety Fuse for Pits.

a. (O) Cut the required length of Safety fuse for dual priming IAW Step 2b.

b. (O)(S) When more than one pit is being used, the Safety fuse will be cut to provide sufficient time between detonations for an accurate count of the detonations to be made.

c. (O)(S) The safety fuse will be cut long enough for personnel to retire to a safe distance.

4. Preparing Blasting Caps.

a. (O)(S) Remove caps with fingers only; do not use nails, wires, or similar implements.

b. (O)(QC)(S) Take one blasting cap from the special cap-carrying box. Inspect the blasting cap by looking into the open end. If any foreign matter or dirt is present, proceed as follows:

(1.) Hold the cap near the open end, between the thumb and middle finger of one hand.

(2.) Aim the open end of the cap at the palm of the second hand.

(3.) Gently bump the wrist of the cap-holding hand against the wrist of the other hand.

(4.) If the foreign matter does not come out, dispose of the cap by setting aside to pit for disposal.

5. Place Blasting Cap on Safety Fuse.

a. (O)(S) Hold the safety fuse vertically with the square-cut end up and slip the blasting cap gently down over it, so that the flash charge in the cap is in contact with the safety fuse.

b. (O)(S) If the end is flat or too large to enter the blasting cap freely, roll the safety fuse between the thumb and fingers until the size is reduced to permit free entry.

- **IF THE CAP IS NOT FULLY SEATED ON THE SAFETY FUSE, IT MAY MISFIRE.**
- **NEVER FORCE THE SAFETY FUSE INTO THE BLASTING CAP BY TWISTING OR ANY OTHER METHOD.**

6. Crimp Blasting Cap to Safety Fuse.

a. (O) The assembly of the cap to the fuse can be accomplished by using either a cap crimper or a bench crimper/cutter.

b. (O) After the blasting cap has been seated, grasp the safety fuse between the thumb and the ring finger so that the fingers are touching the open end of the cap. Place the forefinger over the closed end of the cap to hold it firmly against the end of the safety fuse. Apply slight pressure to end of cap with forefinger.

c. (O) Rest the crimpers on top of the thumb and ring finger. Place the second finger on top of the crimpers to secure them.

d. (O) Place a second crimp at a point ⅛" to ¼" from the open end. A crimp too close to the explosive in the blasting cap may cause detonation. Keeping crimpers in the second crimp, complete the crimp.

7. Transfer the Blasting Cap Assemblies to Pit Area.

   a. (O) Two operators with a pickup truck will be assigned to transport the required quantity of blasting cap assemblies to the pit area in a metal container.

   b. (O)(S) Do not expose blasting cap assemblies to the direct rays of sun or heat sources.

8. Prime Ring Main. Transfer Initiating Systems to Pit.

   a. (O)(S) The pit will be primed when all pits are ready and New Bomb Demolition Grounds Area has been cleared.

   b. (O) Pick up fuse lighter in one hand, and hold the safety fuse close to the blasting cap in such a manner that the caps cannot bump against each other. Proceed to the demolition pit.

   c. (O) Tape two blasting caps to the ends of the detonating cord, at least six inches from the ends of the lead. The explosive end of the blasting cap must be pointed in the direction of the shot. Repeat until all pits have been primed.

9. When all initiating devices have been prepared, relocate truck as designated by Supervisor, or designated representative with demil certification.

SPECIAL REQUIREMENTS:

1. ONLY TWO PEOPLE WILL PREPARE THE INITIATION SYSTEM.

2. PREVENTING NON-ELECTRIC MISFIRES - WORKING ON OR NEAR A MISFIRE IS THE MOST HAZARDOUS BLASTING OPERATION. A MISFIRE IS RARE IF THE FOLLOWING PROCEDURES ARE CAREFULLY OBSERVED:

A. PREPARE ALL PRIMERS PROPERLY.

B. LOAD CHARGES CAREFULLY.

C. PLACE THE PRIMER PROPERLY.

D. PERFORM ANY TAMPING OPERATION WITH CARE TO AVOID DAMAGE TO THE PREPARED CHARGES.

E. FIRE THE CHARGE ACCORDING TO THE PROPER TECHNIQUE.

F. USE DUAL FIRING SYSTEMS. IF BOTH SYSTEMS ARE PROPERLY ASSEMBLED, THE POSSIBILITY OF A MISFIRE IS REDUCED.

G. DO NOT USE BLASTING CAPS UNDERGROUND; USE DETONATING CORD.

3. THE PRIMING OF EXPLOSIVES WILL NOT BE PERFORMED IN ADVANCE OF REQUIREMENTS. PREPARED DEVICES, IF NOT USED, WILL BE RETURNED TO THE TEMPORARY STORAGE SHED AT NEW BOMB.

4. TEST BURNING OF SAFETY FUSE WILL BE PERFORMED DOWNWIND AND A MINIMUM DISTANCE OF 25 FEET FROM BLASTING CAPS OR OTHER EXPLOSIVES.

5. DO NOT INSERT ANYTHING INTO BLASTING CAP TO REMOVE FOREIGN MATERIAL. IF FOREIGN MATERIAL IS PRESENT, HOLD CAP NEAR OPEN END, BETWEEN THUMB AND FOREFINGER, TURN OPEN END DOWN AND GENTLY BUMP WRISTS TOGETHER. IF FOREIGN MATERIAL IS NOT DISLODGED BY THIS PROCEDURE, BLASTING CAP WILL NOT BE USED.

6. DO NOT USE DAMAGED OR CORRODED BLASTING CAPS.

7. A ROUGH, JAGGED-CUT FUSE INSERTED INTO A BLASTING CAP CAN CAUSE A MISFIRE. USE A SERVICEABLE CRIMPER OR BENCH CRIMPER/CUTTER TO CUT THE SAFETY FUSE.

8. DO NOT CRIMP THE SAFETY FUSE MORE THAN THREE INCHES FROM OPEN END OF THE BLASTING CAP. DO NOT USE THE CUTTING JAW OF THE CRIMPERS FOR CRIMPING.

9. DO NOT CUT THE BLASTING CAP. DO NOT POINT THE BLASTING CAP TOWARD OTHER PERSONNEL OR EXPLOSIVES.

10. DO NOT FORCE SAFETY FUSE INTO BLASTING CAP BY TWISTING OR OTHER MEANS. SAFETY FUSE THAT IS TOO LARGE IN DIAMETER TO ENTER THE BLASTING CAP WITHOUT FORCING WILL NOT BE USED.

11. USE BENCH CRIMPER/CUTTER OR THE CUTTING JAW OF M2 CAP CRIMPER, TO CUT DETONATING CORD. CUT DETONATING CORD SQUARELY ACROSS.

12. WHEN DETONATING CORD IS USED AS THE INITIATOR, THE BLASTING CAP(S) WILL BE SECURED TO THE DETONATING CORD WITH THE DETONATING CORD PROTRUDING SIX INCHES FROM THE END OF THE BLASTING CAP. ELECTRICIAN'S TAPE WILL THEN BE WRAPPED AROUND THE CAP AND THE DETONATING CORD. DOUBLE PRIMING IN ALL CASES WILL BE REQUIRED, WITH PROPERLY CRIMPED BLASTING CAPS.

13. TO AVOID A BREAK IN THE EXPLOSIVE CORE OF THE DETONATING CORD, WHICH MIGHT CAUSE A MISFIRE, THE FOLLOWING PRECAUTIONS WILL BE OBSERVED:

    A. AVOID BENDS, KINKS, AND SHARP EDGES. A BEND IN THE CORD OVER 45° CAN CAUSE A MISFIRE.

    B. DETONATING CORD SHOULD BE HANDLED WITH SPECIAL CARE IN COLD WEATHER TO AVOID BREAKING EITHER THE COVERING OR THE EXPLOSIVE.

    C. LAY DETONATING CORD AS STRAIGHT AS POSSIBLE, BUT DO NOT STRETCH IT TAUT.

14. ALL VEHICLES WILL BE MOVED FROM THE DETONATION PIT AREA BEFORE DETONATION. ALL PALLETS AND OTHER CONTAINERS WILL BE REMOVED TO THE INERT STORAGE LOT OR EMERGENCY SHELTER AREA BEFORE INITIATION.

15. BLASTING CAPS WILL NOT BE REMOVED FROM THEIR CONTAINER WITH WIRES, NAILS OR SIMILAR INSTRUMENTS; FINGERS WILL BE USED. BLASTING CAPS MUST NOT BE EXPOSED TO DIRECT SUNLIGHT OR ANY SOURCE OF HEAT FOR EXTENDED PERIODS OF TIME. KEEP THE CAP CARRYING BOX CLOSED, EXCEPT WHEN REMOVING CAPS.

16. DO NOT TRANSPORT LOOSE BLASTING CAPS IN A VEHICLE GLOVE COMPARTMENT OR ANY OTHER UNAUTHORIZED PLACE. BLASTING CAPS WILL BE PLACED IN A CAP CARRYING BOX. IMPROVISED METHODS OF DETONATING BLASTING CAPS ARE STRICTLY PROHIBITED. THE OPERATING PERSONNEL CAN TRANSPORT BLASTING CAPS IF CAPS ARE CONTAINED IN AN APPROVED BOX.

17. ALL EXPLOSIVES (DONOR CHAIN ITEMS) WILL BE REMOVED FROM EACH OF THE NEW BOMB TEMPORARY STORAGE SHEDS AT THE END OF EACH WEEK.

18. FLAME RETARDANT COVERALLS WILL BE WORN BY PERSONNEL DURING SET UP OF THE INITIATING SYSTEM.

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 6

SITE: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Detonate Charge

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 3 **TRANSIENTS:** 1

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Clear Range.

   a. (O)(QC) Assure CCTV is turned on and is operational.

   b. (O)(QC) Assure the red DANGER flags are properly displayed and entrance road gate is closed and locked or there is a guard or personnel at the gate.

   c. (O)(QC) Assure the area over New Bomb Demolition Grounds is clear of aircraft.

   d. (O)(QC)(S) The Supervisor, or designated representative with demil certification, will assure that unauthorized and nonessential personnel have been cleared from New Bomb Demolition Grounds and two traffic control teams and the radio communications coordinator are prepared/on standby to depart to their designated locations.

      (1.) All personnel will return to the personnel shelter at the New Bomb Demolition Grounds Office.

      (2.) The Supervisor, or designated representative with demil certification, will conduct a roll call utilizing the sign in/sign out log book required per Operation 2, Special Requirement 3.

      (3.) Upon completion of the roll call, the Supervisor, or designated representative with demil certification, will direct the assigned crew consisting of two (or three when performing the leap frog method) qualified munitions destroyers, the two traffic control teams, and the communications coordinator to proceed to their designated locations.

      (4.) The traffic control teams will perform Operation 1 for placement of warning signs on Nevada State Highway 359 and stopping traffic during detonations.

   e. (O) The Supervisor, or designated representative with demil certification, will complete the New Bomb Checklist.

2. Initiate Demolition Charges.

   a. (O)(S) One Munitions Destroyer will initiate the demolition charge at the pit farthest from the personnel shelter.

   b. (O) The Munitions Destroyer who pulls the shots will initiate the charge and walk to the next pit to be initiated or to an alternating pit if the "Leap Frog" method is being used.

   c. (O) A Munitions Destroyer will drive/move the escape vehicle along the escape route while maintaining visual contact with the munitions destroyer who pulls the shot.

   d. (O) Repeat Steps 2a through 2c until all charges have been initiated. When the Munitions Destroyer initiates the last charge, proceed to New Bomb Demolition Office.

   e. (O)(QC) Two personnel will be tasked to count the number of detonations.

   f. (S) Do not exit safety shelter for a minimum of one minute after last detonation, due to possible fragmentation hazards.

3. Sweep Nevada State Route 359.

   a. (O)(QC) After the final detonation, the Supervisor, or designated representative with demil certification, will direct a crew of two individuals to slowly drive the highway and inspect the road to assure it is free of any foreign debris. Any foreign debris found will be inspected. If foreign debris is found, it will be processed as scrap IAW Operation 10. If any suspect item is found, the Supervisor, or designated representative with demil certification, will be notified.

   b. (O) Once the road has been cleared, the flag personnel will be notified to release the traffic and the traffic control teams will gather all road signs and return to the New Bomb Demolition Grounds office.

   c. (O) The Supervisor, or designated representative with demil certification, will be responsible to direct the communications coordinator to inform the traffic control teams when to release the traffic.

SPECIAL REQUIREMENTS:

1. **INITIATION OF DEMOLITION CHARGES WILL START AT THE PIT MOST DISTANT FROM THE PERSONNEL SHELTER (NEW BOMB DEMOLITION GROUNDS OFFICE) AFTER THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, HAS CHECKED THAT ALL PITS HAVE BEEN PRIMED AND THE NEW BOMB DEMOLITION GROUNDS ARE CLEAR.**

2. **NOTIFY PERSONNEL AT THE NEW BOMB DEMOLITION GROUNDS OFFICE OF ANY UNUSUAL SITUATION ENCOUNTERED DURING THE INITIATING PROCESS. USE THE VEHICLE/HAND HELD RADIO.**

3. TO FIRE THE LIGHTER ASSEMBLY, REMOVE THE SAFETY CLIP. WHILE HOLDING THE LIGHTER TIGHTLY IN ONE HAND, GIVE A FIRM PULL ON THE WHITE SAFETY CAP. IN THE EVENT OF A MISFIRE, REPLACE THE FUSE LIGHTER AND PULL AGAIN.

4. IF THE FIRST FUSE LIGHTER FAILS, GO TO THE SECOND AND IGNITE. IF THE SECOND FUSE LIGHTER FAILS, REPLACE WITH SPARE FUSE LIGHTER AND IGNITE. IF THE SPARE FUSE LIGHTER FAILS TO IGNITE, DO NOT REPLACE; GO TO THE NEXT PIT.

5. ASSURE THE ESCAPE VEHICLE IS AIMED IN THE DIRECTION OF THE EXIT ROAD, WITH THE MOTOR RUNNING, DURING THE INITIATION OF DEMOLITION CHARGE.

6. IN THE EVENT THE VEHICLE SHOULD STALL FOR ANY REASON, THE SENIOR MUNITIONS DESTROYER WILL USE THEIR DISCRETION TO DETERMINE WHETHER TO COAST THE VEHICLE DOWN THE HILL OR TO ABANDON THE VEHICLE AND PROCEED DOWN THE HILL ON FOOT.

7. TWO PERSONNEL WILL BE TASKED TO COUNT THE NUMBER OF DETONATIONS.

8. DURING DETONATION, PERSONNEL WILL BE STATIONED IN THE NEW BOMB DEMOLITION GROUNDS OFFICE OR LEAVE THE RANGE. PERSONNEL WILL NOT LEAVE ANY PERSONNEL SHELTER FOR A MINIMUM OF ONE MINUTE AFTER THE LAST DETONATION TO AVOID POSSIBLE FRAGMENTATION HAZARDS.

9. THE DETONATION OF AMMUNITION/EXPLOSIVES, OR SIMILARLY HAZARDOUS MATERIAL, WILL NOT BE INITIATED UNLESS:

   A. AMPLE VISIBLE WARNING IS GIVEN, I.E., THE RED (DANGER) FLAG IS DISPLAYED.

   B. OPERABLE COMMUNICATION EQUIPMENT IS AVAILABLE.

   C. THE "SHOT-FIRER" HAS ASCERTAINED THAT THE DEMOLITION PIT AREA IS CLEAR AND ALL PERSONNEL ARE ACCOUNTED FOR AND SAFELY SHELTERED.

   D. ALL EQUIPMENT IS AT A SAFE DISTANCE FROM THE HAZARD AREA.

10. THERE WILL BE NO AMMUNITION/EXPLOSIVES IN THE STAGING AREA DURING DETONATION.

11. FLAME RETARDANT COVERALLS WILL BE WORN BY PERSONNEL DURING INITIATING OF DEMO CHARGES.

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 7

SITE: Pit Area

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Inspection of Pit Area and Unexploded Munitions

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 17 **TRANSIENTS:** 4

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Investigation and Inspection.

   a. (O)(S) Personnel will remain in the safety shelter until all scheduled detonations have occurred and authorized or directed by the Supervisor, or designated representative with demil certification. This will be determined by two personnel tasked to count the number of detonations or by reviewing video recording.

   b. (O)(S) If a misfire or low order detonation is suspected, wait a minimum of one hour after the scheduled detonation time before investigating. Refer to Operations 8 or 9.

   c. (O)(S) After all detonations have been accounted for and the area has been swept and each pit viewed by CCTV, the Supervisor, or designated representative with demil certification, and one Munitions Destroyer will inspect each pit for any hazards (i.e., smoldering embers, explosives, or unexploded munitions).

   d. (O) When the Supervisor, or designated representative with demil certification, is satisfied that there are no undue hazards, all personnel may be called upon to check the area for unexploded munitions and to put out any brush fires.

2. Reject Explosive Products or Components.

   a. (O)(S) Any unit of questionable condition will not be touched or handled by operations personnel without explicit instructions from the Supervisor, or designated representative with demil certification. Any item kicked out of pit during a low order detonation will be immediately reported to the Supervisor, or designated representative with demil certification, who will assess the situation.

b. (O)(S) The Supervisor, or designated representative with demil certification, must decide whether further movement of a questionable explosive item will create additional safety hazards. Any items whose further movement is of even questionable safety will be treated as follows:

1) (O)(S) The Supervisor, or designated representative with demil certification, will evacuate all personnel from the hazardous area to a safe place and notify at least one of the following, in the order listed below:

a) Manager, APOD Division, ext. 7300.

b) Director, M&L, ext. 7244.

c) Manager, Safety Office, ext. 7842.

d) Ammunition Project Manager, ext. 7262.

e) UXO Tech, ext. 7865/7276 or 316-0726/316-0725.

2) (O)(S) The person so notified will be responsible for notifying the appropriate personnel to determine the corrective actions required for the removal and disposal of hazardous item(s).

3) (O) After approval is obtained, the Supervisor, or designated representative with demil certification, and one munitions destroyer will prepare the counter charges. Refer to FM 5-250. The Supervisor, or designated representative with demil certification, will determine placement of the counter charges. **DO NOT DISTURB THE ROUND WHILE PLACING THE CHARGE.** Detonate IAW Operations 4, 5, and 6.

3. Inspection for Ammonium Picrate (from Yellow D Loaded Ammunition Items).

a. (O) Inspect the Pit Area daily for ammonium picrate (as exhibited by a yellow color) and mark areas.

b. (O)(S) Remove the yellow stained soil and transfer to pit for detonation on top of the items to be destroyed IAW Operations 4, 5, and 6. The maximum amount of contaminated soil per pit will not exceed .5 pounds per 1.0 pound of donor explosive (the equivalent of two 55-gallon drums of soil per 2,000 pounds of donor explosive).

SPECIAL REQUIREMENTS:

1. **FLAG UNEXPLODED AMMUNITION AND/OR EXPLOSIVES FOUND DURING AREA INSPECTION. THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, WILL INSPECT ITEM AND DETERMINE ACTION.**

2. **EXTINGUISH ALL FIRES THAT HAVE STARTED. ASSURE THEY ARE COMPLETELY OUT. EXTINGUISH FIRES OUTSIDE THE NEW BOMB DEMOLITION GROUNDS FENCE FIRST.**

3. **A FIRE WATCH WILL BE MAINTAINED UNTIL ALL FIRES HAVE BEEN EXTINGUISHED AND/OR COMPLETELY BURNED OUT.**

4. PERSONNEL WILL ALLOW SUFFICIENT TIME FOR THE DUST CLOUD TO SETTLE (A MINIMUM OF 15 MINUTES) BEFORE PERSONNEL INSPECT PITS FOR ANY HAZARD.

5. THE DETONATION SITE (PIT AREA) WILL BE CLEANED AFTER EACH DETONATION. ANY UNEXPLODED AMMUNITION, UNBURNED PROPELLANT, EXPLOSIVES, OR METAL SCRAP WILL BE PROCESSED IAW OPERATION 10.

6. NO SITE WILL BE USED MORE THAN ONCE PER DAY FOR MATERIAL TO BE DETONATED TO AVOID THE POSSIBILITY OF STACKING MATERIAL ON HOT EMBERS. CRATERS RESULTING FROM DETONATION ON ONE DAY MAY BE USED ON THE SUCCEEDING DAY. THE SITE WILL NOT BE SECURED AT THE END OF THE WORKDAY UNTIL 30 MINUTES AFTER FINAL DETONATION AND ANY BRUSH FIRES ARE EXTINGUISHED.

UNCONTROLLED

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 8

SITE: Pit Area

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Misfires

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 2 **TRANSIENTS:** 0

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Waiting Period.

   a. (O) After it has been determined that a misfire has occurred, either by the two personnel tasked to count the detonations or by review of video recording, the Supervisor, or designated representative with demil certification, will be notified.

   b. (O)(S) Wait a minimum of **one hour** after the scheduled detonation time before investigating the misfire. The Supervisor, or designated representative with demil certification, can extend the waiting time interval.

2. Investigation.

   a. (S) Only the Supervisor, or designated representative with demil certification, and one Munitions Destroyer will investigate misfires after sweeping the area with CCTV. The safety backup will stay clear of the immediate danger area. He/she will utilize natural barriers or obstructions to observe the action of the person examining the misfire.

   b. (O) Upon reaching the misfired charge, check the fuse lighter. If the fuse lighter failed to function, cut off approximately six inches of the safety fuse. This will give a fresh safety fuse upon which to attach a new fuse lighter. Attach a new fuse lighter and perform steps in Operation 6.

   c. (O) If the blasting cap has functioned and failed to initiate the detonation cord, attach a new dual firing system as stated in Operation 5, and perform the steps in Operation 6.

   d. (O) If the blasting cap has functioned and initiated the detonation cord, inspect the pit area for evidence of a low order detonation or failure of the detonation cord to initiate the charges. If this is the case, refer to Operation 9.

e. (S) If required, after investigation of a misfire, the Supervisor, or designated representative with demil certification, may extend the road closure time by calling the Project Manager.

SPECIAL REQUIREMENTS:

1. **WHEN A LOW ORDER DETONATION OR MISFIRE IS SUSPECTED, CONTINUE VIDEO TAPING SUSPECT PIT(S), PARTICULARLY DURING PHYSICAL CHECK OF PIT(S) AND DURING CORRECTIVE ACTION.**

2. **WHEN A MISFIRE IS SUSPECTED, THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, MAY EXTEND THE WAITING TIME INTERVAL. EXTRA CAUTION SHOULD BE EXERCISED WHEN APPROACHING THE PIT.**

3. **IF REQUIRED, AFTER INVESTIGATION OF A MISFIRE, THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, MAY GET PERMISSION TO EXTEND THE ROAD CLOSURE TIME.**

4. **THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, AND ONE MUNITIONS DESTROYER WILL INVESTIGATE. ALL OTHER PERSONNEL WILL REMAIN IN THE PERSONNEL SHELTER. THE SAFETY BACKUP WILL ONLY APPROACH CLOSE ENOUGH TO KEEP THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, UNDER OBSERVATION WHILE THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, CHECKS MISFIRES/LOW ORDERS.**

5. **WHEN THE PITS ARE READY FOR PRIMING, THE BLASTING CAPS WILL BE TRANSPORTED FROM THE CAP LOCKER TO THE PIT AREA IN A METAL CONTAINER WITH LID. NO MORE THAN WHAT IS REQUIRED FOR ONE DAY'S OPERATION WILL BE REMOVED FROM THE CAP LOCKER.**

   A. **BLASTING CAPS MUST BE IN A CLOSED CONTAINER WHEN BEING TRANSPORTED BY VEHICLES.**

   B. **VEHICLES CARRYING EXPLOSIVES WILL BE INSPECTED, USING A DD FORM 626 (MOTOR VEHICLE INSPECTION FORM).**

   C. **VEHICLES CARRYING EXPLOSIVES OFF PLANT (HWY 359) WILL BE PLACARDED ON ALL FOUR SIDES IN COMPLIANCE WITH 49 CFR.**

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 9

SITE: Pit Area

SOP: HW-0000-G-001

~~**REVISION**~~

CHANGE

OPERATION: Low Order/Partial Detonation

EXPLOSIVE LIMITS: 4,000 lbs. per pit, not to exceed a total of 40,000 lbs. on site

PERSONNEL LIMITS: OPERATORS: 2 **TRANSIENTS:** 0

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Waiting Period.

   a. (O)(S) After it has been determined that a low order/partial detonation has occurred by viewing video recordings, personnel will wait a minimum of **one hour** before investigation.

   b. (S) The camera will be utilized to maintain observation as well as videotape for record/investigation. Supervisor, or designated representative with demil certification, may extend the waiting time interval.

2. Investigation.

   a. (S) Only the Supervisor, or designated representative with demil certification, and one Munitions Destroyer will investigate after sweeping the area with CCTV. All other personnel will remain in the safety shelter. If a fire is observed in a pit, personnel will remain in the safety shelter.

   b. (O)(S) If a low order detonation is suspected and there is a fire in the pit, the area will be secured for a minimum of **16 hours** or overnight. Security will be notified to post an overnight guard at the entrance of the New Bomb Demolition Grounds.

   c. (O)(S) If the firing system has functioned but failed to initiate the charges, place primed charge(s) on top of the original charge and perform Operation 6. If necessary, dig a new hole one foot away or to the side and place a primed two-pound charge in the new hole and perform Operation 5, as required.

   d. (S) If required, after investigation of a low order or partial detonation, the Supervisor, or designated representative with demil certification, may extend the road closure time by calling the Project Manager.

SPECIAL REQUIREMENTS:

1. IF A LOW ORDER DETONATION IS SUSPECTED, THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, MAY EXTEND THE WAITING TIME BEYOND ONE HOUR. EXTRA CAUTION SHOULD BE EXERCISED WHEN APPROACHING THE PIT. IF A LOW ORDER DETONATION IS SUSPECTED AND THERE IS A FIRE IN THE PIT, THE AREA WILL BE SECURED FOR A MINIMUM OF 16 HOURS OR OVERNIGHT.

2. THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, AND ONE MUNITIONS DESTROYER WILL INVESTIGATE. ALL OTHER PERSONNEL WILL REMAIN IN THE SAFETY SHELTER.

3. UNEXPLODED AMMUNITION, FUZED AMMUNITION, OR ANY SUSPECT ITEMS KICKED OUT OF THE PIT AND/OR EXPLOSIVES FOUND DURING AREA INSPECTION WILL NOT BE TOUCHED OR HANDLED WITHOUT EXPLICIT INSTRUCTIONS FROM THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION. PLACE A MARKER FLAG ON THE NORTH SIDE AND OFFSET FROM THE MUNITION BY A DISTANCE EQUAL TO THE HEIGHT OF THE MARKER. ONCE APPROVAL IS OBTAINED, THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, AND ONE MUNTIONS DESTROYER WILL PREPARE THE COUNTER CHARGES. THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, WILL DETERMINE PLACEMENT OF THE CHARGES. DO NOT DISTURB THE ITEM WHILE PLACING THE CHARGE. DETONATE IAW OPERATIONS 5, 6, AND 7.

4. ASSURE FIRES THAT HAVE STARTED ARE COMPLETELY EXTINGUISHED. EXTINGUISH FIRES OUTSIDE THE NEW BOMB DEMOLITION GROUNDS FENCE FIRST.

5. A FIRE WATCH WILL BE MAINTAINED UNTIL ALL FIRES ARE COMPLETELY OUT.

6. IF REQUIRED, AFTER INVESTIGATION OF A LOW ORDER OR PARTIAL DETONATION, THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, MAY GET PERMISSION TO EXTEND THE ROAD CLOSURE TIME.

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 10

SITE: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Disposition of Materials

EXPLOSIVE LIMITS: N/A

PERSONNEL LIMITS: OPERATORS: 12 **TRANSIENTS:** 6

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

For ease of operations, this operational step may be performed at either the pit area or the Y- Area within New Bomb Demolition Grounds.

1. Inspect Containers.

   a. (O) Cut steel strapping on all pallets and manually remove containers from pallets. All cylindrical and end-opening containers (i.e., 3"/50 tanks) may remain unitized provided the openings are facing in the same direction (i.e., outward).

   b. (O) Remove lead wire seals, as required, and open all containers. Set aside seals to a sealable container and process IAW SOP HW-0000-A-001.

   c. (O) Containers with lids designed for removal during normal handling will have lids removed and unitized separately.

   d. (O) Inner packs will be removed from the outer packs. Inner packs that can possibly contain munitions (i.e., fiber tubes, etc.) will be inspected, stamped (operator identified), and unitized separately IAW SOP HW-0000-G-001.

   e. (QC) Inspect containers 100% for any ammunition or hazardous material, i.e., donor material. If found, cease operations and notify Supervisor, or designated representative with demil certification. Hazardous material will be transferred to Operation 4.

   f. (QC) A trained operator will stamp all containers on both the interior and exterior of the container to certify the inspection has been performed and items are free of hazardous material IAW SOP HW-0000-G-001.

g. (O) Containers will be packed IAW SOP HW-0000-A-001. Metal containers or crates may be baled at the New Bomb Demolition Grounds to reduce transportation.

h. (S) Inspect wood pallets for presence of PCP. If PCP is found or suspected, process IAW SOP HW-0000-A-001.

2. Inspect Packing Material.

a. (O) Packing material (paper, cardboard, excelsior, and padding) generated from disposal operations that cannot be reused will be inspected prior to local disposal, to preclude the presence of hazardous material, and packed IAW SOP HW-0000-A-001.

3. Inspect Metallic Scrap.

a. (O) Visually inspect scrap. Segregate any explosive suspect material and set aside suspect material to Operation 4 for detonation in pit.

b. (O) Segregate and containerize metallic scrap in designated containers to provide safe handling for transport to temporary storage or flashing furnace, as applicable.

c. (O)(QC) Place the lid on the container. QA will apply seal to container.

d. (O)(QC) Mark container: SCRAP/NEW BOMB.

4. Certify Inert Material.

a. (O)(S) The Supervisor, or designated representative with demil certification, will certify on DD Form 1348-1 that 100% of material being shipped to any of the following locations is inert IAW SOP HW-0000-A-001:

1) Inert storage;

2) PRO;

3) Solid waste landfill; or

4) Treated wood and asbestos landfill.

b. (O) The DD Form 1348-1 will be filled out IAW SOP HW-0000-A-001.

c. (O) The DD Form 1348-1 will contain like metal items (ferrous vs. non-ferrous).

d. (QC) QA will verify that material is rendered free of items of a dangerous nature, IAW the appropriate QATIP, by signing the DD Form 1348-1 after certification has been performed.

5. Dispose of Materials.

a. (O) Serviceable pallets to storage.

b. (O) Unserviceable non-PCP treated boxes and pallets to the landfill.

c. (O) Ammunition containers and lids to storage or PRO, as directed by PP&PE.

d. (O) Lead wire seals to PRO.

e. (O) PCP contaminated items to the treated wood and asbestos landfill.

f. (O) Baled steel to PRO.

SPECIAL REQUIREMENTS:

1. **REUSABLE PACKAGING AND PACKING MATERIAL WILL BE SEGREGATED BY TYPES OF MATERIALS AND PACKAGED IN SUITABLE CONTAINERS FOR TRANSFER TO STORAGE.**

2. **ALL CONTAINERS OF PACKING MATERIALS WILL BE PLAINLY MARKED WITH IDENTIFICATION AND TYPES OF MATERIALS. IN ADDITION, THE AMMUNITION USED WITH THIS TYPE OF PACKING WILL BE MARKED ON THE CONTAINERS. QASAS WILL DETERMINE THE APPROPRIATE CONDITION CODES.**

3. **ANY SUSPECT ITEMS WILL NOT BE TRANSFERRED. TRAINED MUNITIONS DESTROYERS WILL SCREEN ALL SCRAP ON NEW BOMB DEMOLITION GROUNDS PRIOR TO SHIPMENT TO FLASHING BUILDING.**

OPERATING PROCEDURE

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 11

SITE: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Clean up

EXPLOSIVE LIMITS: 5,000 LBS. ENTIRE AREA

PERSONNEL LIMITS: OPERATORS: 17 **TRANSIENTS:** 4

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. (O)(QC)(S) Daily, check all areas for unexploded ammunition/explosives and process IAW Operation 8.
2. (O) Daily, make the appropriate entries in HWAD New Bomb Contemporaneous Log (Form DZHC-223-E).
3. (O) Daily, pick up all large metal scrap from the road and pit area and set it aside to scrap pile.
4. (O) Daily, remove all unprocessed explosive devices/munitions from the New Bomb Demolition Grounds and return to storage.
5. (O) Daily, perform housekeeping in and around the vicinity of the New Bomb Demolition Grounds Office or shelters.

SPECIAL REQUIREMENTS:

1. **SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, AND LEADER MUST SUPERVISE THE CLEAN-UP OPERATION. PERSONNEL WILL BE BRIEFED OF THE HAZARDS AND PROCEDURES.**
2. **EQUIPMENT OPERATORS WILL BE WARNED OF POSSIBLE LIVE BURIED EXPLOSIVES.**
3. **ANY SUSPECT LIVE/DUD MUNITIONS WILL BE PROPERLY FLAGGED AND DETONATED IN PLACE. ALL OTHER SCRAP AND EXPLOSIVES WILL BE COLLECTED, PLACED IN PIT, AND DETONATED. THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, WILL DESIGNATE LOCATION AND DEPTH OF A BLOWHOLE TO ACCOMMODATE THE AMOUNT OF UNEXPLODED EXPLOSIVES.**

STANDING OPERATING PROCEDURE:
Ammunition and Explosives;
Demilitarization by Detonation

OPERATION 12

SITE: New Bomb

SOP: HW-0000-G-001

REVISION

CHANGE

OPERATION: Close Range

EXPLOSIVE LIMITS: 5,000 LBS. ENTIRE AREA

PERSONNEL LIMITS: 17 **TRANSIENTS:** N/A

STEP	DESCRIPTION	SPECIFIC INSTRUCTION (SAFETY OPERATIONAL, QUALITY CHECKS)

1. Daily Closing of Range:

   a. (O) Transfer all vehicles to locations specified by the Supervisor, or designated representative with demil certification.

   b. (O)(QC) Assure all explosive materials are placed in Temporary Storage Sheds and secured.

   c. (O)(QC) Remove the red DANGER flags and secure.

   d. (O)(QC) Assure all building/shelters are secured. Close and lock gate at the entrance to New Bomb Demolition Grounds.

   e. (O) Assure all road signs are collected and secured.

2. Closing Under Unusual Conditions (poor weather, emergencies, etc.):

   a. (O) The Supervisor, or designated representative with demil certification, or a designated Munitions Destroyer will notify the following offices:

      1) Manager, Safety Office, ext. 7842;

      2) Director, Munitions & Logistics Services, ext. 7244;

      3) Manager, APOD, ext. 7300;

      4) Manager, PP&PE, ext. 7463;

      5) Fire Department, ext. 7107;

      6) Security, ext. 7601.

3. Transfer:

   a. (O) Scrap metal for disposal as directed by PP&PE.

   b. (O) Vehicles and materials to point of issue.

4. Daily Documentation.

   a. (O) The Supervisor, or designated representative with demil certification, will turn in the following documents upon daily completion to the PP&PE Office:

      1) New Bomb Checklist, Form DZHC-101-E.

      2) Meteorological Weather Station Inspection Checklist, Form DZHC-104-E.

      3) HWAD New Bomb AP-9711-1134 Open Detonation Contemporaneous Log (Form DZHC-223-E).

      4) Weather Data Statistics – Open Detonation (Form AMC-Form 2887-R-E).

      5) A print out from the Meteorological Weather Station.

      6) All Ammunition Transfer Records.

      7) All Hazardous Waste Manifests.

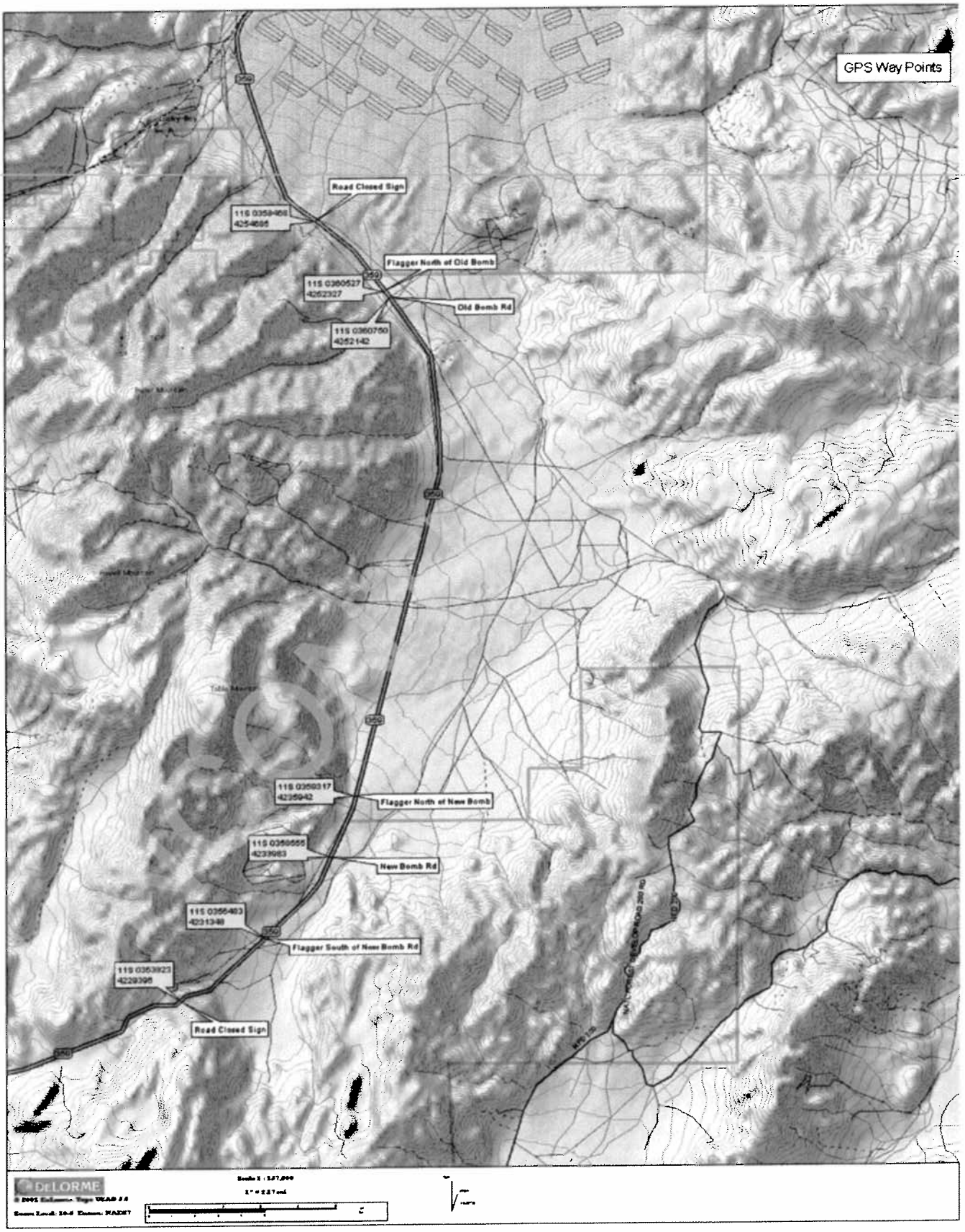
   b. (O) The PP&PE Planner will forward items 1, 2, and 4 to the Environmental Office.

   c. (O) The PP&PE Planner will retain copies of Item 3 & 6 and forward the original to the Environmental Office.

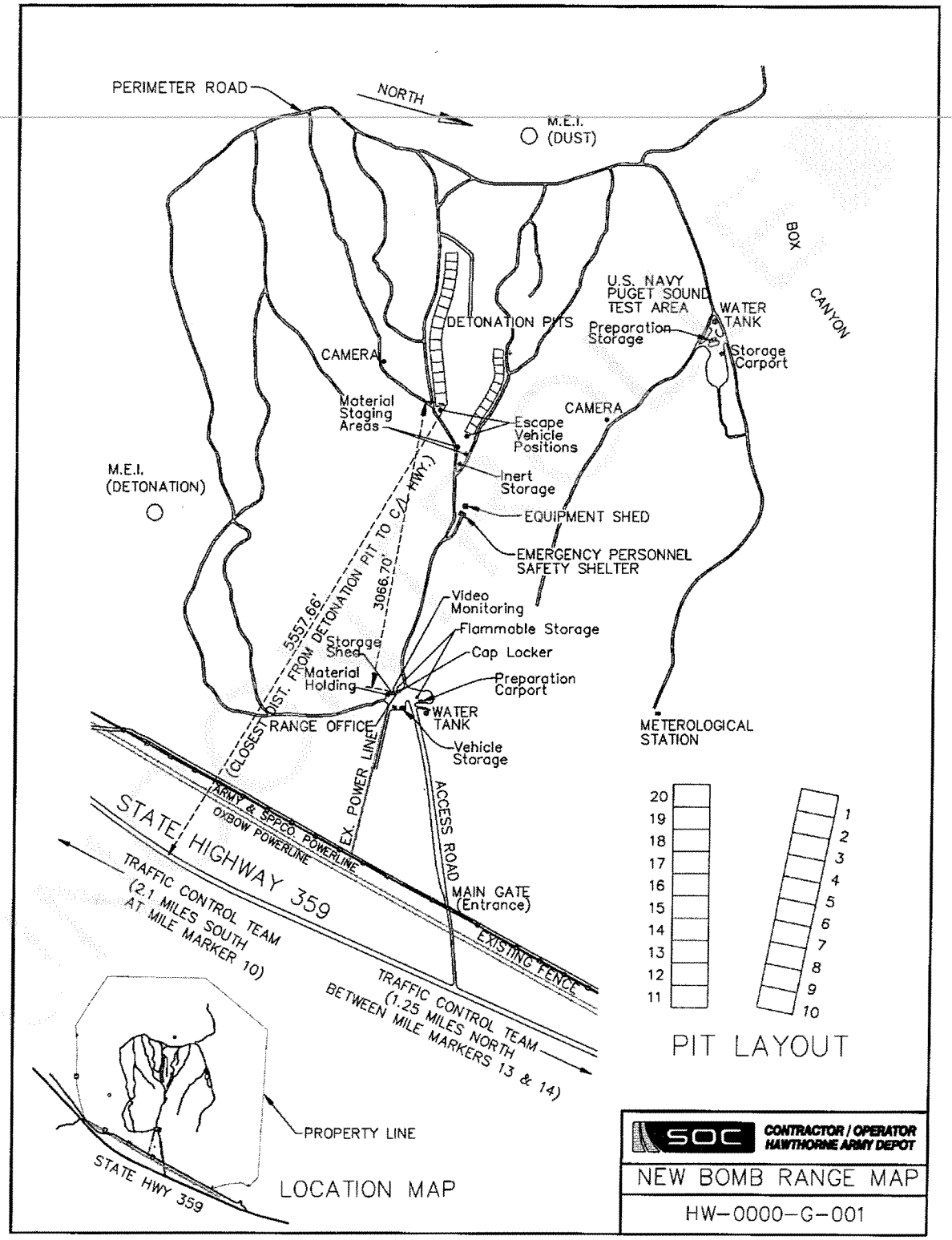
SPECIAL REQUIREMENT:

1. **THE SUPERVISOR, OR DESIGNATED REPRESENTATIVE WITH DEMIL CERTIFICATION, WILL ASSURE THAT THE NEW BOMB LOGS AND WEATHER DATA FORMS ARE PROPERLY FILLED OUT FOR EACH DAY'S OPERATIONS.**

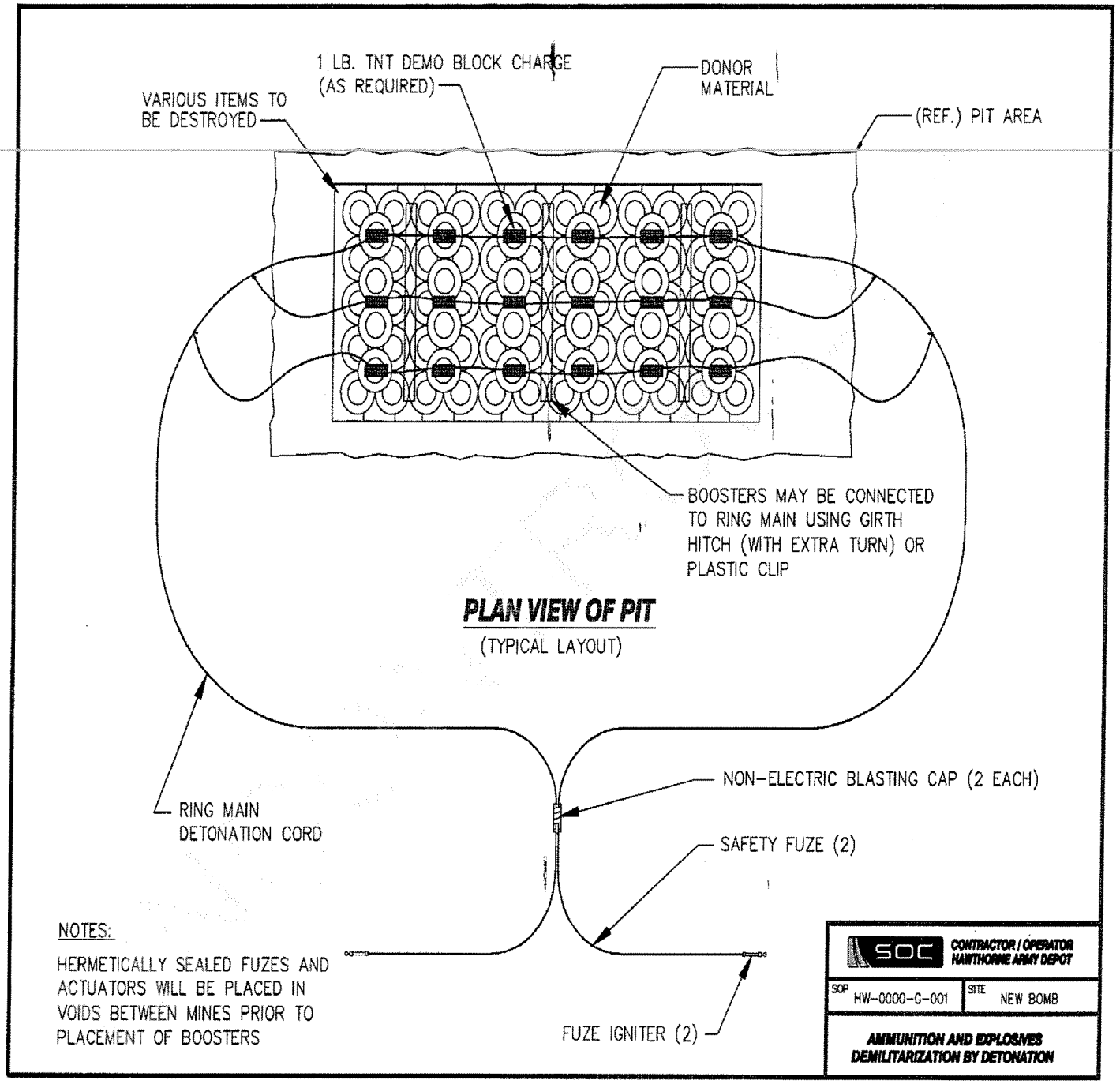
NEVADA STATE HIGHWAY 359 MAP

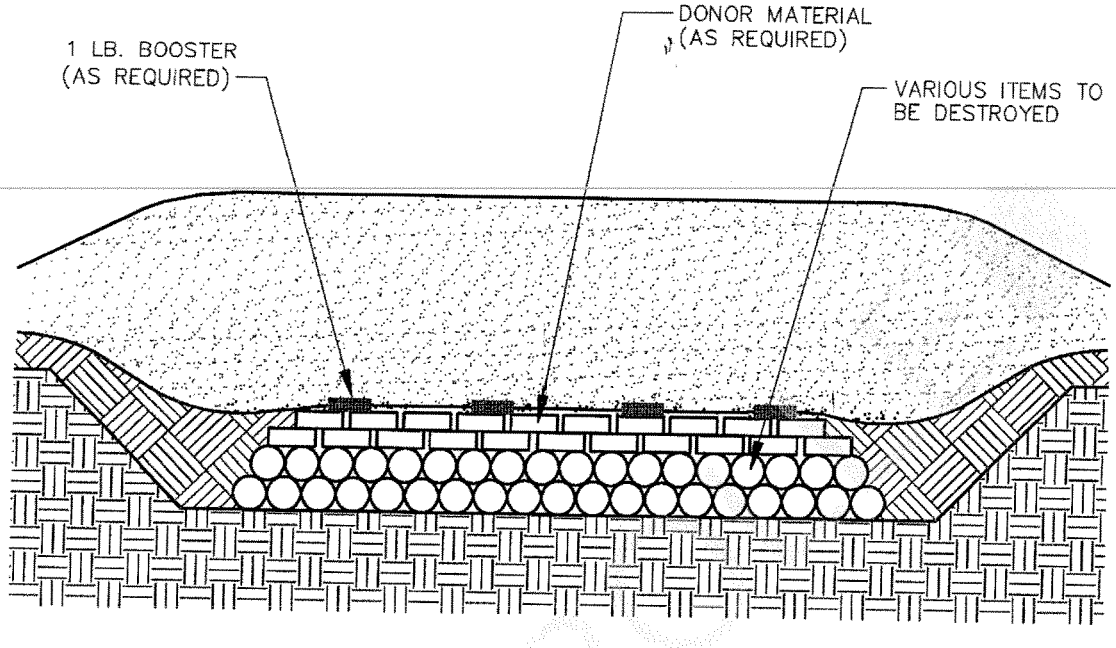


NEW BOMB DEMOLITION GROUNDS MAP



APPENDIX A
VARIOUS PIT LAYOUTS



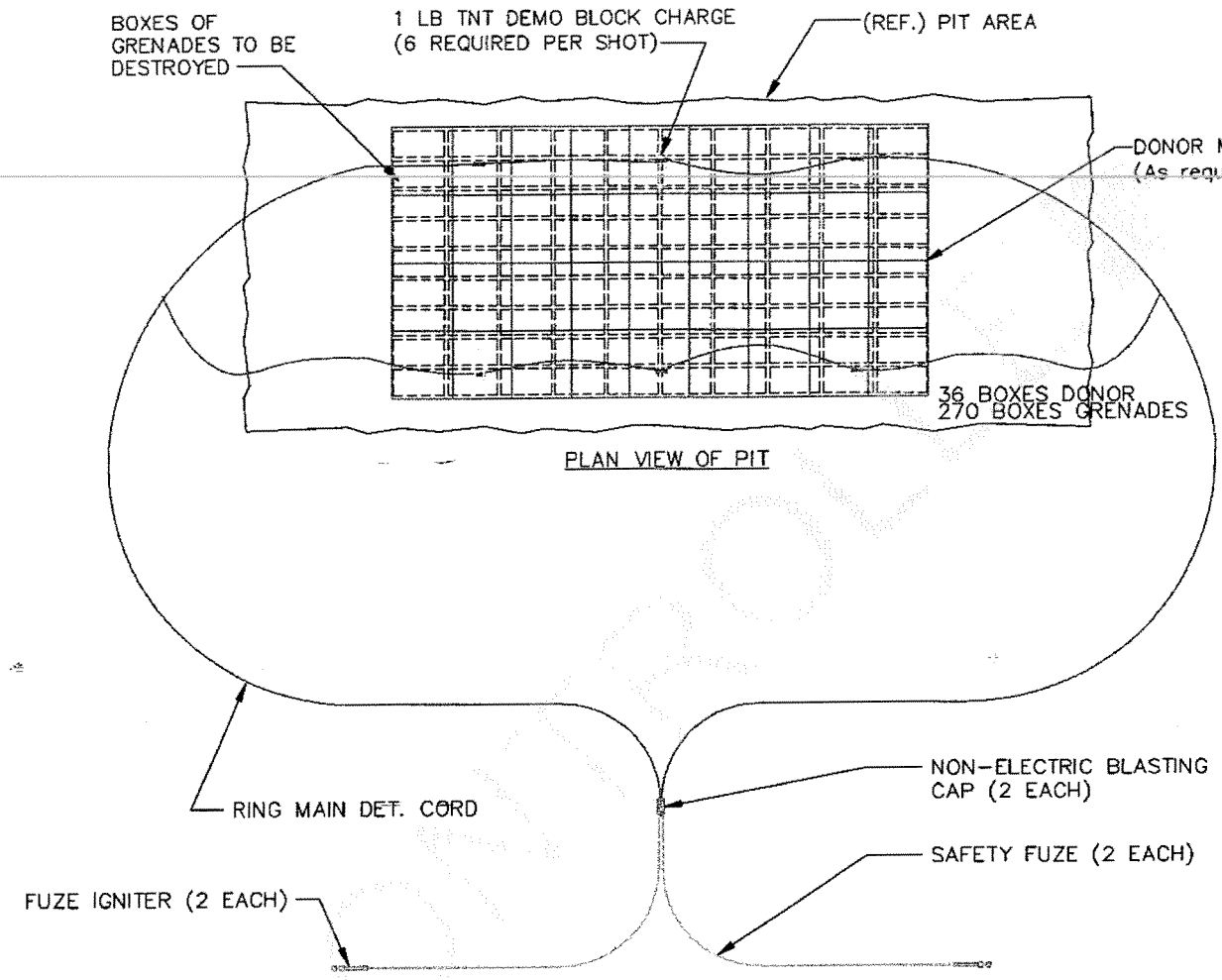


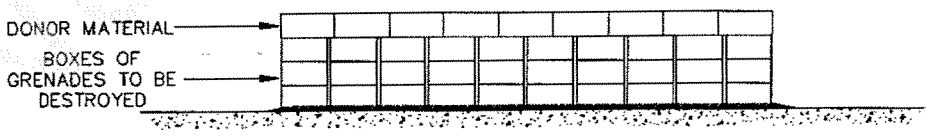
SECTION/ELEVATION OF PIT

NOTES:

HERMETICALLY SEALED FUZES AND ACTUATORS WILL BE PLACED IN VOIDS BETWEEN MINES PRIOR TO PLACEMENT OF BOOSTERS

SOC CONTRACTOR / OPERATOR HAWTHORNE ARMY DEPOT	
SOP HW-0000-G-001	SITE NEW BOMB
PIT LAYOUT FOR VARIOUS ITEMS	





ELEVATION

Notes:

1. Grenades will be placed into the pit in unopened boxes.

2. Boxes of grenades will all be facing the dsame direction (i.e., all content labels will be on one side of the stack when complete). This assures a maximum detonation with minimum fragmentation.

3. Assure all boxes of grenades are placed in a tight pack with minimal space between rows and layers.

Donor material will be placed on top of three rows of boxes and there will be an overhang in all directions..

SOC CONTRACTOR / OPERATOR HAWTHORNE ARMY DEPOT	
SOP HW-0000-G-001	SITE NEW BOMB
PIT CONFIGURATION FOR DETONATION OF M42 GRENADES	

SOC NEVADA LLC DIVISION

HAWTHORNE ARMY DEPOT
HAZARD ANALYSIS & RISK ASSESSMENT

AMMUNITION & EXPLOSIVES DEMILITARIZATION BY DETONATION
(Operational Process/System)

HW-0000-G-001
(Standing Operating Procedure)

November 24, 2010
(Replaces HA/RA, Same Subject, Dtd 08/12/09)
(Date)

NEW BOMB
(Location)

Prepared by: _____
Andrea Marshall, Safety Specialist
Safety & Health Division

November 24, 2010
DATE

Prepared by: _____
Wayne Larson, Manager
Safety & Health Division

November 24, 2010
DATE

SOC NEVADA LLC
HAZARD ANALYSIS

OPERATIONAL PROCESS/SYSTEM: Ammunition & Explosives Demilitarization By Detonation
STANDING OPERATING PROCEDURE: HW-0000-G-001
LOCATION: New Bomb

November 24, 2010

PROCESS DESCRIPTION	RISK ASSESSMENT	RECOMMENDATIONS	REFERENCES
This process covers the operations to be performed for Demilitarization by Detonation. The SOP covers the operations to be performed for the general routine demilitarization of conventional munitions and explosives. The procedure consists of general range operations safety, meteorological requirements, opening range, setup of demolition pits, misfires/partial detonation, inspection, area cleanup, and highway closure procedures.	The Hazard Analysis was performed after considering the adequacy of safety considerations covered in the applicable SOP. A Hazard Severity of I (Catastrophic) and an Accident Probability of D (Remote) are assessed to this operation with a RAC of 3. When recommendations and controls are implemented a Hazard Severity of II (Critical) and an Accident Probability of E (Improbable) are assessed with a RAC of 4 assigned this operation.	1. Operator training and SOP compliance is emphasized. 2. Training and compliance with proper material handling procedures is emphasized. 3. Only trained operators under adequate supervision should perform critical operations and associated procedures. 4. The use of personal protective equipment requirements should be strictly adhered to.	1. MIL-STD 882D; System Safety Program Requirements 2. DoD 4145.26-M; Contractors Safety Manual for Ammunition & Explosives 3. SOC.OHS.SP.0002; SOC Safety Program 4. 29 CFR 1910; Occupational Safety & Health Standards for General Industry

SOC NEVADA LLC DIVSION
HAZARD ANALYSIS

OPERATIONAL PROCESS/SYSTEM: Ammunition & Explosives Demilitarization By Detonation
STANDING OPERATING PROCEDURE: HW-0000-G-001
LOCATION: New Bomb

November 24, 2010

OPERATIONS OR FUNCTIONS	TOOLS AND EQUIPMENT	FAILURE MODE/CAUSE	FAILURE EFFECT	HAZARDS BEFORE CONTROLS	RAC BEFORE CONTROLS	RECOMMENDATIONS AND/OR CONTROLS	HAZARDS AFTER CONTROLS	RAC AFTER CONTROLS
1. Road Closure Procedures	Traffic control signs and reflective vests	Operator fails to inspect highway for UXO prior to letting traffic proceed	Traffic hitting UXO could cause detonation resulting in damage to vehicle and injury to occupants.	II D	3	Operators must insure highway is clear of all UXO prior to allowing traffic to proceed. Any fragmentation should also be removed.	III E	4
2.Open Range	Meteorological Equipment	Improper or incomplete procedures used to determine weather conditions.	Potential high winds or electrical storm could pose danger to operating personnel.	II D	4	Operator instruction in meteorological requirements in determining weather conditions.	III E	5
3. Pre-Operational Check of Range and Equipment	Heavy Equipment and Hand Tools	Ineffective check of pit areas could lead to loading a hot pit.	Death or serious injury to operators could result from fire or premature detonation.	I D	3	Operator training in pit inspection procedures. Supervisors shall ensure all pit checks are complete prior to start of operation.	II E	4
4. Verify Documentation and Unload Explosives	Transport Vehicle and Forklift	Forklift tines penetrate ammunition boxes or drop containers to ground.	Possible injury to personnel and damage to equipment and material.	II D	3	Forklift operator training in loading/unloading transport vehicles of explosives.	III E	4
5. Pit Preparation and Placement of Explosive Material	Hand Tools and Demolition Material	Rough handling or dropping due to improper munitions handling procedures.	Death or serious injury could result due to detonation of explosives caused by rough handling.	I D	3	Operator training in care and proper munitions handling procedures.	II E	4
6. a. Setup Initiating System	Demolition Equipment and Material	While cutting time fuze, operator inadvertently breaks or cuts outer cover of fuze.	Break in the time fuze could cause a misfire.	II D	4	Operator training in the proper demolition procedures. Only fully qualified personnel shall perform this task.	III E	5

SOC NEVADA LLC
HAZARD ANALYSIS

OPERATIONAL PROCESS/SYSTEM: Ammunition & Explosives Demilitarization By Detonation
STANDING OPERATING PROCEDURE: HW-0000-G-001
LOCATION: New Bomb

November 24, 2010

OPERATIONS OR FUNCTIONS	TOOLS AND EQUIPMENT	FAILURE MODE/CAUSE	FAILURE EFFECT	HAZARDS BEFORE CONTROLS	RAC BEFORE CONTROLS	RECOMMENDATIONS AND/OR CONTROLS	HAZARDS AFTER CONTROLS	RAC AFTER CONTROLS
6. b. Setup Initiating System	Demolition Equipment and Material	Operator places crimping tool too close to explosives in blasting cap when crimping.	Possible detonation of the blasting cap causing serious injury to the operator.	I D	3	Operator training in proper demolition procedures. Only fully qualified personnel shall perform this task.	II E	4
7. a. Detonate Charge	Traffic Control Signs and Vests	Traffic control team fails to stop and warn motorists of impending detonations and fragmentation hazards.	Vehicles entering the potential fragmentation area could be hit by metal fragments causing property damage and possible serious injury or loss of life.	I D	3	All vehicles should be stopped.	II E	4
7. b. Detonate Charge	Demolition Material	Premature detonation due to improper demolition preparation or faulty time fuze or blasting caps.	Death or serious injury to operators.	I D	3	Operator training in demolition procedures. Only fully qualified personnel shall perform this task.	II E	4
8. Handling Misfires	Demolition Material	Operators fail to wait required time before approaching the pit.	Death or serious injury to operators could result from delayed detonation.	I D	3	Strict adherence to procedures to be followed in the event of a misfire.	II E	4
9. a. Inspection of Pit Area and Unexploded munitions	Hand Tools	Ammunition kicked out during detonation laying outside pit area.	Death or serious injury could result from disturbing unexploded ordnance.	I D	3	Operator training in recognizing potentially dangerous unexploded ordnance or other armed devices.	II E	4
9. b. Handling Low Order/Partial Detonation	Demolition Material	Operators fail to wait the required time period before approaching pit.	Death or serious injury to operators due to dangerous unexploded ordnance lying around pit area.	I D	3	Strict enforcement of required wait times for low order or partial detonation.	II E	4
10. Disposition of Materials	Packing Material and Containers	Live ordnance or explosive material left in packing material or containers.	Material containing explosives could be offered for sale to the public or buried in a landfill illegally.	II D	3	Operator training in proper inspection procedures to be followed when checking packing material and containers for disposition.	III E	4

SOC NEVADA LLC
HAZARD ANALYSIS

OPERATIONAL PROCESS/SYSTEM: Ammunition & Explosives Demilitarization By Detonation
STANDING OPERATING PROCEDURE: HW-0000-G-001
LOCATION: New Bomb

November 24, 2010

OPERATIONS OR FUNCTIONS	TOOLS AND EQUIPMENT	FAILURE MODE/CAUSE	FAILURE EFFECT	HAZARDS BEFORE CONTROLS	RAC BEFORE CONTROLS	RECOMMENDATIONS AND/OR CONTROLS	HAZARDS AFTER CONTROLS	RAC AFTER CONTROLS
11. Range Cleanup	Hand Tools	Incomplete cleanup may lead to subsequent detonation of unexploded ordnance.	Unexploded ordnance left on range could pose danger to operating personnel at a later date.	I D	3	Operator training in proper range clearance procedures.	II E	4
12. Closing Range	Communications Equipment	Unused explosives not secured as required	Unauthorized use or removal of explosives endangering people and property.	I D	3	Operator training in proper range clearance procedures.	II E	4

HAZARD PROBABILITY CODES					HAZARD SEVERITY CODES			
FREQUENT	PROBABLE	OCCASIONAL	REMOTE	IMPROBABLE	CATASTROPHIC	CRITICAL	MARGINAL	NEGLIGIBLE
A	B	C	D	E	I	II	III	IV

RISK ASSESSMENT CODE			
UNACCEPTABLE	UNDESIRABLE	ACCEPTABLE WITH REVIEW	ACCEPTABLE WITHOUT REVIEW
1 OR 2	3	4	5

APPENDIX B
Master Training Plan

SOC SECURING OUR COUNTRY	QUALITY PLAN SYSTEM LEVEL PROCEDURE ISO 9001:2008 SOC HAWTHORNE DIVISION	DOCUMENT NO. SOC.QP.HRD.0005
TITLE	MASTER TRAINING PLAN	REV. 3 PAGE 1 OF 34

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APPROVED BY	WAYNE LARSON, MANAGER SAFETY OFFICE	DATE 4/2010
APPROVED BY	YVONNE DOWNS, ENVIRONMENTALIST ENVIRONMENTAL SERVICES	DATE 4/2010
APPROVED BY	ROBERT MATHIAS, FIRE CHIEF FIRE & EMERGENCY SERVICES	DATE 4/2010
APPROVED BY	CHERI BRYANT, MANAGER GUARD OPERATIONS	DATE 4/2010
APPROVED BY	CLARENCE CARLOS, MANAGER PHYSICAL & INDUSTRIAL SECURITY	DATE 4/2010
APPROVED BY	HUGH QUALLS, DIRECTOR BASE OPERATIONS	DATE 4/2010
APPROVED BY	RONALD GOING, DIRECTOR MUNITIONS & LOGISTICS SERVICES	DATE 4/2010
APPROVED BY	JOHN GEORGE, DEPUTY DIRECTOR LOGISTICS SERVICE DIVISION	DATE 4/2010
APPROVED BY	THERESA VINSON, DIRECTOR CONTRACT ADMINISTRATION & PURCHASING	DATE 4/2010
APPROVED BY	NANCY RUTHERFORD, ACTING DIRECTOR HUMAN RESOURCES DIVISION	DATE 4/2010

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REVISION HISTORY

REV #	CHANGE DESCRIPTION	AUTHOR	REVIEW DATE
3	• To reflect regulatory training requirements, as they existed on 1/31/2008 • Incorporate Mercury Storage Training Program – Program Requirements	S. Berry	4/2011

REFERENCE DOCUMENTS

DOCUMENT NUMBER	DOCUMENT TITLE
N/A	Collective Bargaining Unit Agreements (Labor and Security Guard Force)
	Job Classification Tiering Requirements
Title 10 CFR	Code of Federal Regulations - Labor
N/A	SOC Policies, goals & objectives
DAAA09-99-D-0022	Present Contract Requirements
Title 49 CFR	Code of Federal Regulations - Department of Transportation
Title 40 CFR	Code of Federal Regulations - Resource, Conservation & Recovery Act (RCRA)
Title 29 CFR	Code of Federal Regulations - Occupational Health and Safety Act
NFPA	National Fire Prevention Association
Various Statutory Requirements	Specific to DOD EMT
CAPP NAC 459.95418	State of Nevada Chemical Accident Prevention Program Training Procedures (NRS 459.3818, 459.3833)

DOCUMENTS REFERENCED IN THIS PROCEDURE ARE APPLICABLE TO THE EXTENT SPECIFIED HEREIN.

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1. PURPOSE

1.1 The primary purpose of this document is to provide a trained, efficient, informed and safe workforce for the accomplishment of SOC's mission and to ensure total customer satisfaction.

1.2 Pursuant to NAC 459.95418 the Owner/Operator of a facility with a process that is subject to the Chemical Accident Prevention Program (CAPP) shall provide training in each of the following areas:

1.2.1 Process Overview;
1.2.2 Operating Procedures;
1.2.3 Plant/Facility Layout;
1.2.4 Equipment and instrumentation Location;
1.2.5 Safety and Health hazards specific to various processes;
1.2.6 Emergency Operations and Instructions;
1.2.7 Safe work practices specific to operations and assigned tasks;
1.2.8 Management of Change (MOC) development and implementation pursuant to NAC 459.95423 to include instruction on how to recognize activities that are "replacement in kind".

1.3 Training specific to the Mercury Storage Program (MSP) and the Chemical Accident Prevention Program (CAPP) is incorporated in this document to ensure personnel are trained to the following:

1.3.1 The hazards associated with the receipt, storage, and inspection operations;
1.3.2 Maintenance of containerized mercury and carbon dioxide (CO_2) Fire Suppression System;
1.3.3 Knowledge and understanding of Standing Operating Procedures (SOP), Internal Operating Procedures (IOP) and Quality Plans (QP);
1.3.4 The process by which changes are managed and evaluated see, Management of Change (MOC) Standard Procedures.

1.4 This plan is intended to provide the framework necessary to implement and achieve contractual requirements, policy compliance and regulatory/statutory requirements.

1.5 This plan also provides guidance to set goals to meet training and educational requirements and promote their awareness.

1.6 This plan also establishes the timelines for refresher and/or certification renewal training.

2. SCOPE

2.1 The scope of this document is applicable to all personnel employed by the operating contractor at the Hawthorne Army Depot (HWAD).

2.2 The Human Resource Division will ensure that local Government Employees, to include tenant activities are included in all opportunities for training at their request.

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3. POLICY

3.1 **TRAINING POLICY**: The operating contractor, will provide employees with the training necessary to increase efficiency in the performance of official duties and to develop employee potential

3.1.1 The Director, Human Resources will ensure training of employees is accomplished. Employees will be selected to participated in training programs without regard to race, color, religion, national origin, sex, handicap conditions, age, marital status or other factors unrelated to their need for training and development.

3.1.2 Employees will not be selected for non-regulatory training when a personnel action is pending which would nullify the benefit of the training to the operating contractor. i.e., resignation, retirement, transfer or an extended leave of absence

3.1.3 The operating contractor will provide educational assistance to its regular full-time employees. This includes General Equivalency Diplomas (GED), accredited college or university classes, internet and correspondence courses through accredited colleges, universities or other commercial organizations.

3.2 HWAD's Policy Statement #13 approved 06 October 2006, reads as follows; "In cooperation with Federal and State Environmental Protection Agencies, the Hawthorne Army Depot (HWAD) will comply with all applicable legal requirements and with other requirements to which the organization subscribes which relates to its environmental aspects. HWAD will strive for excellence in environmental leadership and will establish primary values in environmental stewardship to achieve continuous improvements in environmental management. Those values are: Safety, Health, and the Environment. Through the implementation of sustainable, sound, and proactive programs such as an environmental management system, utilizing behavior based processes, and meeting the operational excellence standards of ISO 14001, we will minimize or eliminate adverse environmental impacts and maximize environmental protection and stewardship."

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3. POLICY

3.2 **OCCUPATIONAL HEALTH & SAFETY POLICY** 1101-1 – SOC Hawthorne is dedicated to protecting and improving the quality of life of our employees, subcontractors and visitors. Our Occupational Health and Management System ensures a safe workplace where a zero injury and zero occupational related ill health is a commitment and assures compliance with all applicable regulations. This is achieved through our core values of safety, integrity, quality and our commitment to excellence.

Values:

- **INVOLVEMENT** – Our employees and subcontractors are actively involved in our OH&S programs
- **IMPROVEMENT** – Continuous improvement of our operations while identifying and controlling hazards/risks
- **ASSESSMENT** – Conducting OH&S assessments of all operations on HWAD and taking the necessary actions to control, identified hazards and risks
- **EVALUATION** – Regular review and revision of policies, objectives and programs (at least annually so they remain relevant to changing needs.
- **COMPLIANCE** – Complying with all applicable local, state and federal regulations and other requirements
- **ADVOCACY** – Advocating innovation, awareness, and OH&S best practices
- **MANAGEMENT** – Requiring Top Management to establish a proactive OH&S culture through leadership, governance and monitoring
- **COMMITMENT** – Our commitment to safety extends beyond the workplace; safety behavior is a core value – on and off the job.

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4. DEFINITIONS AND ACRONYMS

4.1 **AFTER DUTY HOURS TRAINING** – Typically defined as a training program conducted outside the normal hours of work, and primarily applies to individuals who will compete for job openings in the skilled trades and crafts areas; This type of training is usually conducted by journeymen in their specific fields of expertise as they apply. After-duty training programs serve to provide an evaluation of the capabilities and/or limitations of employees, as well as increasing the pool of employees who demonstrate potential in one or more of the critical skills of a specific classification.

4.2 **A/R** – As Required

4.3 **CAPP** – Chemical Accident Prevention Program - State of Nevada, Division of Environmental Protection (NDEP).

4.4 **CO_2** – Carbon Dioxide

4.5 **DZHC** – Day & Zimmermann Hawthorne Corporation, also known as SOC LLC.

4.6 **GROUP I CERTIFICATION** – Curriculum includes Safety, Security, Environmental Awareness and knowledge and use of Personal Protective Equipment (PPE). Additional requirements include Explosive Safety, Material Handling Equipment (MHE) Technical Ammunition I, Standing Operating Procedures (SOP) (Specific to Job Assignment(s)), Production Operation Procedures and Hazardous Communication (HAZCOM). Successful completion of each area of study is a minimum passing grade of 75%.

4.6 **GROUP II CERTIFICATION** – Prerequisite: Successful completion of all Group I certification training. Group II includes refresher courses in the Group I category, in addition to Hazardous Materials (HAZMAT), Waste and Hazardous Waste Handling, Emergency Response Procedures, Storage Procedures Level II, Technical Ammunition Level II, Military Munitions Rule, and ISPM 15 requirements for Non-Manufactured Wood Products. Successful completion of each area of study is a minimum passing grade of 75%.

4.7 **GROUP III CERTIFICATION** – Prerequisite: Successful completion of all Group II certification training. Group III includes refresher courses in the Group II category, development of Hazard Analysis and Risk Assessments (HARA) and Job Safety Analysis' (JSA), in addition to Leadership and Supervision, Management courses/certifications as identified by the division Director or Special Staff Office (SSO) Manager. Successful completion of each area of study is a minimum passing grade of 75%.

4.8 **HARA** – Hazard Analysis/Risk Assessment

4.9 **HRD** – Human Resources Division

4.10 **Hg** – Elemental Mercury

4.11 **HWAD** – Hawthorne Army Depot

4.12 **IOP** – Internal Operating Procedure (Level II document) specific to instructional guidance for completing a job specific task

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4. DEFINITIONS AND ACRONYMS

4.13 **ISO** – International Organization on Standardization

4.14 **JSA** – Job Safety Analysis

4.15. **MINIMUM PASSING GRADE** – Any testing given the student is required to achieve a minimum grade of 75%.

4.16 **MOC** – Management of Change

4.17 **MTP** – Master Training Plan

4.18 **NAC** – Nevada Administrative Code

4.19 **NDEP** – Nevada Division of Environmental Protection

4.20 **NRS** – Nevada Revised Statute

4.21 **ON-SITE TRAINING** – Training provided at the Hawthorne Army Depot by either contracted educators and/or local subject matter experts (SME)

4.22 **OFF-SITE TRAINING** – Training that is provided for away from or outside the confines of the Hawthorne Army Depot.

4.23 **OJT** – On the Job Training – and may include any and/or all of the following types of training: Company policies, new and re-implemented procedures, regulatory requirements and awareness, management system requirements (ISO 9001, 14001, and OHS 18001), this plan and/or any other training that may be accomplished on a one on one basis or through team or group meetings. OJT subject matter may pertain to internal communications, general and/or specific work assignments. Examples of OJT include but are not limited to topics on diversity, safety statistics, departmental overview, team performance/behavior operational instructions and/or desk procedures.

4.24 **SELF DEVELOPMENT** – is training an employee receives either through his/her own initiative and resources for the purpose of self improvement. Primary sources for self development are correspondence courses, approved internal courses and courses offered through local community colleges or universities. Employees are strongly encouraged to participate when self development will improve their skills, knowledge and abilities and improve their ability to contribute to the success of their department and the company.

4.25 **SME** – Subject Matter Expert

4.26 **SOP** – Standing Operating Procedure

4.27 **SSO** – Special Staff Office

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4. DEFINITIONS AND ACRONYMS

4.27. **TIER TRAINING** – The Company employs a paid tier structure in many of the job classifications for hourly employees within the scope of the collective bargaining unit. The successful completion of identified, required training within each of those classifications participating in the tier program must be completed prior to advancing within those tiered systems. Additional requirements may include a minimum amount of time employed at each level within the respective system(s). Advancement will mean incremental adjustments in the hourly rate of pay for the specific classification.

4.28 **TRAINING PROGRAM** – The training needs and requirements expected to be accomplished to attain educational objectives for personnel in each job category/classification.

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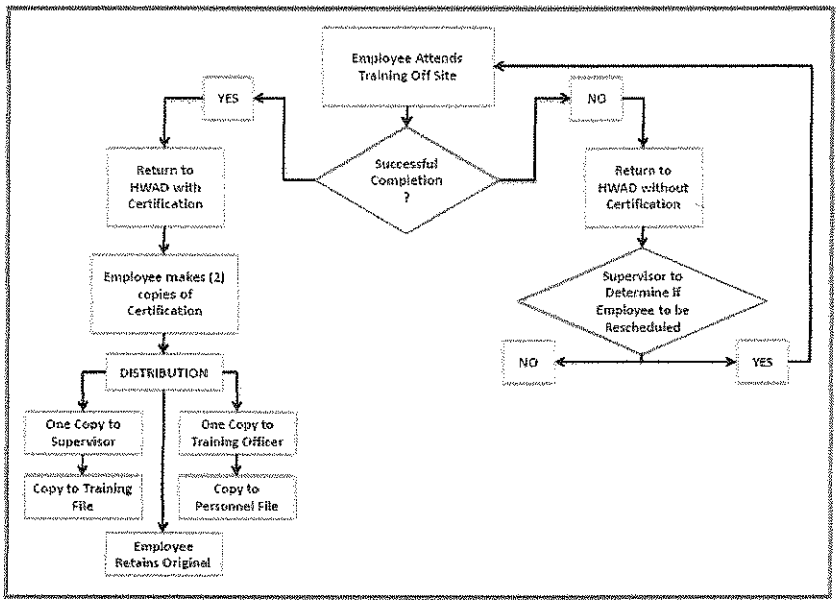
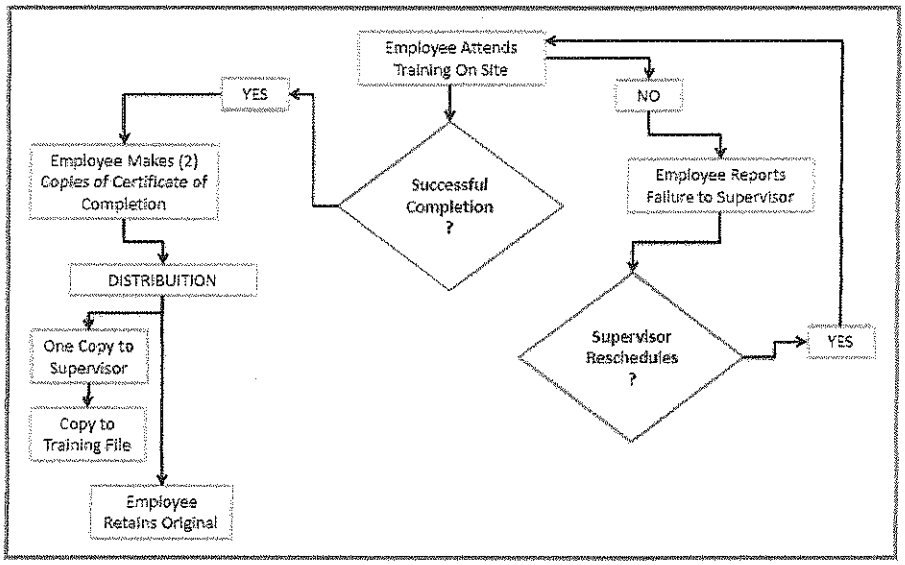
5. FLOWCHART

5.1 TRAINING REPORTING REQUIREMENTS – OFF STATION



5.2 TRAINING REPORTING REQUIREMENTS – ON STATION



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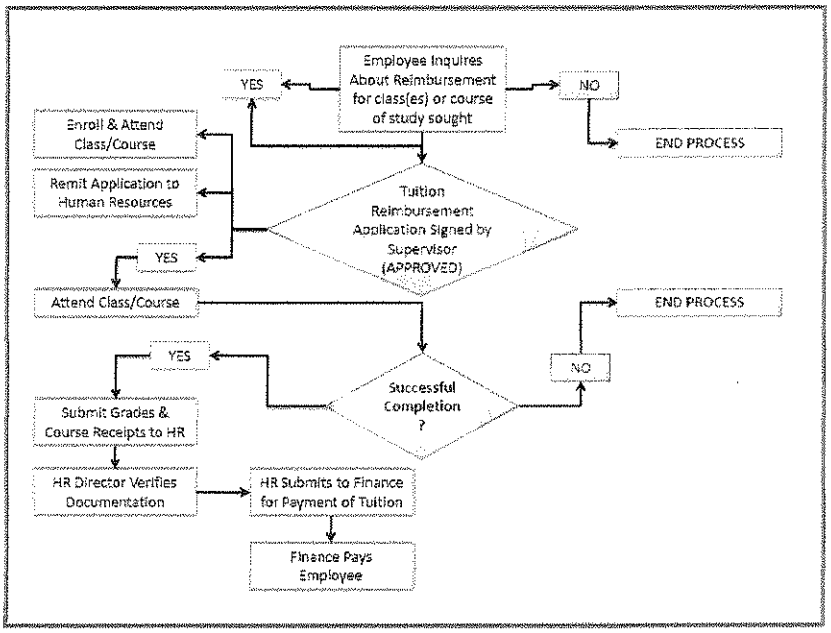
5. FLOWCHART

5.3 TUITION REIMBURSEMENT



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6. RESPONSIBILITIES

6.1 **THE HUMAN RESOURCE DIVISION (HRD) will:**

6.1.1 Maintain oversight and responsibility of the Training Program for the Company. The assistance, cooperation and participation of each organization is required to ensure the success of the program as well as to maintain compliance to company policies, regulatory and our contractual requirements.

6.1.2 Provide facilities and an environment to conduct training in large groups that is conducive to the learning process.

6.1.3 Maintain records of documented training that is regulatory in nature, manage and update personnel files with records of certification and/or professional licenses.

6.1.4 Provide assistance in identifying training needs, planning such training and the administration of training within each directorate.

6.1.5 Develop, organize, schedule and monitor training programs and course designs to ensure the presented material meets the intended requirement and educational goals.

6.1.6 Provide assistance in the establishment and development of training programs to include, but not limited to scheduling, monitoring and verification of records (tests, evaluations, presentation materials etc.).

6.1.7 Ensure all training programs and sessions are evaluated. Such evaluations will be documented on the HWAD 328-E, Course Evaluation and reviewed with instructors at the conclusion of scheduled training to offer course content and presentation materials improvements.

6.2 **THE ENVIRONMENTAL SERVICES DIVISION will:**

6.2.1 Retain responsibility for the technical administration of the Mercury Storage Training Program. This includes but is not limited to administering and updating the CAPP overview training module, including testing to all HWAD personnel inclusive of tenant activities, subcontractor personnel and off-station visitors.

6.2.2 Schedule CAPP overview through the Human Resources Division to ensure all affected personnel receive the required type of training specific to the Elemental Mercury Training Program.

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6. RESPONSIBILITIES

6.3 **DIRECTORS & DEPARTMENTAL MANAGERS will:**

6.3.1 Determine the immediate and long range training needs within their areas of responsibility.

6.3.2 Identify and appoint personnel within their organizations to instruct personnel when their knowledge and expertise can be utilized to meet specific and/or required training objectives.

6.3.3 Guard Operations and Fire and Emergency Services will provide all training internally or through outsourcing for employees under their responsibility where it applies to job specific functions.

6.3.4 Ensure that employees are trained to meet the required performance standards to include NAC 459.95418 and state and local safety policies and regulations respective of their assigned duties and assigned positions. All training specific to the Mercury Storage Program, regardless of the source will be documented as follows:

a. Employee name
b. Employee ID number (payroll number)
c. The name of the individual presenting the material
d. The date the training was presented
e. Copies of any tests/quizzes and the score achieved regardless of the score achieved
f. A brief description of the training presented or a copy of any presentations
g. Course and Instructor Evaluation (DZHC 328-E)

6.3.5 Ensure training curriculum specific to the Mercury Storage Program includes, without limitation the following information:

a. Plant/Depot Layout
b. The location of equipment and instruments
c. Specific safety and health hazards
d. Emergency Operations, including but not limited to procedures for emergency shut down
e. Safe work practices applicable to the assigned task
f. The process and procedure by which a management of change is initiated, developed and implemented pursuant to NAC 459.95423, to include instruction on how to recognize activities that are not replacement in kind.

6.3.6 Provide employees with refresher training specific to the Mercury Storage Program at a minimum of once every three (3) years or more often as deemed necessary. Employees may be polled randomly to ensure their knowledge and awareness is adequate to maintain a safe working environment and their ability to report and respond to an incident and meets the requirements of the CAPP.

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6. RESPONSIBILITIES

6.3.7 Schedule, execute and evaluate site-specific training programs within their respective organizations.

6.4 **SUPERVISORY PERSONNEL will**:

6.4.1 Determine immediate and long range training needs for personnel assigned to their area of responsibility.

6.4.2 Provide OJT to personnel assigned to their area of responsibility to ensure efficiency and promote work and safety requirements and understanding.

6.4.3 Submit all requests for training for employees within their area of responsibility to include but not limited to obtaining professional licenses and/or certifications.

6.4.4 Documenting training conducted in the workplace either formally or informally on the DZHC Training Report (DZHC Form 84-E). Training Reports will be kept on hand at the point of origin and are not required to be forwarded to the HRD. Files will be maintained for a minimum of five (5) years, with the present and last calendar year on hand. All other records may be transferred to the records storage facility.

6.4.5 Ensure employees within their area of responsibility are aware of this plan and the specific training requirement relative to their assigned job classification. Supervisors will also ensure each employee knows how to execute requests for training and tier advancements.

6.4.6 Ensure employees who obtain and are required to maintain specialized certifications and or professional licenses forward copies of the obtained license/certification to the Training Officer. Specialized or Professional licenses/certification requirements may be found in Appendix B of this document.

6.4.7 Establish and maintain training files for individuals within their area of responsibility to document and record on-site training, OJT, local licenses/requirements and copies of the items described in 6.4.6 of this section.

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7. PROCEDURE

7.1 TRAINING REQUIREMENTS SHALL:

7.1.2 Be determined by a continual review and analysis of the Company mission and vision. As part of this analysis, the number and type of personnel necessary to carry out the required mission based on long and short term work load requirements and will be assessed in addition to any regulatory, statutory and/or contractual requirements.

7.2 REQUESTING TRAINING/TRAVEL FROM A GOVERNMENT AGENCY

7.2.1 Complete the DD Form 1556-1, Request, Authorization, Agreement, Certification of Training and Reimbursement a minimum of 90 days prior to the scheduled training start date.

7.2.2 Complete the DZHC 78-E Request for Official Travel

7.2.3 Submit the completed forms to the Department Director or SSO for Approval

7.2.4 Signed Copies will be distributed as follows:

a. A copy of the DD Form 1556-1 and the DZHC 78-E to the Controller's Office;
b. A copy of the DD Form 1556-1 to the Administrative Contracting Officer;
c. Retain a copy in the Employee's training folder of the requesting office.

7.2.5 The DD Form 1556-1 must accompany the trainee to the destination for the instructor to sign and assign a grade upon completion of the requested training.

7.2.6 Upon completion of training, the DD Form 1556-1 and any certificates of completion will be submitted to the employee's supervisor and to the HRD.

7.3 REQUESTING TRAINING/TRAVEL FROM A COMMERCIAL AGENCY:

7.3.1 Complete the DZHC 78-E Request for Official Travel

7.3.2 Submit the completed form to the Department Director or SSO for Approval

7.3.3 Signed Copies will be distributed as follows:

a. The signed DZHC 78-E to the Controller's Office
b. Retain a copy in the employee's training folder of the requesting office.

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7. PROCEDURE

7.4 REQUESTING LOCAL TRAINING:

7.4.1 The requestor must identify a source for the specific training (i.e., local instruction, or contracted agency)

7.4.2 Submit the request for training to the Training Officer via telephone and/or email. Be precise in your description of the training you are requesting, i.e., Munitions Operations Level I/II, Local HAZCOM, RCRA etc.

7.4.3 To request training that is to be provided by an outside source or contractor/consultant, the requestor must submit a Requisition (DZHC 16-E Form) to the Purchasing Division with all of the source data, pricing/quote and availability. For additional purchasing guidance, for securing services utilize the Purchasing Manual.

7.5 TUITION REIMBURSEMENT:

7.5.1 The Company will provide educational assistance to its regular full-time employees, who have been employed for at least three months, who attend accredited, job-related, courses or programs during non-duty hours. To be eligible to participate in the program, employees must be actively employed by the Company at the beginning of an approved course and remain so throughout the duration of the course.

a. Tuition reimbursement covers the actual tuition charge. The cost of books, supplies, fees, etc. will be the responsibility of the employee. Employees must provide proof of successful completion of the course and provide original, itemized receipts of approved courses to HR prior to reimbursement.

b. Correspondence or Internet course enrollment through accredited colleges, universities, or commercial organizations may be included in the program. The internet or correspondence course must be approved by management prior to enrollment or reimbursement. To meet accreditation, the schools must be recognized by the U.S. Department of Education and accredited by agencies that are recognized by the Commission on Recognition of Post-secondary Accreditation (CORPA).

c. Degree programs offered through community colleges or universities will be approved on a case-by-case basis. Employees will be required to provide degree program enrollment verification and a list of courses required for the degree in advance of enrollment.

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7. PROCEDURE

7.5.2 RESPONSIBILITIES:

a. Directors are responsible for stimulating and encouraging employees to pursue self-development programs that will enhance On-the-Job performance or prepare them for reassignment or advancement. They should discuss the appropriateness of the course desired with the employee prior to course registration.

b. The HR Director is responsible for the administration of the program.

c. Employees will complete the Tuition Refund Application (DZHC 199-E Form), with the course title, school or college, start date, and cost per course.

d. Directors will forward the completed form, annotated with appropriate comments, to the Human Resources for submittal.

e. Human Resources will forward the form to the Controller for approval. Human Resources will notify the employee if approval is denied.

f. Employees will submit copies of their grade scores and original, itemized receipts to HR. HR will attach the grade scores and itemized receipts to the appropriate approved course forms and forward to the Controller for reimbursement.

Note: Taxes may be withheld from tuition reimbursements in accordance with IRS guidelines.

7.5.3 REPAYMENT OF REIMBURSEMENT GUIDELINES

a. Employees who voluntarily leave the Company within three years after completion of a course for which tuition reimbursement was received are required to repay the reimbursed amount according to the following prorated schedule:

1. If an employee leaves within one year of course completion, 100% reimbursement will be refunded to the Company.

2. If an employee leaves within two years of course completion, 50% reimbursement is to be refunded to the Company.

3. If an employee leaves within three years of course completion, 25% reimbursement is to be refunded to the Company.

4. The amount of reimbursement owed will be deducted from the employee's final paycheck if he/she is unable to reimburse the Company otherwise.

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8. ESTABLISHMENT OF COURSE CURRICULUM

8.1 NEW EMPLOYEE TRAINING

8.1.1 Newly hired employees will be provided training and orientation to become familiar with the company policies and procedures, directorate functions and the general duties and responsibilities of the assigned positions. New Hire Training also incorporates Mercury Awareness in accordance with the CAPP.

8.1.2 New Employee Training will contain at a minimum the following instruction (based on a ten (10) hour work day – times may be adjusted to accommodate longer or shorter work schedules)

DAY ONE		
SECTION NAME	SUBJECT MATTER EXPERT(S)	TIME ALLOTMENT
General Orientation – Local Company Overview	Human Resources	3.50
Corporate Overview	General Manager	1.00
Introduction to Ethics	Ethics Officer	1.00
Defensive Driving	Security Office	.50
Introduction to Quality Management/ISO 9001:2008	Quality Assurance	.50
Security Issues & Awareness	Security Office	.50
Diversity & Sexual Harassment	Human Resources	.50
Union Orientation & Awareness	Union Representative	.50
Drug & Alcohol Awareness	Safety Office	.50
Breaks & Lunch Period	N/A	1.50
	DAY ONE TOTAL HOURS (WEEKLY TOTAL = 40 HOURS)	**10.00**

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8. ESTABLISHMENT OF COURSE CURRICULUM

DAY TWO		
SECTION NAME	**SUBJECT MATTER EXPERT(S)**	**TIME ALLOTMENT**
Insurance & 401k Introduction	Human Resources	.75
General Safety Awareness [1, 3]	Safety Office	1.00
Asbestos Awareness [1, 3]		.25
Hanta Virus Awareness [1, 3]		.25
Explosive Safety [1, 3]		2.00
Lock Out/Tag Out Hot Work Permitting [1, 2, 3, 4]		.50
Confined Space Entry [1, 3]		.25
**Hazardous Communication [1, 2, 3, 4] (MSDS's – Specific to Hg, CO_2 & Chlorine) General Mercury Awareness	Fire & Emergency Services	2.00
Blood Borne Pathogens [1, 3]	Health Clinic	.25
Personal Protective Equipment [1, 3]	Safety Office	.25
Introduction to Safe Crane Operations in Production Buildings - Classroom	Equipment Maintenance/(Electronics	1.00
Breaks & Lunch Period	N/A	1.50
	DAY TWO TOTAL HOURS (WEEKLY TOTAL = 50 HOURS)	**10.00**

DAY THREE		
SECTION NAME	**SUBJECT MATTER EXPERT(S)**	**TIME ALLOTMENT**
Radiation Safety/Awareness [1, 3]	Radiation Safety Officer	.50
Introduction to EPA, CWA, CAA, EMS & RCRA Requirements [1, 2, 3, 4]	Environmental Services	2.50
Introduction to CFR Title 49 – Transportation	Quality Assurance Division	1.00
Hazardous Material Awareness [2, 3, 4]	Fire & Emergency Services	5.00
Breaks & Lunch Period	N/A	1.00
	DAY THREE TOTAL HOURS (WEEKLY TOTAL = 50 HOURS)	**10.00**

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8. ESTABLISHMENT OF COURSE CURRICULUM

DAY FOUR		
SECTION NAME	SUBJECT MATTER EXPERT(S)	TIME ALLOTMENT
Emergency Response Plans & Emergency Planning [1, 2, 3, 4]	Fire & Emergency Services	.75
Toxicology [1, 2, 3, 4]	Health Clinic	.75
Fire Safety, Evacuation Procedures, Fire Extinguisher Training	Fire & Emergency Services	1.50
Emergency Response Training [1, 2, 3, 4]		.75
JSA's & HIRA's [1, 2, 3, 4]	Safety Office	.75
HAZMAT Security [1, 2, 3, 4]	Security Office	.75
Material Handling Equipment [2, 3, 4] (Classroom)	MHE Instructor	3.75
Breaks & Lunch Period	N/A	1.00
DAY FOUR TOTAL HOURS (WEEKLY TOTAL = 50 HOURS)		**10.00**

DAY FIVE		
SECTION NAME	SUBJECT MATTER EXPERT(S)	TIME ALLOTMENT
MHE Training – Hands On [1, 2, 3, 4]	MHE Instructor	9.00
Breaks & Lunch Period	N/A	1.00
DAY FIVE TOTAL HOURS (WEEKLY TOTAL = 50 HOURS)		**10.00**

Foot Notes:

[1] = Training is credited to the required 24 Hour Hazmat
[2] = Training is credited to the required General Mercury Awareness as required by the CAPP
[3] = Refresher training will include the same subject matter in smaller, more condensed versions of the original material presented.
[4] = Elements of training will require the student to be tested and achieve a passing grade of 75% or greater

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8. ESTABLISHMENT OF COURSE CURRICULUM

8.2 Prior to any job assignment involving the handling of hazardous materials, to include but not limited to explosives/energetic materials, hazardous substances and/or wastes each employee must receive, at a minimum training in each of the following areas:

8.2.1 Safety, security, personal protective equipment and environmental awareness.
8.2.2 Explosive Safety
8.2.3 General Mercury Awareness
8.2.4 SOP Training – An overview of the SOP development and implementation process. Job specific training is given when an employee is assigned to his/her project/division
8.2.5 Hazardous Materials Communication – HAZCOM
8.2.6 Employee Participation Program – Employees will be asked for their input, comments and suggestions in writing by department heads, supervisors and/or the Human Resource Training Officer
8.2.7 Operational Procedures – Site specific in nature and **NOT** exclusive to Munitions and Logistics Services. Operational procedures include, but are not limited to the following areas:

a. Elemental Mercury – Receipt, Storage & Issue Standing Operating Procedures (DZHC.0000.M.010)
b. Mercury Monitoring & Response (DPD.IOP.FES.0019)
c. 110 Area Hg Storage Buildings with CO_2 Fire Suppression Systems – (DPD.IOP.FES.0017)
d. Test, Inspection & Maintenance of CO_2 Fire Suppression Systems in 110 Area Hg Storage Facilities (DPD.IOP.FES.0015)
e. Lock Out – Tag Out Procedure (SOC.HSE.SP.0001, Chapter 2)
f. Start Up & Shut Down of CO_2 Tanks, Filling & Re-Filling Procedures (QP.BOP.EMD.1301)
g. Refrigeration & Maintenance Plan (BOP.IOP.EMD.1300)
h. Inspection of Mercury Storage Sites (SOC.QP.QAD.0002)
i. Inspection of Incoming/Outgoing Shipments of Hazardous Materials by Truck, Rail and Container QAD.IOP.0006)
j. Safety Hot Work Permits (SOC.HSE.SP.0001, Chapter 10)

8.2.8 All training specific to the CAPP will be re-administered at a minimum on a three (3) year cycle or more often as deemed necessary.

8.2.9 All training specific to the CAPP will be re-administered at the time a process change is incorporated - Management of Change.

8.2.10 Training requirements for each position bearing direct or indirect responsibility within the CAPP and the Mercury Storage Program are documented in Appendix A – Matrix of Employee Training Requirements.

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APPENDIX A - MATRIX OF EMPLOYEE TRAINING REQUIREMENTS

The following matrix indicates, by course code number which classes are required for personnel holding that specific job classification. This Matrix is followed by the Course Key Matrix which identifies each course code by name/title.

CLASSIFICATION	COURSE CODES											
Accounting Tech	5	20										
Air Conditioning Technician	5	12	96	20	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Alarm Room Operator	5	16	80	20	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Alarm Room Supervisor	5	16	80	20	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Ammunition Project Manager	5	12	42	80	20							
Associate Engineer	5	12	55	59	80	20						
Assistant Fire Chief	5	12	13	15	30	31	38	77	105	20	150	139
	140	141	142	143	144	145	146	148	149	151	37	34
	35	36	52	131	134	136	138	21				
Automobile Mechanic	5	12	58	20								
Battery Repairman	5	12	20									
Blocker and Bracer	5	12	46	20								
Boiler Plant Operator	5	12	17	52	53	105	20					
Boilermaker	5	12	17	52	53	20						
Boxcar Repairman	5	12	20									
Budget Analyst	5	20										
CAD Draftsman I	5	80	20									
CAD Draftsman II	5	80	20									
Carpenter	5	12	20									
Chemical Laboratory Aide	5	12	80	20								
Chemical Laboratory Technician	5	12	80	20								
Chief, Fire Inspection/Training Officer	5	12	13	15	20	139	140	141	142	143	144	145
	146	148	149	151	37	150	34	35	36	52	131	134
	136	138	21									
Chief, Fire and Emergency Services	5	12	13	15	20	139	140	141	142	143	144	145
	146	148	149	151	37	150	34	35	36	52	131	134
	136	138	21									
Clerk, Typist	5	80	20									
Clerk-Typist General	5	80	20									
Conductor/MVL	5	12	20									
Contract Specialist	5	20										
Controller	5	20										
Deputy Director Supply Depot Operations	5	80	20									
Deputy Director Munitions Projects	5	80	20									
Director, Base Operations	5	80	20	150	139	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Director, Contract Admin & Purchasing	5	80	20	150	139	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Director, Depot Protection	5	80	20									
Director Human Resources	5	20										

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CLASSIFICATION	COURSE CODES											
Director Munitions Services & Logistics	5	80	20	150	139	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Director, Safety, Health, QA, & Environmental	5	12	80	20	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Dispatcher	5	80	20									
Electrical Engineer	5	12	80	20	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Electrician	5	12	80	20	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Electromotive Equip Mechanic	5	12	80	20								
Electronic Sys Inspection Tech	5	57	20	21	150	139	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
Electronic Technician	5	57	20	150	139	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Engineer Locomotive/MVL	5	12	19	92	95	20	21					
Environmental Technician	5	12	17	18	115	20	150	139	140	141	142	143
	144	145	146	148	149	151	37	34	35	36	52	131
	134	136	138	21								
Environmentalist – 6	5	12	17	18	115	20	150	139	140	141	142	143
	144	145	146	148	149	151	37	80	34	35	36	52
	131	134	136	138	21							
Environmentalist – 8	5	12	17	18	115	20	150	139	140	141	142	143
	144	145	146	148	149	151	37	80	34	35	36	52
	131	134	136	138	21							
Equipment Spec. Maintenance/Quality	5	20										
Equipment Maintenance Manager	5	20										
Equipment Mechanic	5	12	52	80	20							
Equipment Operator	5	12	20									
Exec Asst/Public Relations Officer	5	20										
Facilities Mechanic	5	12	20									
Field Supervisor	5	80	20									
Fire Captain	5	12	13	15	77	105	20	150	139	140	141	142
	143	144	145	146	148	149	151	37	34	35	36	52
	131	134	136	138	21							
Firefighter	5	12	13	15	30	31	77	109	20	150	139	140
	141	142	143	144	145	146	148	149	151	37	34	35
	36	52	131	134	136	138	21					
Greens keeper	5	12	20									
General Manager	20	150	139	140	141	142	143	144	145	146	148	149
	151	37	34	35	36	52	131	134	136	138	21	
Guard II	5	62	63	80	20	150	139	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Guard Training Officer	5	80	20	150	139	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Heavy Equip. Mechanic	5	12	52	20								
Heavy Equip. Operator	5	12	17	92	20							
High Voltage Electrician	5	52	53	92	20							

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CLASSIFICATION	COURSE CODES											
HR Specialist	5	20	150	139	140	141	142	143	144	145	146	148
	149	151	37	34	35	36	52	131	134	136	138	21
Industrial Program Manager	5	12	80	20								
Instrument Technician	5	12	20	139	140	141	142	143	144	145	146	148
	149	151	37	34	35	36	52	131	134	136	138	21
Janitor	5	12	20									
Laborer	5	12	20									
Licensed Practical Nurse	5	20										
Locksmith	5	12	80	20								
Logistics Technician	5	20										
Mail Clerk	5	20										
Maintenance Control Clerk	5	20	139	140	141	142	143	144	145	146	148	149
	151	37	150	34	35	36	52	131	134	136	138	21
Maintenance Control Specialist	5	20	139	140	141	142	143	144	145	146	148	149
	151	37	150	34	35	36	52	131	134	136	138	21
Maintenance Control Technician	5	20	139	140	141	142	143	144	145	146	148	149
	151	37	150	34	35	36	52	131	134	136	138	21
Management Anal./Proposals	5	80	20									
Manager Accounting	5	20										
Manager Budget	5	20										
Manager Chem. Lab	5	12	80	20								
Manager Demil & Special Projects	5	12	42	80	20							
Manager Engineering	5	12	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Manager, Environmental Services	5	12	17	18	19	80	115	20	150	140	141	142
	143	144	145	146	148	149	151	37	34	35	36	52
	131	134	136	138	21							
Manager, Facilities/Utilities	5	54	80	20								
Manager, Golf Course	5	12	57	20								
Manager Guard Operations	5	16	60	80	20	150	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Manager, HR Programs	5	20	150	140	141	142	143	144	145	146	148	149
	151	37	34	35	36	52	131	134	136	138	21	
Manager, Information Services	5	80	82	85	20							
Manager, Maintenance, Planning & Housing	5	20	150	140	141	142	143	144	145	146	148	149
	151	37	34	35	36	52	131	134	136	138	21	
Manager Marketing	5	20										
Manager, PP&PE	5	80	20									
Manager, Quality Assurance	5	12	73	80	20	150	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Manager Safety & Health	5	12	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Material Segregator/Classifier	5	12	80	20								
Mechanical Engineer	5	12	80	20								
Motor Vehicle Loader	5	12	20	21								
Motor Vehicle Operator	5	12	19	92	20	21						
Munitions Controller	5	12	40	41	91	20						
Munitions Destroyer	5	12	40	41	91	20						

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CLASSIFICATION	COURSE CODES											
Munitions Handler	5	12	40	41	80	91	20	150	140	141	142	143
	144	145	146	148	149	151	37	34	35	36	52	131
	134	136	138	21								
Munitions Handler -Grandfathered	5	12	40	41	80	91	20					
Network Administrator	5	12	80	20								
Network Security Admin. & IANO	5	80	82	83	85	20						
Nursing Assistant	5	20										
Painter	5	12	20									
Parts Room Attendant	5	12	20									
PC Support Tech I	5	80	20									
PC Support Tech II	5	80	20									
Personnel Assistant - I	5	20										
Personnel Assistant – II	5	20										
Pest Controller	5	12	53	114	20							
Petroleum Technician	5	12	20									
Pipe-fitter/Plumber	5	12	52	53	105	111	112	20				
President & General Manager	5	20										
Property Book Officer	5	20										
Property Disposal Technician	5	12	20									
Property Reutilization Officer	5	12	80	20								
Property Technician	5	80	20									
Purchasing Agent	5	20	150	140	141	142	143	144	145	146	148	149
	151	37	34	35	36	52	131	134	136	138	21	
Purchasing Officer	5	20	150	140	141	142	143	144	145	146	148	149
	151	37	34	35	36	52	131	134	136	138	21	
Quality Assurance Inspector	5	12	14	76	80	20	150	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Quality Assurance Specialist	5	12	14	76	80	20	150	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Rail Equipment Operator	5	12	95	110	20							
Railroad Inspector Supervisor	5	12	51	110	20							
Railroad Repairman	5	12	51	20								
Real Property/Housing Technician	5	20										
Rigger	5	12	52	20								
Safety Engineer	5	12	52	55	80	20	150	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Safety Specialist	5	12	52	55	80	20	150	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Safety Specialist – 6	5	12	52	55	80	20	150	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Safety Specialist/Hygienist	5	12	52	55	80	20	150	140	141	142	143	144
	145	146	148	149	151	37	34	35	36	52	131	134
	136	138	21									
Secretary	5	80	20									
Security Chief	5	12	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Senior Accountant	5	80	20									
Senior Field Supervisor	5	80	20									

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CLASSIFICATION	COURSE CODES											
Sheet Metal Mechanic	5	12	52	20								
Site Manager, MTMS-FM/LMP	5	80	20									
Storage Planner	5	12	42	44	45	80	20	34	35	36	52	131
	134	136	138	20	21							
Supervisor, Bldg Maintenance	5	54	20	21								
Supervisor, B&B	5	12	40	41	80	92	93	94	20			
Supervisor, Electric Shop	5	12	52	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Supervisor EOD/UXO Tech I & II	5	12	42	43	80	20						
Supervisor, Equipment Maintenance	5	12	52	20	34	35	36	52	131	134	136	138
Supervisor, Infrastructure Maintenance	5	12	52	20								
Supervisor, Maintenance Planning & Control	5	12	52	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Supervisor MH	5	12	40	41	80	92	93	20	150	140	141	142
	143	144	145	146	148	149	151	37	34	35	36	52
	131	134	136	138	21							
Supervisor, MHE Maintenance	5	12	20									
Supervisor, QA Inspector	5	12	14	80	20	150	140	141	142	143	144	145
	146	148	149	151	37	34	35	36	52	131	134	136
	138	21										
Supervisor, Supply Tech	5	12	80	20								
Supervisor, Traffic Tech	5	12	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Supervisor Transportation	5	12	80	20	21							
Supply Clerk	5	12	80	20								
Supply Specialist	5	12	80	20								
Supply Technician	5	12	80	20								
Supply Technician – ISD	5	12	20									
Surveillance Expeditor	5	12	40	41	80	20						
Telecom Mechanic I	5	12	52	80	20							
Telecom Mechanic II	5	12	52	80	20							
Temp General Worker	5	20										
Tire Repairman	5	12	20									
Tool Room Specialist	5	12	20									
Toolmaker/Machinist	5	12	20									
Traffic Clerk	5	14	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Traffic Specialist	5	14	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Traffic Technician	5	14	80	20	150	140	141	142	143	144	145	146
	148	149	151	37	34	35	36	52	131	134	136	138
	21											
Warehouse - ISD	5	12	20									
Water Operator	5	12	54	97	98	99	100	101	104	105	20	
Water Treatment Plant Operator	5	12	99	105	20							
Welder	5	12	53	20	21							

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APPENDIX B - MATRIX OF COURSE CODES & DESCRIPTIONS

The following is a description of the training that employees must attend and complete to maintain compliance to this Master Training Plan. Some course codes encompass the requirements of other courses. Please ensure you check all notes associated with course description if applicable.

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
NEW HIRE TRAINING	1	5	NEW HIRE(NH)
a) Hazardous Communications (HAZCOM)	2	10	NH/AR
b) 24 Hour HAZMAT	4	12	NH, Annual 8 Hr Refresher
c) NIMS Training (National Incident Management Systems) (Under Executive Order)		13	Annual
d) Technical Transportation of Hazardous Materials		14	2 Years
e) Hazardous Materials Technician Level III		15	Annual
f) Hazard Awareness Level I		16	Annual
g) Visible Emissions	2	17	Semi-Annual
h) RCRA Fundamentals	2	18	Annual
i) DOT Transportation of Hazardous Materials	2	19	3 Years
j) Mercury Storage Program Overview & General Awareness	9 a	20	NH/Annual/AR
k) Mercury Specialized Training	9 a, b, c	21	3 Years

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
FIRE FIGHTING & HAZMAT RESPONSE			
Driver/Operator	2	30	One Time Only
Firefighter I		31	One Time Only
Firefighter II		32	One Time Only
Firefighter Certification Course		33	One Time Only
Mercury Monitoring & Response (DPD.IOP.FES.0019)	9 c	34	Annual/AR
110 Group Hg Storage Sites w/CO2 Fire Suppression Systems – Response & Activation of Systems (DPD.IOP.FES.0017)		35	Annual/AR
Test, Inspection & Maintenance of CO2 Fire Suppression Systems f/110 Area Storage Sites (DPD.IOP.FES.0015)		36	Annual/AR
Emergency Operations Plan, Annex C, Emergency Response (SOC.HWAD.FES.0005)		37	Annual/AR

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APPENDIX B - MATRIX OF COURSE CODES & DESCRIPTIONS

CONTINUATION

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
MUNITIONS OPERATIONS *MUNITIONS OPERATIONS ARE PART OF THE BARGAINING AGREEMENT REQUIREMENTS FOR TIERED PAY STRUCTURES WITHIN THE MUNITIONS HANDLER CLASSIFICATION*			
MUNITIONS OPERATIONS LEVEL I			
a) Safety & Security Level I b) Technical Ammunition Level I c) Storage Procedures Level I	5	40	One Time Only
MUNITIONS OPERATIONS LEVEL II			
a) Safety & Security Level II b) Technical Ammunition Level II c) Storage Procedures Level II d) Elemental Mercury – Receipt, Storage & Issue Standing Operating Procedures (DZHC.0000.M.010) Training will be provided Annually and As Required, however will be presented in Munitions Operation Level II as additional training	8	41	**One Time Only
MUNITIONS OPERATIONS LEVEL III			
a) Safety & Security Level III b) Technical Ammunition Level III c) Storage Procedures Level III	9	42	One Time Only

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
OSHA SAFETY TRAINING			
MHE (Material Handling Equipment to include Crane Familiarization)	1	50	New Hire & AR
Lock Out – Tag Out Procedures (SOC.HSE.QP.0001, Chapter 2)	9 c	51	New Hire (AR) & Annually
Safety Hot Work Permits (SOC.HSE.QP.0001, Chapter 10)	9 c	52	
Confined Space Entry	9 c	53	
Asbestos Abatement Supervisor/Contractor	2	54	
Asbestos Abatement Inspector/Management/Planner	2	55	
Asbestos Abatement Awareness	1	56	
Asbestos Abatement Operations & Maintenance	2	57	
Asbestos Abatement Project Designer	2	58	

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APPENDIX B - MATRIX OF COURSE CODES & DESCRIPTIONS

CONTINUATION

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
GUARD OPERATIONS			
a) Weapons Qualifications	None	60	Annual
b) HAZMAT Training		61	
c) Basic Guard Training		62	Initial

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
SPECIAL TRAINING REQUIREMENTS			
ISO 14001 Awareness		70	Annual
ISO Management System Auditing Procedures		71	Initial/Refresher AR
Technical Rescue		73	Annual
COMPUTER SECURITY			
Computer Network Security	2	80	Annual
IA Sys Administrator/IA Network Officer Security Course Level II	2	82	
Information Assurance Security Officer Certification		83	18 Months
Information Assurance Manager Security Level		85	
SPECIAL CERTIFICATIONS & LICENSES			
Intermodal Dry Cargo Container (CSC) Re-Inspection		72	4 Year
Blaster Certification	2	90	
Highway Flagging Certification		91	2 Year
Commercial Driver's License	6	92	
Third Party Certifier (DMV)	2	93	
Forklift Evaluator/Instructor		94	
Locomotive Engineer License		95	3 Year
Refrigeration/Air Conditioning		96	
Distribution Systems Certification		97	
Water Distribution Operator 1		98	2 Year
Water Treatment Operator 1		99	
Water Treatment Operator T2		100	
Backflow Tester		101	3 Year
Ambulance Attendant Cert		102	Annual
Emergency Medical Tech Cert - (Continuing Education Quarterly)		103	2 Year
Water Distribution Operator 2		104	
Chlorine First Responder Technician		105	3 Year
Railroad Inspector Certification		110	2 Year
Basic Principles and Practices Propane		111	3 Year

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APPENDIX B - MATRIX OF COURSE CODES & DESCRIPTIONS

CONTINUATION

COURSE DESCRIPTION	NOTES	COURSE CODE	FREQUENCY
SPECIAL CERTIFICATIONS & LICENSES - CONTINUED			
Propane Distribution	2	112	3 Years
Pest Control		114	As Required
Advanced Specialized Environmental Courses		115	
MERCURY STORAGE PROGRAM SPECIALIZED TRAINING (TIER 2 - MSP)			
MSP Safety System Description	2/9 a, c	130	Annual/AR
Receipt, Storage & Issue of Elemental Mercury (DZHC.M.0000.002)		131	
Electrician Preventative Maintenance		132	
Safety Hot Work Permits - (SOC.HSE.QP.0001, Chapter 10)		133	
Inspection of Mercury Storage Sites (SOC.QP.QAD.0002)		134	
MAXIMO (Classroom/OJT)		135	
Inspection of Incoming Conveyances – Truck, Rail & Container (SOC.QAD.IOP.0006)		136	
Forklift Operator Training (MHE) (Classroom/OJT)		137	
Equipment Maintenance Division IOP's 1300, 1301, 1302, 1303		138	
MERCURY STORAGE PROGRAM SPECIALIZED TRAINING (TIER 1 - MSP)			
Process Safety Information	2/9 a, b	139	3 Year
Process Hazard Analysis		140	
Standard Operating Procedures		141	
Mercury Training Program		142	
Mechanical Integrity		143	
Management of Change		144	
Pre-Start Up Safety Review		145	
Compliance Audit Program		146	
MSP Management System & Implementation Plan		147	
Incident Investigation		148	
Employee Participation		149	
CAPP Management Plan		150	
Contractor Program		151	

SPECIFIC OSHA OR OTHER REQUIRED TRAINING TO BE PROVIDED BY SUPERVISOR'S OR DEPARTMENT HEADS AS REQUIRED

Chemical Lab Safety	Cranes, Material Hoists	General Awareness – Mercury Storage Program
Electrical Power & Equipment	Excavation	Environmental (BBE)
Fall Protection/Scaffolding/Work Platforms	Mechanical Power Press	Other Training Not Previously Identified
Power Tools	Personal Protective Equipment (PPE)	Diversity & Sexual Harassment
Process Safety Management Plan	Safety Signs	General Safety & Security, Behavior Based
Tires & Rims	Tree Trimming	Fire Drills
Welding, Cutting & Brazing	Safe Woodworking	Hazardous Communication (HAZCOM)
General Safety	Hearing Protection	

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APPENDIX C - NOTES

1. For New Employee Training Requirements See Section 8 Course Curriculum
2. Not all personnel, in every job classification is required to have the specified training. Some classifications only required a minimum number of personnel to hold the certification/license to meet the driving requirements.
3. Employees from various job classifications are assigned to this training to serve on the Emergency Response Team
4. Firefighters and Emergency Response Team members will also receive the initial 24 hour HAZMAT class. Thereafter the annual HAZMAT Refresher requirement is satisfied through Fire Department and Emergency Response Team training
5. Class is required for advancement through a Tiered Pay Structure 75% to 85%/85% to 100%/100% to 110%.
6. Class is required only if advancing to the 110% range of a Tiered Pay Structure
7. Guard basic training consists training that conveys company expectations to new guards, and a code of conduct while they are on duty at HWAD
8. **MUNITIONS OPERATIONS**
   a. Level I - Technical Ammunition, Storage Procedures, Safety & Security and must be completed prior to advancement.
   b. Level II - Technical Ammunition, Storage Procedures, Safety, & Security at a more advanced level than Level I and must be completed prior to advancement.
9. **MERCURY MANAGEMENT** – The Mercury Management System Training is broken down into four (4) sections of required training
   a. General Awareness of the Mercury Storage Program – Training is relative to the storage of Elemental Mercury at HWAD and is a requirement for all personnel located at HWAD, to include tenant and subcontractor activities. While the Contractor cannot mandate tenant activities attend the supplied training it is offered to all personnel located at the installation.
   b. Tier I (Systems Management) – Process and documentation outlined in the training requirements in various sections throughout this document. See Specific Course Numbers in Appendices A and B.
   c. Tier II (Operational Level Requirements & Documentation) - Process and documentation outlined in the training requirements in various sections throughout this document. See Specific Course Numbers in Appendices A and B.
   d. Chemical Accident Prevention Plan Overview

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9. METRICS

9.1 Metrics for this plan are measured in the form of pass and failure rates for all course curriculum, whether offered for special, localized training or in the form of formalized outsourced training.

9.2 Customer satisfaction will be measured through the analysis of data retrieved through instructor and course evaluations.

10. RECORDS

9.1 The following Quality Records shall be generated and managed in accordance with SOC.QP.QMS.0002

QUALITY RECORDS			
RECORD REQUIRED	CUSTODIAN	RETENTION	DISPOSITION
Training Record	HR/Various Supervisory Personnel	5 Years	Trash
OJT Records – DZHC 84-E	Training Provider	Life of Contract	
Master Training Plan (QP.HRD.HRD.0005)	Human Resources		
Training Schedules	Human Resources	2 Years	
Course Outlines	Human Resources	5 Years	
Lesson Plans	Human Resources	1 Year – Reviewed Annually for continued compliance to requirements	1 year Historical reference – all others to Trash
Training Certificates	Human Resources – Individual Receiving Training	Life of Contract	SHRED
DD Form 1556-1	Requestor	Life of Contract or Until Recertification is Required	
Computer Generated Sign In Sheet	Human Resources	Life of Contract	

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11. FORMS

10.1 The following forms are applicable to this document

APPLICABLE FORMS	
FORM NUMBER	TITLE
DD FORM 1556-1	Request, Authorization, Agreement, Certification of Training
DZHC 84-E	Training Record
DZHC 199-E	Tuition Reimbursement

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ATTACHMENT 1 – MERCURY TRAINING SYLLABUS

MERCURY STORAGE PROGRAM TRAINING SYLLABUS

COURSE INFORMATION		TYPE			FORUM			VALIDATION			
NAME	CONTENT	INITIAL	REFRESHER *	DURATION	CLASS ROOM	RQ'D READ	OJT	WRITTEN TEST	ORAL TEST	PERFORMANCE PROFICIENCY	CERTIFICATION
Mercury Storage Program Overview	Operations descriptions, safety, regulatory standards, Management of Change	x	x*	4 hours	x			x		>75%	x

TIER I PROCEDURES

COURSE INFORMATION		TYPE			FORUM			VALIDATION			
NAME	CONTENT	INITIAL	REFRESHER *	DURATION	CLASS ROOM	RQ'D READ	OJT	WRITTEN TEST	ORAL TEST	PERFORMANCE PROFICIENCY	CERTIFICATION or OPERATOR STATEMENT
Process Safety Information Procedure	Procedure	x	x*	2 hours		x					C
Process Hazard Analysis	Procedure	x	x*	2 hours		x					C
Standard Operating Procedure Program	Procedure	x	x*	2 hours		x					C
Training Program	Procedure	x	x*	2 hours		x					C
Mechanical Integrity	Procedure	x	x*	2 hours		x					C
Management of Change	Procedure	x	x*	2 hours		x					C
Pre-Start Up Safety Review	Procedure	x	x*	2 hours		x					C
Compliance Audit Program	Procedure	x	x*	2 hours		x					C
Incident Investigation Procedure	Procedure	x	x*	2 hours		x					C
Employee Participation Procedure	Procedure	x	x*	2 hours		x					C
Emergency Response Plan	Procedure	x	x*	2 hours		x	x				C
Management System & Implementation Plan	Procedure	x	x*	2 hours		x					C
DZHC.M.010 Receipt Storage & Issue of Elemental Mercury	Procedure	x	x*	2 hours		x	x			x	OS

NOTES:
* Refresher Training is required on an annual basis
** May be more frequent if procedural revisions are issued
*** Varies per job assignment
OS = Operators Statement as defined by proceudre
2 Hour scheduled times may vary by 1 hour +/-

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ATTACHMENT 1 – MERCURY TRAINING SYLLABUS

COURSE INFORMATION				TIER II PROCEDURES								
		TYPE		FORUM					VALIDATION			
NAME	CONTENT	INITIAL	REFRESHER *	DURATION	CLASS ROOM	RQ'D READ	OJT	WRITTEN TEST	ORAL TEST	PERFORMANCE PROFICIENCY	CERTIFICATION
FES.0019	Procedure	X	X*	2 hours		X	X			X	QS
FES.0017	Procedure	X	X*	2 hours		X	X			X	QS
FES.0015	Procedure	X	X*	2 hours		X	X			X	QS
Lock-Out/Tag Out	Procedure	X	X*	2 hours	X	X	X			X	QS
Hot Work Permits	Procedure	X	X*	2 hours	X	X	X			X	QS
EMD.1130	Procedure	X	X*	2 hours	X	X	X			X	C
Inspection of Mercury	Procedure	X	X*	2 hours		X	X			X	QS
Storage Silos QAD.0002											
Conveyance Receipt	Procedure	X	X*	2 hours	X	X	X			>75%	QS
Inspection QAD.2006											
MAXIMO	Procedure	X	n	2 hours	X	X	X			>75%	QS
MAXIMO	System Training Procedure	X	n	4 hours		X	X				C
Safety System Description		X	n	4 hours		X	X				QS
Forklift Operator Training	Driver Skills & Equipment Maintenance Procedure	X	X*	4 hours	X	X	X			>75%	QS/QS
Electronic Preventative Maintenance	Procedure	X	X*	2 hours	X	X	X				QS

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APPENDIX C

C-1 New Bomb Contingency Plan

ADDENDUM I
HAZARDOUS MATERIALS/WASTES CONTINGENCY PLAN

Hawthorne Army Depot New Bomb

SOC Environmental Services

PREFACE

The HWAD Hazardous Materials/Waste Contingency Plan has been written as required by both Army and US Environmental Protection Agency regulations. This Plan meets the requirements of the Resource Conservation and Recovery Act (40 CFR Parts 261 through 270) for a Hazardous Waste Contingency Plan. This plan establishes procedures for the prevention of and the response to fires, explosions, and discharges involving hazardous materials, hazardous wastes. It also defines the responsibilities of HWAD employees in controlling these emergencies should they occur. It is the responsibility of each Director/Manager/Special Staff Officer to familiarize themselves and their subordinates with this plan and its implementation.

KIRK BAUSMAN
Deputy to the Commander
Hawthorne Army Depot

And

GORGE R. GRAM
General Manager
SOC NEVADA LLC

CERTIFICATION

I hereby certify, under penalty of law, that this Hazardous Waste Hazardous Materials Contingency Plan was prepared under my direction or supervision in accordance with the requirements of the Resource Conservation and Recovery Act (40 CFR 261 through 270) for the establishment of procedures for the prevention of and the response to fires, explosions, and discharges involving hazardous material, hazardous wastes. It describes the responsibilities of employees involved in such responses and that I am the responsible person to assure the implementation of the provisions of this plan at Hawthorne Army Depot (HWAD).

_____ _____

KIRK BAUSMAN Date
Deputy to the Commander
Hawthorne Army Depot

_____ _____

GEORGE GRAM Date
General Manager
SOC NEVADA LLC

TABLE OF CONTENTS

CERTIFICATION ..... **ii**

1.0 General Information **1**
1.1 Introduction 1
1.2 Mission 1
1.3 Facility Description 1
1.4 Description of Hazardous Waste Facilities 2
1.5 POL Facilities 3
1.6 Hazardous Materials Facilities 3
1.7 Definitions 3

2.0 Emergency Response Organization [264.52(d), 264.55] **4**

3.0 Criteria for Implementation of Hazardous Materials/Waste Contingency Plan [264.51(b), 264.54] **5**

4.0 Emergency Response Procedures [264.56] **6**
4.1 Notification [264.56(a)(2)] 6
4.2 Identification of Released Hazardous Materials/Wastes [264.56(b)] 7
4.3 Hazard Assessment [264.56(c)] 7
4.4 Control Procedures [264.52(a)] 8
4.5 Prevention of Recurrence or Spread of Fires, Explosions, or Releases [264.56(e)] 11
4.6 Storage and Treatment of Released Material [264.56(g)] 11
4.7 Incompatible Materials [264.56(h)(1)] 11
4.8 Post-Emergency Equipment Maintenance [264.56 (h)(2)] 11
4.9 Container Spills and Leakage [264.52] 12
4.10 Notification 264.56 (i) 12
4.11 Reporting 264.56 (j) 12

5.0 Emergency Equipment [264.52(e), 264.32] **13**
5.1 Location of Emergency Equipment 13
5.2 Communications Equipment [264.34] 13

6.0 Spill Prevention Measures **15**
6.1 Inspections 15
6.2 Loading and Unloading of Vehicles 16
6.3 Hazardous Waste Treatment 17

7.0 Coordination Agreements [264.52(c), 264.37] **20**

8.0 Evacuation Plan [264.52(f)] **21**

9.0 Required Reports [264.56(j)] 23

10.0 Location and Distribution of Contingency Plan [264.53] 24

List of Figures

Figure II-1 7
Figure II-2 36
Figure II-3 36

List of Tables

Table A-1: Chemical Composition of Representative Energetics In Items Treated by Detonation at HWAD 26
Table A-2: Inspection Schedule for Detonation Activities 35
Table A-3 Inspection Checklist for Detonation Operations..... Error! Bookmark not defined.

HAZARDOUS MATERIALS/WASTES CONTINGENCY PLAN ADDENDUM 1 - NEW BOMB

1.0 General Information

1.1 Introduction

This addendum to the Hawthorne Army Depot (HWAD) Hazardous Materials/Waste Installation Contingency Plan (ISCP) has been written to specifically address the detonation of energetic materials at the New Bomb site. This addendum establishes procedures for the prevention of and the response to fires, explosions, and discharges involving hazardous materials, hazardous wastes, or hazardous waste constituents at the New bomb site in compliance with 40 CFR 264.50 through 264.56. Those procedures and employee responsibilities have been previously described in the HWAD ISCP for the Main Base at HWAD, are also applicable to the New Bomb site, and will be included by reference in this addendum.

1.2 Mission

The New Bomb Area of HWAD has the responsibility to demilitarize and thermally treat unserviceable ammunition and explosives. Thermal treatment of munitions by detonation is conducted at New Bomb for demilitarization activities.

1.3 Facility Description

HWAD, also referred to as Main Base is located in central Nevada approximately 135 miles southeast of Reno. HWAD occupies 147,236 acres of Federal land south of Walker Lake in Mineral County, Nevada.

The New Bomb Area, where detonation operations are conducted, is located approximately 22 miles south of HWAD in Mineral County, Nevada. The New Bomb Area occupies approximately 3,000 acres of land. The location of the New Bomb Area is shown on the Vicinity Map, Figure II-2. Structures, internal roads, and access controls at New Bomb are shown on Figure II-3. Access controls are shown in Figure II-3 page 43. State Highway 359 lies approximately 4,000 ft from the detonation unit. No passenger railroads or sanitary or sewage lines exist in the New Bomb Area. The closest receptor to the New Bomb Area lies nine miles away (Sweetwater Ranch).

Although the detonation unit occupies only 743 acres, the HWAD has set aside an additional 2,250 acres surrounding the unit as a Restricted Area. The general security provisions at the New Bomb Area include: natural and artificial barriers; warning signs posted along the perimeter of the 2,250 acre HWAD restricted zone surrounding the detonation unit to discourage unauthorized entry; and controlled entry to the area through two locked vehicle gates. Access to the area, is controlled by the HWAD Security Office.

Entrance to the New Bomb Area from State Highway 359 is completely restricted by a five strand barbed wire fence approximately four feet high, with an exception for an area on the west side where steep mountain terrain precludes access.

Vehicle gates are locked at all times and are opened on an as-needed basis with keys provided by security personnel. During detonation operations, personnel access is limited to personnel having a legitimate need to enter the unit. Range personnel search for unauthorized personnel and then monitor the gates to prevent entry into the area.

1.4 Description of Hazardous Waste Facilities

Detonation of unusable munitions at HWAD is performed by the HWAD contractor at the detonation unit located within the New Bomb Area, with oversight by the government staff assigned to quality assurance surveillance.

Munitions that are stored in magazines located at the HWAD Main Base and that become unserviceable are transferred to New Bomb for treatment by detonation. Explosive items typically detonated at New Bomb consist of cartridges, projectiles, bombs, rockets, artillery, mortar, and explosives.

A typical Detonation operation takes place in a 20 ft by 6 ft earthen cell dug 4 ft deep. A total of 20 cell areas are available for detonation with 10 cells located at the northern base of a 185 ft high ridge and another 10 located at the southern base of the ridge. Donor explosive, usually trinitrotoluene (TNT), is covered with the munitions, typically at a 1:1 ratio, to achieve complete reaction. Donor material punctures shell casings and allows explosives within the shells to be exposed to the thermal treatment.

Waste ordnance is placed at the center of the detonation cell in a 4 ft deep (minimum) pit with sloping sides approximately 10° to 20° with the vertical. The specific dimensions of each cell will vary depending upon the amount and type of munitions to be treated. Because of the

type of detonation unit used for HWAD, no engineering drawings exist for the New Bomb detonation unit. The minimum distance between adjacent pits is 75 ft, to prevent sympathetic detonation.

The wastes to be treated by detonation will consist primarily of military energetic materials that have exceeded their shelf life, off-specification versions of these same materials, and those materials that cannot be treated at the Western Area Demilitarization Facility (WADF). The off-specification items generally are composed of the same raw material as the usable items, but for one or more reasons they do not meet some performance specification(s).

The specific chemical composition of representative energetic material contained in munitions demolition items currently treated or to be treated by detonation are given in Table A-1. Although additional energetic items may be treated by detonation in the future, the chemical composition of these items is not expected to be significantly different than the items presented in Table A-1. Table A-1 also lists the U.S. Environmental Protection Agency (EPA) hazardous waste codes of the waste munitions and ordnance treated at HWAD. This data is from the standard U.S. military technical manuals, field manuals, and various handbooks.

1.5 POL Facilities

There are no Petroleum, Oil, & Lubricants (POL) facilities located in the New Bomb Area.

1.6 Hazardous Materials Facilities

No hazardous materials are normally accumulated or stored in the New Bomb Area. No more than two five gallon cans of gasoline are stored in the flammable fluids locker located approximately three-fifths of a mile from the detonation unit.

1.7 Definitions

The definitions are as provided in Section 1g of the HWAD Main Base ISCP.

2.0 Emergency Response Organization [264.52(d), 264.55]

The emergency response organization and response actions for the New Bomb Area are as described for the Main Base in Section 2 of the HWAD Main Base ISCP.

These individuals and organizations are the most appropriate and timely for emergency response activities to the New Bomb Area. The purpose of the organization is to allow qualified personnel to conduct an accurate assessment of the threat posed by an incident, alert the appropriate authorities, and implement response actions to minimize the effects of the incident. The response actions to be taken are described in Section 4.0 of this Addendum.

3.0 Criteria for Implementation of Hazardous Materials/Waste Contingency Plan [264.51(b), 264.54]

The provisions of the HWAD Main Base ISCP and Addendum must be carried out immediately whenever there is a fire, explosion, or release of hazardous materials, hazardous waste, or hazardous waste constituents could threaten human health or the environment.

Typical types of incidents include:

- Fire and/or explosion involving a hazardous material/waste or occurring near a hazardous waste management site.
- A large and/or unconfined spill or release of a hazardous waste off the installation boundary.

The HWAD Main Base ISCP and Addendum will be reviewed and amended, if necessary, whenever:

- The facility permit is revised.
- The plan fails in an emergency.
- The facility changes its design, construction, operation, maintenance, or other circumstances in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous constituents, or changes the response necessary in an emergency.
- The list of Emergency Response Coordinators (ERC) changes.
- The list of emergency equipment changes.

4.0 Emergency Response Procedures [264.56]

Whenever there is an imminent or actual emergency situation, the ERC will immediately follow the procedures outlined in the following sections and, as appropriate, in the HWAD ISCP and as follows in Figure II-3. The HWAD operates and maintains its own full time (365 days per year at 24 hours per day) Fire and Emergency Services (FES) with approximately twenty-three FES personnel who are also Emergency Response Team (ERT) personnel. The primary and designated alternate Emergency Response Coordinators (ERC) are the FES Chief, FES Assistant Chiefs, Captains, and Inspector, one of whom is on duty at all times. All the HWADs specialized personnel and/or resources are available to the ERC through the General Manager during an emergency or upon the implementation of this plan. HWAD is essentially self-sufficient in such matters.

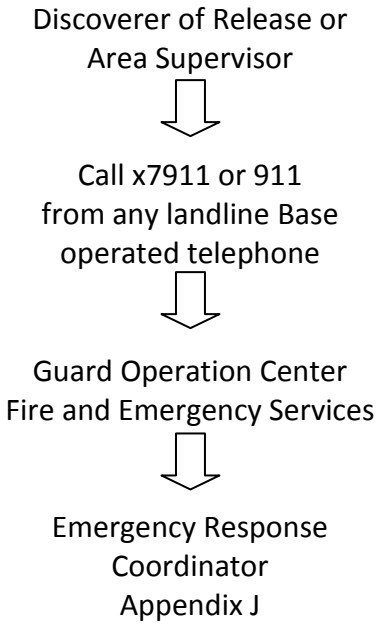
Buildings within the New Bomb Area are sparse and roads are constructed to provide easy access to and from an emergency situation. Cell pits at the detonation unit are spaced at 75 ft. This design allows the unobstructed movement of personnel, fire protection equipment, or spill control equipment to any area of facility operation during an emergency.

4.1 Notification [264.56(a)(2)]

The notification sequence for emergency responses during duty and off-duty hours at the New Bomb Area are as presented in Section 4a of the HWAD Main Base ISCP.

Figure II-1

HWAD Emergency Notification Procedures



4.2 Identification of Released Hazardous Materials/Wastes [264.56(b)]

The ERC, in consultation with the Area Supervisor and the Environmental Personnel, will identify the type, source, and quantity of any release of a hazardous materials or hazardous wastes. The identification of released hazardous wastes or materials potentially involved in the incident will be based on knowledge of the facility involved and the knowledge of the materials being stored, handled, or processed. In some cases, test equipment from the Safety/Environmental Office or Chemistry Laboratory may be used to aid in identification of hazardous materials.

4.3 Hazard Assessment [264.56(c)]

Based on the initial evaluation of the hazardous materials or hazardous wastes composition and the emergency conditions, the ERC will determine the potential hazard to human health/safety and the environment, determine appropriate actions to minimize and abate

that hazard, and assess the need for evacuation and the notification of authorities. Material Safety Data Sheets and U.S. Army specification data can be used in assessing the hazard posed by a given spill or release.

4.4 Control Procedures [264.52(a)]

Potential hazardous materials/wastes accidents at the New Bomb Facility can be classed as: fires or explosions; spills or releases. The initial response to any emergency will be to protect human health and safety, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response. The following paragraphs describe the emergency response procedures.

Fires and/or Explosions

There are two types of explosion and/or fires that could occur at the HWAD facility those which are planned and those which are unplanned.

- The planned explosions and/or fires include **permitted** open burning, open detonation, range activity (generally associated with munitions treatment or demilitarization), and scheduled horticultural (fence line) burns.

- The unplanned explosions and/or fires are those which are not planned. Unplanned explosions and/or fires may include those associated with the functioning of reactive components in munitions or during transportation or handling of the components or explosives; and unscheduled explosions and/or fires which could include those associated with more common causes such as; electrical failures, fuel line leaks, and ignition of combustible materials.

HWAD FES will respond to fires or explosions occurring on the facility grounds. Assistance from the Hawthorne FES will be requested to supplement on site capabilities of the Main Base Fire Department if required in accordance to the Mutual Aid Agreement (Appendix D). Hawthorne FES will not be utilized to fight fires at New Bomb. All fire response personnel will be provided with the appropriate protective clothing and safety equipment. Care will be taken to contain and recover any run-off of waste and water; foams;

or chemicals applied to the fire. If possible, the area should be diked and/or any run-off drains blocked prior to using liquids to put out the fire. Once extinguished, the materials involved in the fire and surrounding area will be examined, decontaminated, recovered, and placed in containers for proper disposal if necessary.

Fires or explosions within some of HWADs buildings handling flammable or explosive materials will be controlled and may be extinguished by built-in fire-protection systems, including sprinklers and deluge systems. The built-in systems will be activated automatically by heat sensors, but can be activated manually. Fire extinguishers and/or hydrants are located in strategic locations inside or outside some buildings for use by on-site personnel.

In the event of a fire, the ERCs major efforts will be placed on preventing the fire from spreading to nearby areas. The following actions (not necessarily listed in order of importance or action sequence) will be taken in indoor areas affected by a fire or explosion:

(1) Hazardous work in all areas will be terminated immediately.

(2) Fire doors in buildings will be closed.

(3) All feed lines to the furnaces and additional equipment will be shut down, as necessary and practical.

(4) All electrical circuits will be deactivated.

(5) The area will be cleared of all personnel not actively involved in fighting the fire.

(6) All injured persons will be removed and medical treatment will be administered by qualified personnel.

If the ERC decides that the chances of an impending explosion are high, the entire area within a 4,000 ft radius of the source will be evacuated. A greater radius will be evacuated if recommended by the Safety Representative. Specifics are outlined under general evacuation procedures contained in the Standard Operating Procedures for each facility. All personnel have been trained in evacuation procedures.

Until evacuation is signaled, personnel who are not in an affected area will stay in their respective work areas. Subcontract personnel and visitors will be cleared from the area and instructed to report to a designated evacuation point.

The ERC will be responsible for all fire fighting efforts. Supervisors of unaffected areas will stay with their personnel and be ready to evacuate and account for the persons under their supervision.

A verbal "all clear" signal will be given when the fire has been extinguished and the safety of personnel is no longer endangered. The ERC will determine when the emergency has passed and the "all clear" signal is given. All emergency equipment used in the emergency response must be cleaned and ready for use prior to resumption of plant operation in the affected areas. Once the "all clear" is given, steps will be taken to remove hazardous materials or wastes to a safe storage location unless investigators require that they be left in place.

Spills or Releases

All hazardous material or waste releases will be contained as close to the source as possible. For small spills, absorbent materials such as sand, sawdust, commercial absorbents, etc., should be placed directly on the material to prevent further spread and aid recovery. If the material is hazardous, it should be neutralized or desensitized prior to attempting recovery and provisions should be made to contain and recover the neutralizing or desensitizing solution. Berms of earthen or absorbent materials can be used to contain larger spills and should be constructed downstream of the leading edge. They are especially effective in containing continuing spills such as impoundment or pipeline leaks. Drains or drainage in the spill area should also be surrounded by berms to exclude the spilled materials or wastes and any materials applied to it. Any contaminated absorbents or earthen materials should be cleaned up and placed in drums for proper storage or disposal. No contaminant or contaminated materials will be left at the spill site. The ERC will determine the procedures for the timely removal of these materials.

Explosive Items/Materials

Whenever any potentially explosive items or materials are released or scattered, immediately secure the area and notify the GOC by call x7911 or 911 from any Base operated phone. The GOC will notify FES as outlined in Figure 3 of the HWAD Main Base ISCP. Every precaution must be taken to guard against explosion due to impact, friction, spark, shock, or heat. The ERC, Safety Officer, or Environmental Personnel will determine the appropriate procedures to clean up the explosive waste. If the accident occurs outside of

HWAD property, the proper local authorities will be notified. The local authorities will be asked to help secure the area in accordance with the Mutual Aid Agreement (HWAD Main Base ISCP).

4.5 Prevention of Recurrence or Spread of Fires, Explosions, or Releases [264.56(e)]

During an emergency, the ERC will take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other areas. Response actions are the primary means of preventing releases of hazardous materials or hazardous waste due to the recurrence or spread of fires and explosions. Other actions include collecting and containing the released waste.

4.6 Storage and Treatment of Released Material [264.56(g)]

Immediately after an emergency, the ERC will make arrangements for treatment, storage, or disposal of recovered waste, contaminated soil, surface water, or any other contaminated material. In general, the recovered wastes and contaminated materials will be placed in drums and stored with other hazardous wastes at a container storage facility and treated or disposed of in accordance with State and Federal regulations.

4.7 Incompatible Materials [264.56(h)(1)]

The ERC will be responsible for assuring that no incompatible materials or wastes will be treated, stored, or located in an area where a hazardous material or waste incident has occurred until cleanup procedures are completed.

4.8 Post-Emergency Equipment Maintenance [264.56 (h)(2)]

After an emergency event, all emergency equipment that was used will be cleaned so that it is fit for reuse, or it will be replaced. The equipment and protective clothing will be washed or discarded in proper containers and replaced with new equipment or clothing. Before operations are resumed, an inspection of all safety equipment will be conducted by the ERC, Safety Officer, and Environmental Personnel (as required) to ensure that they are fit for future use. When the inspection is completed, the Government Staff, the EPA Regional Administrator, the State, the local authorities, and the IOC will be notified that the response operations were satisfactorily completed; all waste materials were stored or disposed of in an appropriate manner; and the

status of the emergency equipment. Once notification has been completed normal operations will resume.

4.9 Container Spills and Leakage [264.52]

The procedures for responding to container spills or leakage under this plan will be to evacuate the area within a 50 ft radius and contain and clean up the spill with small berms and/or absorbent materials. Damaged containers will be thoroughly cleaned and disposed of or placed in over pack containers. Other response procedures are discussed in Section 4d.

4.10 Notification 264.56 (i)

Once the ERC ensures that in the affected area(s) no waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed and all emergency equipment listed in this plan is cleaned and fit for its intended use before operations are resumed. Then the ERC will notify Environmental Personnel who will notify the State and local authorities that the facility is in compliance.

4.11 Reporting 264.56 (j)

Within 15 days after the incident the Environmental Personnel must submit a written report on the incident to the Regional Administrator. The report must include:

(1) Name, address, and telephone number of the owner or operator;

(2) Name, address, and telephone number of the facility;

(3) Date, time, and type of incident (e.g., fire, explosion);

(4) Name and quantity of material(s) involved;

(5) The extent of injuries, if any;

(6) An assessment of actual or potential hazards to human health or the environment, where this is applicable; and

(7) Estimated quantity and disposition of recovered material that resulted from the incident.

5.0 Emergency Equipment [264.52(e), 264.32]

5.1 Location of Emergency Equipment

Fire fighting equipment such as fire extinguishers, axes, and shovels, are available for use at all times in the detonation unit, and are maintained in a storage shelter located at New Bomb. This storage shelter is indicated on Figure II-2.

Additional emergency, fire, and spill equipment is stored at the HWAD FES, located at the Main Base. This equipment includes those items listed in the Main Base ISCP. It should be noted that fires generally would not be fought in the detonation unit, but only at the boundary of the detonation unit. Fire fighting efforts are precluded by the presence of possible unexploded ordnance (UXO) within the boundaries of the detonation unit. The only exceptions would be if required as part of a rescue effort or if a small fire occurs during operations which could be easily put out by hand held tools.

Decontamination of equipment is outlined in the Main Base ISCP.

To prevent fires from occurring, smoking is prohibited in the vicinity of explosives and flammable wastes, and all flame-producing devices such as matches are removed from the detonation unit. Only non-sparking tools are used when working in the vicinity of explosive material.

Telephone/radio communications are maintained at all times in the detonation unit with local emergency response teams at HWAD. A vehicle is available to transport casualties that may occur during detonation of munitions.

A source of water at the detonation unit is not necessary because there is limited potential fire hazard. The area around the detonation unit is cleared from all vegetation, eliminating the possibility of fires. Further, no combustible materials are stored at the detonation unit. However, there are two 5,000 gallon tanker trailers positioned at the facility for fire fighting. There is also a water truck that wets the pits and road ways located at this facility.

5.2 Communications Equipment [264.34]

In addition to the equipment discussed above, the Range Office houses a telephone and can gain access to outside telephone lines, each person or group of persons will be equipped with a two-way, hand-held radio to maintain contact with the operations center and request assistance if required. The communications system at HWAD consists of two-way communications

between security personnel, selected employees, and a central communications (Guard Operations) center. Two base radio stations are located at the GOC, with an alternate station at the Electronics Shop (Building 95). Remote transmitters are located in the Guard Center (Building 37), Electronics Shop (Building 95), and ACO (Building 5). Communications during power failures will be maintained by field telephones and radios with independent battery supplies. A list of communications equipment is given in the Main Base ISCP.

Should an emergency situation develop at the facility, the first person to observe the situation will notify the GOC (who will notify FES) by calling extension x7911 or 911 from any base operated phone. A call to x7911 or 911 is answered by GOC and dispatched to the FES. The FES communications recorder is activated and records all x7911 or 911 calls and records radio emergency communications and the times of those communications. The FES will notify the ERC, who is responsible for channeling the needs for emergency assistance to the appropriate Federal, State, or local agencies.

6.0 Spill Prevention Measures

6.1 Inspections

The purpose of the inspections is to detect potential problems and correct them before they affect human health or the environment. All inspections are performed in accordance with the HWAD Standard Operating Procedure (SOP) for ammunition and explosives and demilitarization by detonation (Figure II-2). Inspections are conducted on the following: equipment used at the detonation unit; UXO, metal fragments; and other possible problems that could threaten human health, safety, or the environment.

Personnel conducting explosive operations at New Bomb are responsible for inspecting necessary equipment for operational readiness prior to the beginning of detonation that day. If any vital equipment in the area is inoperative, deteriorated, or not in compliance with permit conditions, maintenance is initiated before operations commence. Table A-2 is a schedule for inspecting safety and emergency equipment, security devices, operating equipment, and the detonation unit. This schedule is integrated with HWAD SOP's. The inspection frequency specified reflects an estimate of the probability of an undetected incident occurring between inspections, based on the expected rate of deterioration of the equipment. This schedule and listing of inspection locations may be periodically revised due to military requirements. The items listed in Table A-2 are considered important because of their role in preventing, detecting, or responding to possible safety and environmental problems.

After all detonations have been counted and accounted for, the Range supervisor and one Munitions Destroyer inspect each cell pit for any smoldering embers, explosives, and unexploded munitions. If a misfire has occurred, a new fire system is attached and detonation is reactivated. If a low order/partial detonation is suspected, the area will be secured until the Range Supervisor determines the action to be taken.

Inspections may be conducted weekly, monthly, or based on a detonation event. An event is defined as the detonation of an item with similar chemical constituent profiles. The log will be maintained at HWAD. Completed records will be kept on file for a period of three years.

Repairs on deteriorating or malfunctioning equipment are initiated immediately to ensure that human health or the environment is not threatened. Schedules for implementing and completing remedial actions are established as soon as problems are identified. These records are maintained at HWAD.

6.2 Loading and Unloading of Vehicles

Motor vehicles and mobile heavy equipment used for transporting ammunition meet the vehicle unloading requirements in the SOP on the New Bomb Area for HWAD (SOP No. HW-0000-G-001). Appropriate U.S. Department of Transportation (DOT)/U.S. Department of Defense (DOD) explosive placards are displayed on the transporting vehicles prior to loading ammunition.

- A designated safety observer, with communications capability, is strategically positioned away from the hazard areas but close enough to give warning and assistance. The observer provides rescue and first aid in the event of an accident.
- Brakes are set and, if the vehicle is on a grade, both front and rear wheels are chocked. The wheels of trailers are chocked at all times when separated from the tractor.
- The vehicle(s) are turned off and ammunition is loaded/unloaded on/from the truck(s).
- During unloading operations, compatibility requirements are maintained. Initiators, combustible materials, and fuels are positioned at a safe distance away from explosives or ordnance.
- Munitions are not unloaded or piled immediately in back of the exhaust system of transporting vehicle.
- All explosive and ordnance containers are spotted and opened at least 10 ft from each other and from previously laid out material.
- Packages are opened only when the vehicle is out of the area.
- When the vehicle is completely unloaded, it is withdrawn from the area to a safe location, until completion of the detonation.

Item transported to New Bomb are packaged in containers of strength equal to or greater than those described in 49 CFR Part 173 Subpart C-Explosive and Blasting Agents, Definition and Preparation. Containers are transported to New Bomb in contractor owned vehicles and off loaded at the two Material Staging Areas. All containers will be securely stowed to prevent movement during transport. During transport, ammunition is handled with strict adherence to DOT motor courier, State, Army, and local regulations. Drivers are furnished with DD Form 836 (Special Instruction for Motor Vehicle Drivers) that describes the nature of the ammunition on the truck, the fire hazards, the methods to be used in fighting fires involving the truck or cargo, the missile distance in case of explosion, proper distance to maintain from other trucks, and any other information which will bring about safe delivery of the shipment to its destination. Army regulations require that the form be transferred to each subsequent driver and finally to consignee at destination. Transport vehicles are removed from the hazard area prior to opening the containers.

All loading and unloading activities occur at the two Materials Staging Areas located in Figure II-2. These areas are large enough and graded allowing easy access for semi-trailers. When explosive materials are delivered to the Materials Staging Area, Munitions Handler personnel inspect the load on the truck to assure the material identification matches the description of the shipping documents and to assure the materials are scheduled for destruction.

6.3 Hazardous Waste Treatment

The detonation unit is designed, operated, and maintained to minimize potential releases of hazardous waste materials. Shipments of munitions items will not be allowed entry into the detonation area for unloading until they have been inspected and approved for safe detonation treatment.

Methods of operation and maintenance at the detonation unit which will minimize the potential for releases of hazardous materials include: inspection of the site before and after detonation; collection of explosive fragments left on the ground surface after detonations; ground

cleanup of detonation unit following four consecutive days of detonation activity; and separation of waste explosives and detonation subunits to reduce the possibility of uncontrolled detonation or fire. Waste munitions to be disposed of by detonation will be placed with a demolition charge in a cell not less than 4 ft in depth. These measures, to minimize release of hazardous materials, are documented in HWAD SOP's.

Obsolete munitions are moved to New Bomb on contractor owned semi-trailer trucks by trained personnel. Ammunition and projectiles are moved in containers placed on wooden pallets, and depending on the type of munitions, may range in weight from 1,500 pounds to nearly 3,000 pounds. Each truck normally carries six to eight pallets, totaling 9,000 to 24,000 pounds per truckload.

All hazardous materials and hazardous wastes handled at the HWAD detonation unit are assumed to be reactive, since they are military ordnance and only reactive wastes may be treated at the site. Non-reactive wastes are generally not treated at this facility. All personnel working in the detonation operations must take all appropriate measures to prevent incidents that:

- Generate uncontrolled extreme heat or pressure, fire or explosions, or violent reactions;
- Produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health or the environment;
- Produce uncontrolled inflammable fumes or gases in sufficient quantities to pose a risk of fire or explosion; and
- Through any other means, threaten human health or the environment.

Detonation operations generate heat, pressure (shock waves), explosions, and violent reactions. The intent of the detonation operations is to initiate these phenomena in a controlled setting.

The means to prevent unintended reactions is provided through the establishment of safety guidelines implemented through the HWAD New Bomb SOP's. As summarized below, the safety guidelines include, but are not limited to, the following:

- Unauthorized ignition sources such as flame producing devices are prohibited at New Bomb at any time.

- Sparking equipment and tools are prohibited from near explosive materials unless specifically authorized by the Range Supervisor.
- All hand tools and mechanical devices are inspected prior to use to ensure their safety.
- Motor vehicles used to transport waste explosives, ammunition, or other material meet the requirements of TM-9-1300-206.
- Detonation operations will not be initiated during electrical storms, snow storms, or rain.
- The material is protected against accidental ignition or explosion from fragments, grass fires, burning embers, or the impulse associated with materials being detonated.
- Dry grass, leaves, and flammable/combustible materials are removed from around the detonation unit.
- Initiators (e.g. blasting caps, primers) and explosives are packaged, transported, and handled separately until placement for treatment.
- Engines of transport vehicles are turned off prior to unloading munitions at Material Staging Areas.
- Containers of explosives are not tumbled, thrown, dropped, rolled, or struck against each other. Explosives are not exposed to high temperatures and direct sunlight for any length of time.
- Non-static protective clothing worn by handlers.

No hazardous wastes are present at the detonation unit except during detonation operations. Detonation operations are not conducted during periods of precipitation of flooding so that there is no potential for runoff contacting hazardous wastes.

The earth that underlies the various items will absorb much of the energy released during detonation, therefore, keeping the spray of soil to a minimum. Also, operations are only conducted when wind speed forecasts are between 3 and <20 miles per hour (mph), with gusts up to <30 mph.

7.0 Coordination Agreements [264.52(c), 264.37]

HWAD provides its own 24 hour FES which has primacy over the installation (264.37(a)(2)), therefore, coordinated arrangements for services from local police, fire department, emergency personnel, state response teams, emergency response contractors, and equipment suppliers are not required (264.52(c), 264.37(a), and 264.37(a)(3)).

HWADs 24 hour FES are familiar with: the layout of the facility; properties of hazardous waste handled at the installation and the associated hazards; places where facility personnel would normally be working; entrances to and roads inside the facility; and possible evacuation routes as required by the National Fire Protection Code (NFPA) and the Uniform Fire Code (UFC), (264.37(a)(1)).

The local hospital has been made aware of the properties of hazardous waste handled involved and the type of injuries or illnesses which could result from fires, explosions, or releases at the installation (264.37(a)(4)). The local hospital also retains a copy of this plan.

Appendix D of the Main Base ISCP is a mutual aid agreement between the HWAD and the Mineral County FES for non-hazardous events. The Mineral County FES will only respond to non-hazardous incidences if requested and retains a copy of this plan.

Appendix F of the Main Base ISCP is a mutual aid agreement between the HWAD and the Mineral County Sheriff's Office in the form of a Memorandum of Understanding and a copy of this plan.

Appendix E of the Main Base ISCP is an agreement for the use of the railroad for emergency support, training and for advance notice of train movement and unusual hazards between HWAD and the Walker River Paiute Tribe.

8.0 Evacuation Plan [264.52(f)]

In the event of a hazardous waste incident that requires evacuation, communication via two-way radios will alert personnel to evacuate the premises. If the hazard is capable of explosion, the personnel will be instructed to go to the nearest bunker, ditch, or dirt mound to protect against shrapnel. If the material/waste is toxic or flammable, the personnel will be instructed to move upwind to a safe area.

If the ERC decides that the chances of an impending explosion are high, the entire area within a 4,000 ft radius of the source will be evacuated. A greater radius will be evacuated if recommended by the safety representative. All personnel have been trained in evacuation procedures. The ERC will be responsible for all firefighting efforts until help arrives.

If the spill results in the formation of a toxic vapor cloud, (by reaction with surrounding materials or by outbreak of fire) further evacuation may be required. A downwind area at least 500 ft wide and 1,000 ft long should be evacuated. A larger area may need to be evacuated, depending on the materials/wastes involved and the ambient weather conditions.

A verbal "all clear" signal will be given when the fire has been extinguished and the safety of personnel is no longer endangered. The Fire Department Chief will determine when the emergency has passed and consult with the ERC before the "all clear" signal is given.

The Area Supervisor is responsible for training assigned personnel, involved in a new job, of evacuation procedures, retrain the personnel annually and to train any new employees before they start work.

Agreements are made with Hawthorne Fire Department in case of a fire emergency. Local police are available to assist in controlling traffic on U.S. Highway 95 and State Highway 359 in the event of an emergency. Coordination Agreements are listed in the HWAD Main Base ISCP.

The initial assessment of the emergency is made by the ERC. The ERC determines the potential hazard to human health/safety and the environment and decides on the type of emergency response; i.e., firefighting equipment, traffic control, medical treatment, isolation/evacuation requirement. If the assessment of the ERC indicates the evacuation of local

areas may be advisable, he/she will immediately notify appropriate local authorities as outlined in Section 4a of the HWAD Contingency Plan.

9.0 Required Reports [264.56(j)]

Any emergency event that requires implementation of this plan will be reported by Environmental Personnel to the Government Staff, the LEPC, and provide telephonic notification to Nevada Division of Environmental Protection (NDEP). This notification will be followed up with a report, in writing to the Region IX Administrator of the Environmental Protection Agency (EPA) and/or the NDEP within 15 days. The following information will be provided:

(1) Name, address, and phone number of owner/operator.
(2) Name, address, and phone number of facility.
(3) Date, time, and type of incident (e.g., fire, spill, etc.)
(4) Type and quantity of material involved.
(5) Extent of injuries, if any.
(6) Assessment of actual or potential hazards to human health or the environment, if applicable.
(7) Estimated quantity and disposition of material recovered from the incident.

The time, date, and details of emergency incidents requiring implementation of this plan will be entered in the facilities operating record. The form to be completed for a hazardous material or waste spill report is found in the Main Base ISCP, Appendix A. Other reports for hazardous material or waste accidents or incidents are required by the U.S. Army and are discussed in this Plan. The HWAD Commander will be responsible for making these reports available to the appropriate Army personnel.

10.0 Location and Distribution of Contingency Plan [264.53]

Copies of this Addendum are maintained with the Environmental Office, FES, and at the New Bomb Facility. In addition, copies are distributed with the Main Base Contingency Plan to the local authorities including the Mineral County Fire and Emergency Service, Local Emergency Planning Committee, Mount Grant General Hospital, Mineral County Sheriff's Department.

The New Bomb Addendum Contingency Plan is not complete without the Main Base Contingency Plan.

TABLES

Table A-1: Chemical Composition of Representative Energetics In Items Treated by Detonation at HWAD

DODAC Number	Item	Energetic Constituent	Weight (lb)	Weight Percent	Hazardous Waste Code
1305-A974	Cartridge, 25-mm APD5-T Lnkd, M791	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	2.02E-1 1.54E-2 1.32E-3 1.98E-3 4.41E-4	91.4 7.0 0.6 0.9 0.2	D003, D030
1305-A975	Cartridge, 25-mm HEI-T Lnkd, M792	HMX Nylon Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	5.20E-2 2.74E-3 1.90E-1 1.45E-2 1.25E-3 1.87E-3 4.16E-4	19.79 1.04 72.30 5.52 0.48 0.71 0.16	D003, D030
1305-A976	Cartridge, 25-mm TP-T Lnkd, M793	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	2.02E-1 1.54E-2 1.32E-3 1.98E-3 4.41E-4	91.4 7.0 0.6 0.9 0.2	D003, D030
1305-A978	Cartridge, 25-mm TP Sngl Rd, PGU-23/U	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	1.91E-1 1.47E-2 1.26E-3 1.89E-3 4.19E-4	91.4 7.0 0.6 0.9 0.2	D003, D030
1305-B112	Cartridge, 30-mm HEI Lnkd LHF, MK3Z	PETN TNT	1.1E-1 1.1E-1	50 50	D003, D030
1305-B113	Cartridge, 30-mm TP Lnkd LHF, MK4Z	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	9.25E-2 7.1E-3 6.0E-4 9.0E-4 2.0E-4	91.4 7.0 0.6 0.9 0.2	D003, D030
1305-B114	Cartridge, 30-mm HEI Lnkd RHF, M3Z-1	PETN TNT	1.4E-1 1.4E-1	50 50	D003, D030
1305-B115	Cartridge, 30-mm TP Lnkd RHF, MK4Z	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	9.25E-2 7.1E-3 6.08E-4 9.12E-4 2.03E-4	91.4 7.0 0.6 0.9 0.2	D003, D030
1305-B124	Cartridge, 30-mm HEI Lnkd LHF, M799	PETN TNT	1.0E-1 1.0E-1	50 50	D003, D030
1305-B125	Cartridge, 30-mm HEI Lnkd RHF, M799	PETN TNT	1.0E-1 1.0E-1	50 50	D003, D030
1310-B470	Cartridge, 40-mm HE Lnkd, M384 Series	RDX Wax Nitrocellulose Nitroglycerin	1.18E-1 1.8E-3 7.92E-3 1.99E-3	90.63 1.38 6.08 1.53	D003, D005, D008

		Potassium Nitrate Lead Compounds Antimony Sulfide Barium Nitrate Ethyl Centralite Potassium Chlorate	8.1E-5 1.49E-4 1.3E-5 1.5E-4 6.1E-5 2.7E-5	0.06 0.11 0.01 0.12 0.05 0.02	
1310-B480	Cartridge, 40-mm TP Lnkd F/Heli Launcher, M385	Nitrocellulose Nitroglycerin Potassium Nitrate Antimony Sulfide Barium Nitrate Ethyl Centralite Lead Azide Potassium Chlorate Lead Thiocyanate	7.60E-3 1.91E-3 7.43E-5 8.57E-6 1.37E-4 5.86E-5 2.86E-6 2.71E-5 1.29E-5	77.27 19.46 0.76 Trace 1.39 0.60 0.03 0.28 0.13	D003, D005, D008
1310-B534	Cartridge, 40-mm MO, M576	Metal Pellets Antimony Sulfide Barium Nitrate Nitrocellulose Nitroglycerin Potassium Nitrate Lead Azide Graphite Ethyl Centralite Potassium Chlorate Lead Thiocyanate	5.28E-2 8.57E-6 5.71E-6 3.21E-4 8.14E-5 2.86E-6 2.86E-6 1.43E-6 2.86E-6 2.71E-6 1.29E-5	99.12 0.02 0.01 0.60 0.15 5.37E-3 5.37E-3 2.69E-3 5.37E-3 0.05 0.02	D003, D005 D008
1310-B542	Cartridge, 40-mm HEDP, M430	Lead Azide Antimony Sulfide Barium Nitrate Tetracene Nitrocellulose Nitroglycerin Potassium Nitrate RDX Tetryl Desensitizer Ethyl Centralite Potassium Chlorate	2.68E-4 1.29E-5 1.50E-4 1.43E-6 7.92E-3 1.99E-3 8.14E-5 8.24E-2 1.23E-3 1.25E-3 6.14E-5 2.71E-5	0.28 0.01 0.16 0.01 8.29 2.09 0.08 86.34 1.30 1.31 0.06 0.03	D003, D005, D008
1310-B545	Cartridge, 40-mm Blank Saluting	Sodium Nitrate Charcoal Sulfur	5.78E-1 1.16E-1 7.71E-2	75 15 10	D003
1310-B551	Cartridge, 40-mm AP Clipped, M81A1	Potassium: Nitrate + Chlorate Lead Thiocyanate Antimony Sulfide Nitrocellulose Dinitrotoluene Dibutylphthalate Diphenylamine Strontium Nitrate Magnesium Aluminum Polyvinyl Chloride Barium Peroxide	 6.85E-3 3.57E-5 2.43E-5 5.52E-1 6.49E-2 3.25E-2 6.49E-3 1.12E-2 7.50E-3 3.80E-4 1.40E-3 2.30E-3	 0.99 Trace Trace 80.23 9.44 4.72 0.94 1.62 1.09 0.05 0.20 0.33	D003,D005 D008, D030
1310-B553	Cartridge, 40-mm HEP MK2	Nitrocellulose	6.11E-1	69.77	D003, D008

		TNT Dinitrotoluene Dibutylphthalate Diphenylamine Potassium Nitrate + Sulfur Lead Azide + Thiocyanate Antimony Sulfide	1.40E-1 7.19E-2 3.60E-2 7.19E-3 6.86E-3 1.43E-3 9.51E-4 2.91E-4 4.57E-5	15.99 8.21 4.11 0.82 0.78 0.16 0.11 0.03 0.01	D030
1310-B555	Cartridge, 40-mm HEI-P MK2	Nitrocellulose TNT Dinitrotoluene Dibutylphthalate Diphenylamine Potassium Nitrate + Chlorate Charcoal Sulfur Lead Azide + Thiocyanate Antimony Sulfide	6.11E-1 1.40E-1 7.19E-2 3.60E-2 7.19E-3 6.86E-3 1.43E-3 9.51E-4 2.91E-4 4.57E-5	69.77 15.99 8.21 4.11 0.82 0.78 0.16 0.11 0.03 0.01	D003, D008 D030
1310-B556	Cartridge, 40-mm HEI-P-NP	TNT	2.03E-1	100	D003, D030
1310-B557	Cartridge, 40-mm HEI-SD 4/Clip	TNT	2.03E-1	100	D003, D030
1310-B558	Cartridge, 40-mm HEI-T-NSD 4/Clip	TNT	2.03E-1	100	D003, D030
1310-B559	Cartridge, 40-mm HE-T-SD 4/Clip	Nitrocellulose Dinitrotoluene Diphenylamine Dibutylphthalate Potassium Chlorate Antimony Sulfide Potassium Nitrate Charcoal Sulfur Lead TNT Carborundum Lead Sulfocyanate	6.12E-1 7.20E-2 7.20E-3 2.88E-2 9.95E-5 4.81E-5 6.86E-3 1.37E-3 9.14E-4 2.63E-4 1.4E-1 3.57E-6 3.57E-5	70.38 8.38 0.83 3.31 0.01 5.53E-3 0.79 0.16 0.11 0.03 16.10 4.11E-4 4.11E-3	D003, D008 D030
1310-B560	Cartridge, 40-mm HEI-T-DI-SD	TNT	2.03E-1	100	D003, D030
1310-B561	Cartridge, 40-mm HE-P	TNT	2.03E-1	100	D003, D030
1310-B562	Cartridge, 40-mm HE-T-SD, MK2	TNT	2.03E-1	100	D003, D030
1310-B563	Cartridge, 40-mm BL-P	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite	6.04E-1 4.62E-2 3.96E-3 5.95E-3 1.32E-3	91.4 7.0 0.6 0.9 0.2	D003, D030
1310-B564	Cartridge, 40-mm BL-T 4/Clip	Nitrocellulose Dinitrotoluene	6.04E-1 4.62E-2	91.4 7.0	D003, D030

		Potassium Sulfate Diphenylamine Graphite	3.96E-3 5.95E-3 1.32E-3	0.6 0.9 0.2	
1310-B568	Cartridge, 40-mm, M406	RDX Trinitrotoluene Wax Lead Compounds Antimony Sulfide Barium Nitrate Nitrocellulose Nitroglycerin Potassium Nitrate Potassium Chlorate Ethyl Centralite	4.23E-2 2.75E-2 7.04E-4 1.49E-4 1.29E-5 7.14E-6 4.21E-4 2.91E-4 1.14E-5 2.71E-5 5.71E-6	59.22 38.50 0.99 0.20 0.02 0.01 0.59 0.41 0.02 0.04 0.01	D003, D005, D008, D030
1310-B569	Cartridge, 40-mm HE, M406	Antimony Sulfide Barium Nitrate Tetracene Nitrocellulose Nitroglycerin Potassium Compounds Lead Compounds TNT Ethyl Centralite Wax RDX	1.29E-5 7.14E-6 1.43E-6 4.21E-4 2.91E-4 3.85E-5 1.49E-4 2.75E-2 5.71E-6 7.04E-4 4.23E-2	0.02 0.01 Trace 0.59 0.41 0.05 0.21 38.52 Trace 0.99 59.32	D003, D005 D008, D030
1310-B572	Cartridge, 40-mm HE Lnkd, M384 Series	RDX Desensitizer Nitrocellulose Nitroglycerin Potassium Nitrate Lead Compounds Antimony Sulfide Barium Nitrate Ethyl Centralite Potassium Chlorate	1.18E-1 1.8E-3 7.92E-3 1.99E-3 8.1E-5 1.49E-4 1.3E-5 1.5E-4 6.1E-5 2.7E-5	90.63 1.38 6.08 1.53 0.06 0.11 0.01 0.12 0.05 0.02	D003, D005 D008
1310-B576	Cartridge, 40-mm TP LNKD, M385	Nitrocellulose Nitroglycerin Potassium Nitrate Antimony Sulfide Barium Nitrate Graphite Ethyl Centralite Lead Azide Potassium Chlorate Lead Thiocyanate	7.6E-3 1.91E-3 7.43E-5 8.57E-6 1.37E-4 3.0E-5 5.86E-5 2.86E-6 2.71E-5 1.29E-5	77.07 19.37 0.75 0.09 1.39 0.30 0.59 0.03 0.28 1.31E-3	D003, D005 D008
1310-B666	Cartridge, 3 Pounder BLNK, MK1-1	Potassium Nitrate Charcoal Sulfur	7.5E-1 1.5E-1 1.0E-1	75 15 10	D003
1315-C025	Cartridge, 75-mm Blank, M337A2	Potassium Nitrate Charcoal Sulfur Potassium Chlorate	7.6E-1 1.5E-1 1.0E-1 7.5E-5	75 15 10 0.01	D003
1315-C162	Cartridge, 3-in 50 Cal VT Non- frag, MK33	Nitrocellulose Dinitrotoluene	4.04E0 3.10E-1	72.66 5.56	D003, D030

		Potassium Sulfate Diphenylamine Graphite Potassium Nitrate Charcoal Sulfur	2.65E-2 3.98E-2 8.84E-3 8.55E-1 1.71E-1 1.14E-1	0.47 0.72 0.16 15.35 3.07 2.05	
1315-C164	Cartridge, 3-in 50 Cal VT Non-frag, MK 33	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite Potassium Nitrate Charcoal Sulfur	4.04E0 3.10E-1 2.65E-2 3.98E-2 8.84E-3 8.55E-1 1.71E-1 1.14E-1	72.53 5.57 0.48 0.72 0.16 15.35 3.07 2.05	D003, D030
1315-C183	Cartridge, 3-in 50 Cal Blank	Sodium Nitrate Charcoal Sulfur	1.51E0 3.01E-1 2.01E-1	75 15 10	D003
1315-C319	Cartridge, 3-in 50 Cal VT Non-frag, MK31	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite Potassium Nitrate Charcoal Sulfur	4.04E0 3.10E-1 2.65E-2 3.98E-2 8.84E-3 8.55E-1 1.71E-1 1.14E-1	72.53 5.57 0.48 0.72 0.16 15.35 3.07 2.05	D003, D030
1315-C320	Cartridge, 3-in 50 Cal VT Non-frag, MK31	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite Potassium Nitrate Charcoal Sulfur	4.04E0 3.10E-1 2.65E-2 3.98E-2 8.84E-3 8.55E-1 1.71E-1 1.14E-1	72.53 5.57 0.48 0.72 0.16 15.35 3.07 2.05	D003, D030
1315-C373	Cartridge, 3-in 50 Cal VT Non-frag, MK36 NFL	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite Potassium Nitrate Charcoal Sulfur	5.99E0 4.58E-01 3.93E-2 5.90E-2 1.31E-2 8.55E-1 1.71E-1 1.14E-1	77.85 5.96 0.51 0.77 0.17 11.12 2.22 1.48	D003, D030
1315-C375	Cartridge, 3-in 50 Cal VT Non-frag, MK36 NFL	Nitrocellulose Dinitrotoluene Potassium Sulfate Diphenylamine Graphite Potassium Nitrate Charcoal Sulfur	5.99E0 4.58E-1 3.93E-2 5.90E-2 1.31E-2 8.55E-1 1.71E-1 1.14E-1	77.85 5.96 0.51 0.77 0.17 11.12 2.22 1.48	D003, D030
1315-C697	Cartridge, 4.2-in HE w/o Fuze, M329A2	RDX TNT Nitroglycerin Nitrocellulose Wax Potassium Nitrate	3.45E0 2.61E0 2.58E-1 3.13E-1 5.75E-2 2.66E-2	51.19 38.69 3.83 4.65 0.85 0.40	D003, D030

		Methylphthalate Charcoal Ethyl Centralite Sulfur	1.8E-2 3.75E-3 3.6E-3 2.5E-3	0.27 0.06 0.05 0.04	
1315-F382	Bomb, Adapter Booster, Mod TA6E4	Tetryl	9.04E-1	100	D003
1320-D579	Projectile, 155-mm HE RAP, M549 Series (COMP B)	RDX TNT Wax Nitrocellulose Dinitrotoluene Diphenylamine Dibutylphthalate Lead Compounds Antimony Sulfide Potassium Sulfate Tetryl	9.6E0 6.6E0 1.6E-1 1.12E1 1.31E-0 1.31E-1 5.25E-1 1.23E-3 7.0E-5 1E-3 4.95E-2	31.43 21.63 0.524 36.52 4.30 0.43 1.72 4.03E-3 2.30E-4 3.27E-3 0.16	D003, D008 D030
1325-E463	Bomb, GP 250 lb, MK81 Mod 1 (H-6/Tritonal)	TNT Powdered Aluminum	80.0 20.0	80 20	D003, D030
1325-E464	Bomb, GP 250 lb, MK81 Mod 0 (Tritonal)	TNT Powdered Aluminum	80.0 20.0	80 20	D003, D030
1325-E465	Bomb, GP 250 lb, MK81 Mod 1 (H-6, Tritonal)	TNT Powdered Aluminum	80.0 20.0	80 20	D003, D030
1325-E485	Bomb, GP 550 lb, MK82 Mod 1 (Tritonal)	TNT Powdered aluminum	153.6 38.4	80 20	D003, D030
1325-E506	Bomb, GP 1000 lb, MK83 Mod 4	RDX TNT Powdered Aluminum Paraffin Nitrocellulose Calcium Chloride Lecithin	200.25 133.50 89.00 17.80 3.12 1.34 0.45	45.0 30.0 20.0 4.0 0.7 0.3 0.1	D003, D030
1325-E807	Dispenser and Bomb, ACFT LS FAE, CBU 55/B	Ethylene Oxide PETN	216.00 2.36	98.92 1.08	D001, D003
1325-E820	Dispenser and Bomb, ACFT, CBU 59/B	HMX Nylon	80.46 5.14	94 6	D003
1325-F372	Adapter, Booster, T45E7	Tetryl	NA	100	D003
1325-G881	Grenade, Hand Frag, M67	RDX TNT Wax	2.47E-1 1.58E-1 4.0E-3	60.39 38.63 0.01	D003, D030
1330-G890	Grenade, Hand Frag, MK2/M26 Series	RDX TNT Wax Tetryl Pellets	2.06E-1 2.55E-1 3.0E-3 1.9E-2	42.04 54.04 0.01 3.88	D003, D030
1330-G892	Grenade, Hand Frag, MK2A1	TNT	1.0E-1	100	D003, D030
1330-G911	Grenade, Hand Off, MK3A2	TNT Lead Compounds Barium Compounds RDX	5.0E-1 7.4E-4 1.7E-3 1.9E-3	99.0 0.14 0.34 0.38	D003, D005, D008, D030

		Zirconium Powder Nickel Powder Potassium Perchlorate	3.25E-4 4.17E-4 4.0E-4	0.06 0.08 0.08	
1330-G970	Grenade, Rifle Heat, M28/M31	RDX TNT Wax Lead Azide PETN Tetryl	3.72E-1 2.41E-1 6E-3 2.57E-4 3.57E-4 1.2E-2	58.95 38.19 0.95 0.04 0.05 1.90	D03, D008, D030
1340-H342	Rocket Motor, JATO, MK25 Mod 1	Ammonium Nitrate	122.0	100	D003
1340-H343	Rocket Motor, JATO, MK7 Mod 2 w/o Igniter	Ammonium Perchlorate	117.5	100	D003
1340-H345	Rocket Motor, JATO, MK7 Mod 1 w/o Igniter	Ammonium Perchlorate	117.5	100	D003
1345-K090	Mine, AP, M2 Series	Potassium Nitrate Charcoal Sulfur Lead Azide Tetryl TNT	5.77E-3 1.15E-3 7.70E-4 5.83E-4 3.56E-2 3.4E-1	1.50 0.30 0.20 0.15 9.27 88.56	D003, D008 D030
1345-K092	Mine, APER Bounding, M16 Series	TNT Potassium Perchlorate Potassium Nitrate Charcoal Sulfur Barium Chromate Zirconium Nickel Alloy	1.3E0 1.46E-4 1.05E-3 2.23E-4 1.48E-4 6.26E-4 1.18E-4 1.53E-4	99.80 0.01 0.08 0.02 0.01 0.05 0.09 0.01	D003, D005 D030
1345-K121	Mine, APERS, M14	Tetryl	6.25E-1	100	D003
1345-K143	Mine, APERS w/M57 Firing Device, M18A1	RDX Lead Compounds PETN Barium Chromate	1.43E0 2.21E-3 7.71E-4 1.39E-4	99.79 0.15 0.05 0.01	D003, D005 D008
1345-K146	Mine, APERS, M26	RDX TNT Wax	NA	60 39 1	D003, D030
1345-K181	Mine, AT Heavy, M21	RDX Lead Azide TNT Powdered Aluminum Wax Nitrocellulose Calcium Chloride Lecithin	4.89E0 1.28E-3 3.24E0 2.16E0 4.32E-1 7.56E-2 3.24E-2 2.81E-4	45.15 0.01 29.9 19.9 3.099 0.70 0.10 2.60E-3	D003, D008 D030
1345-K250	Mine, AT Heavy Non-metallic, M19	RDX TNT Wax Potassium Chlorate Lead Compounds	1.27E1 8.19E0 2.1E-1 1.23E-4 6.08E-4	60.22 38.78 0.99 5.82E-4 2.88E-3	D003, D008, D030

		Antimony Sulfide	4.0E-5	1.89E-4	
1370-L377	Simulator, Expl, MK2 Mod 0	Potassium Nitrate Charcoal Sulfur	9.90E-3 1.98E-3 1.32E-3	75 15 10	D003
1370-L594	Simulator, Proj Grnd Burst, M115A1	Aluminum Powder Magnesium-Type 1 Potassium Perchlorate Sodium Salicylate Red Gum	4.06E-2 5.30E-2 6.54E-2 1.23E-3 1.31E-4	25.37 33.12 40.87 0.77 0.08	D003
1370-L596	Simulator, Flash Artillery, M110	Potassium Nitrate Sulfur Charcoal Potassium Chlorate Diazodinitrophenol Charcoal Nitrostarch	NA	1.24 0.17 0.26 59.0 19.7 14.8 4.9	D003
1375-M023	Charge, Demo Block 1 1/4 Lb. Comp C-4, M112	RDX Non-explosive plasticizers, Teflon	3.41E1 3.38E0	91 9	D003
1375-M026	Demo Kit, Bangalore Torp, M1A1	Amatol TNT	81 9	90 10	D003, D030
1375-M031	Charge, Demo Block TNT 1/2 Lb.	TNT	5.0E-1	100	D003, D030
1375-M032	Charge, Demo Block TNT 1 Lb.	TNT	1.00E0	100	D003, D030
1375-M034	Charge, Demo Block TNT 8 Lb.	TNT	8.00E0	100	D003, D030
1375-M035	Charge, Demo Chain, M1 8 X 2 2 Lb.	Tetryl TNT	15.09 5.03	75 25	D003, D030
1375-M420	Charge, Demo Shaped, M2 Series	RDX TNT Wax	6.60E0 4.29E0 1.1E-1	60 39 1	D003, D030
1375-M421	Charge, Demo Shaped, 40 lb, M3 Series	RDX TNT PETN Lead Azide Cellulose	27.5E0 11.95E0 1.25E0 1.0E-3 1.0E-2	67.55 29.35 3.07 0.01 0.02	D003, D008, D030
1375-M445	Demo Kit, Proj Chg AP M1/M1A1	PETN	4.60E1	100	D003
1375-M456	Cord, Type 1 Class E (PETN) @ 1000 ft.	PETN	2.48E0	100	D003
1375-M591	Military Dynamite, M1	RDX TNT Starch SAE No. 10 Oil Polyisobutylene	NA	75 15 5 4 1	D003, D030
1375-M757	Charge, Assy Demo Comp C-4	RDX Sebacate	1.83E1 1.06E0	91 5.3	D003

	8X2 2 Lb., M183	Polyisobutylene Motor Oil	4.2E-1 3.2E-1	2.1 1.6	
1377-M500	Cutter, Ctg Act F/Reefing Line, M21	Nitrocellulose Diphenylamine	NA	50 50	D003
1390-N538	Primer, Elec, MK49 Mod 4	Potassium Nitrate Charcoal Sulfur	4.23E-2 8.91E-3 5.94E-3	74.0 15.6 10.4	D003

Weights and percentages of energetics are estimates in some cases. Where percentages vary for a constituent, midpoints were chosen. Total percentage may not equal 100 percent.

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Table A-2: Inspection Schedule for Detonation Activities

Inspection Item	Type of Inspection	Frequency
Immediate Detonation Area	Unauthorized Personnel (onsite or cliffs west of site)	Before Detonation
	Misfires	After Detonation
	Low Order/Partial Detonation	After Detonation
	Shell Fragments	Before/After Detonation
	Smoldering Embers	Before/After Detonation
	Housekeeping	Before/After Detonation
	Standing Water in Pits/Cells	Before Detonation
Communication Equipment	Vegetation	Before Detonation
Two Way Radio (vehicular & portable)	Operational	Weekly
Telephones	Operational	Monthly
Safety and Emergency Equipment		
Fire Extinguishers		
First Aid Kit	Present/Operational	Weekly
Coveralls, Head Covering	Present	Weekly
(Fire retardant)	Present	Weekly
Safety Glasses		
Respirators	Present	Monthly
	Present	Monthly
Security Devices		
Gate		
Lock	Integrity	After Detonation
Warning Signs	Operational	After Detonation
Scarlet Range Flag	Present	Weekly
	Present	Weekly

FIGURES

Figure II-2

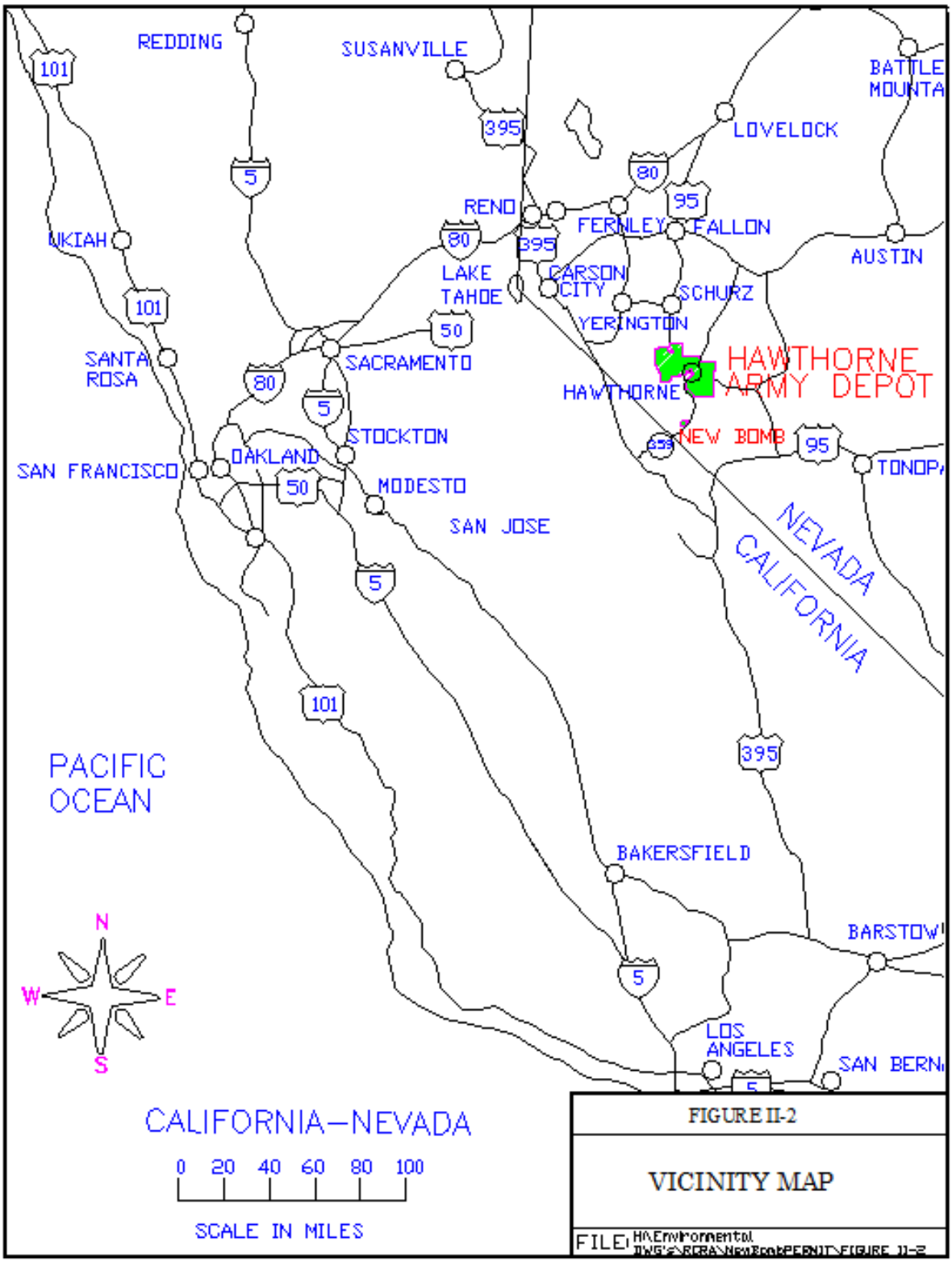
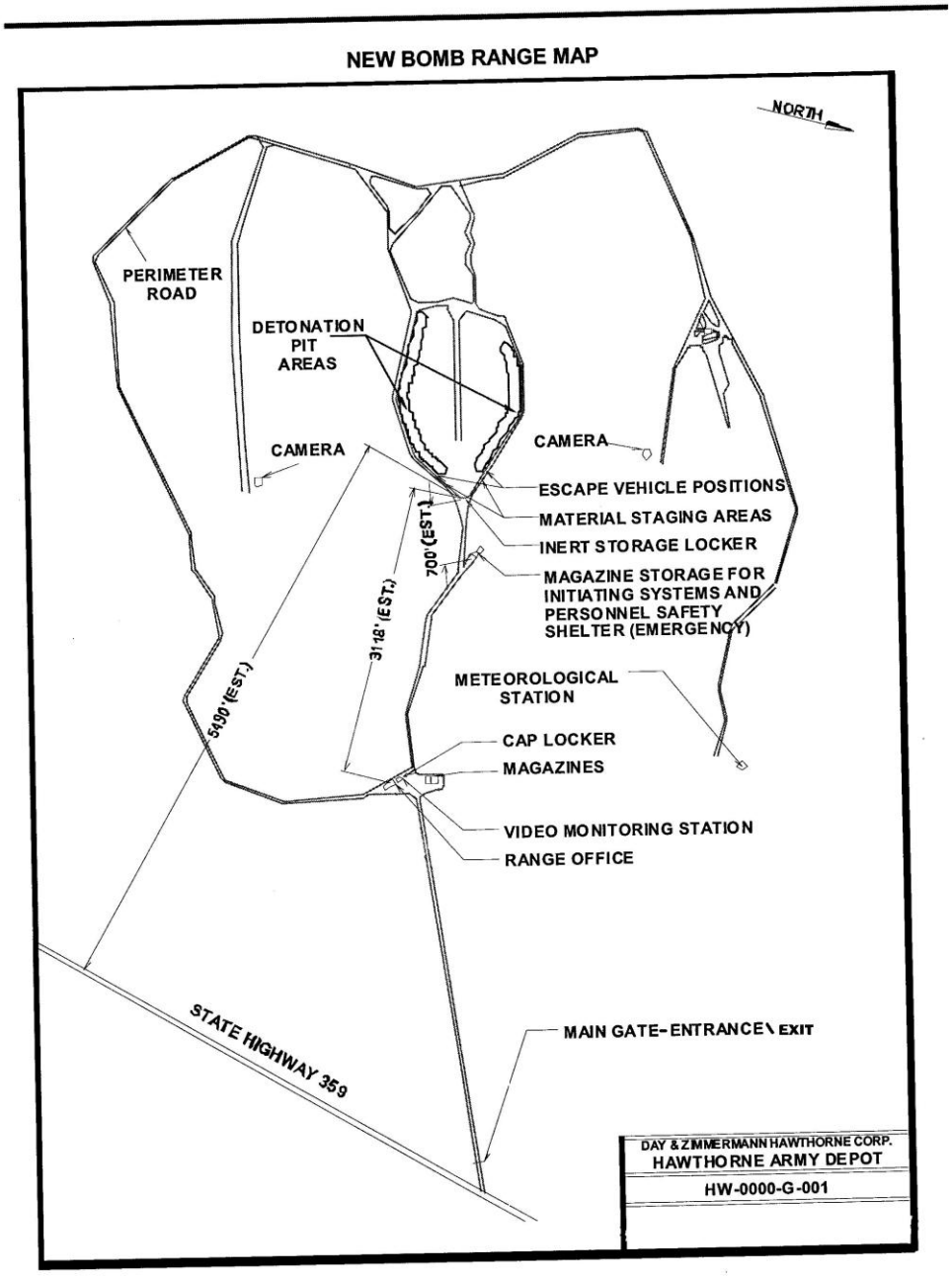

REDDING
SUSANVILLE
BATTLE MOUNTA
LOVELOCK
RENO
FERNLEY
FALLON
AUSTIN
UKIAH
LAKE TAHOE
CARSON CITY
SCHURZ
YERINGTON
SACRAMENTO
SANTA ROSA
HAWTHORNE
HAWTHORNE ARMY DEPOT
NEW BOMB
STOCKTON
OAKLAND
SAN FRANCISCO
MODESTO
SAN JOSE
TONOPA
NEVADA
CALIFORNIA
PACIFIC OCEAN
BAKERSFIELD
BARSTOW
LOS ANGELES
SAN BERN
101
5
395
80
95
50
N
W
E
S
CALIFORNIA–NEVADA
0 20 40 60 80 100
SCALE IN MILES
FIGURE II-2
VICINITY MAP
FILE: H:\Environmental\DWG's\RCRA\NewBomb\PERMIT\FIGURE II-2

Figure II-3


NEW BOMB RANGE MAP
NORTH
PERIMETER ROAD
DETONATION PIT AREAS
CAMERA
CAMERA
ESCAPE VEHICLE POSITIONS
MATERIAL STAGING AREAS
INERT STORAGE LOCKER
MAGAZINE STORAGE FOR INITIATING SYSTEMS AND PERSONNEL SAFETY SHELTER (EMERGENCY)
700' (EST.)
3118' (EST.)
5490' (EST.)
METEOROLOGICAL STATION
CAP LOCKER
MAGAZINES
VIDEO MONITORING STATION
RANGE OFFICE
STATE HIGHWAY 359
MAIN GATE- ENTRANCE\ EXIT
DAY & ZIMMERMANN HAWTHORNE CORP.
HAWTHORNE ARMY DEPOT
HW-0000-G-001

APPENDIX D
NEW BOMB AIR PERMIT

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

July 8, 2011

William C. Johnson, Jr.
Lieutenant Colonel, U.S. Army Commanding
Department of the Army, Hawthorne Army Depot
1 South Maine Avenue
Hawthorne, Nevada 89415

RE: Request for Class II Air Quality Operating Permit AP9711-1134.02 Renewal
FIN A0022 – New Bomb Facility

Dear Lieutenant Colonel Johnson:

The application submitted by the Department of the Army, Hawthorne Army Depot regarding the renewal of the Class II Air Quality Operating Permit AP9711-1134.01 has been reviewed by my staff under legal authority from Nevada Revised Statutes 445B.100 through 445B.640 and pursuant to regulations in Nevada Administrative Code 445B.001 through 445B.3689. Based on staff review and recommendation, I am hereby issuing Air Quality Operating Permit AP9711-1134.02, with appropriate restrictions. AP9711-1134.02 must be posted conspicuously at or near the source.

Enclosed is your copy of Operating Permit AP9711-1134.02. In accordance with Nevada Revised Statute 445B.340, you may appeal the department's action of issuance of this operating permit renewal within 10 days after you receive the permit. Appeals may be filed with the State Environmental Commission, 901 South Stewart St., Suite 4001, Carson City, Nevada, 89701-5249, telephone (775) 687-4670.

Please review your renewal permit carefully to understand all conditions, restrictions, and monitoring and recordkeeping requirements. If you have any questions, please call Randy Phillips of my staff, at (775)687-9362.

Sincerely,

Jeff Denison, P.E.
Supervisor, Permitting Branch
Bureau of Air Pollution Control

JD/rp
Enclosures – Renewed Air Permit
Certified Mail No. 7010 3090 0002 0571 7833

Nevada Department of Conservation and Natural Resources • Division of Environmental Protection

BUREAU OF AIR POLLUTION CONTROL

901 SOUTH STEWART STREET SUITE 4001
CARSON CITY, NEVADA 89701-5249
p: 775-687-9350 • www.ndep.nv.gov/bapc • f: 775-687-6396

Facility ID No. A0022 *Permit No.* AP9711-1134.02

CLASS II AIR QUALITY OPERATING PERMIT

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT, hereinafter referred to as Permittee
Mailing Address: 1 South Maine Avenue, Hawthorne, Nevada 89415-9404
Physical Address: State Route 359, Approximately 22 miles south of town of Hawthorne, Nevada
General Facility Location:
SECTION 33, T 5N, R 30E MDB&M (HA 110C) (MINERAL COUNTY)
UTM NORTH 4,234.25 KM, EAST 356.48 KM (ZONE 11, NAD 83)

Process Description:
The New Bomb Detonation Unit covers 743 acres within the approximately 3,000 acre New Bomb Area Facility, and is used for deactivation by detonation of explosive munitions that are unserviceable, unstable or where there is no market for reuse, recycling, or re-utilization. When safety and regulatory requirements allow, explosive munitions will be processed or treated at the Hawthorne Army Depot Main Base. The New Bomb open detonation area consists of 20 earthen pits (10 on each side) at the north and south bases of an east-to-west oriented hill, surrounded by a box canyon within a 743 acre area. The Department of the Army, Hawthorne Army Depot uses conventional earth-moving equipment to for the typical 20 foot by 6 foot earthen pits to a 4 foot depth, then loads the pits with waste and donor munitions prior to each detonation event. Operation of the New Bomb unit is required to be performed in adherence to approved safety procedures and is restricted to specific meteorological conditions and maximum treatment amounts.

A.	**System 1 - New Bomb Detonation Unit**	
F	0.001	Open Detonation Pit #1
F	0.002	Open Detonation Pit #2
F	0.003	Open Detonation Pit #3
F	0.004	Open Detonation Pit #4
F	0.005	Open Detonation Pit #5
F	0.006	Open Detonation Pit #6
F	0.007	Open Detonation Pit #7
F	0.008	Open Detonation Pit #8
F	0.009	Open Detonation Pit #9
F	0.010	Open Detonation Pit #10
F	0.011	Open Detonation Pit #11
F	0.012	Open Detonation Pit #12
F	0.013	Open Detonation Pit #13
F	0.014	Open Detonation Pit #14
F	0.015	Open Detonation Pit #15
F	0.016	Open Detonation Pit #16
F	0.017	Open Detonation Pit #17
F	0.018	Open Detonation Pit #18
F	0.019	Open Detonation Pit #19
F	0.020	Open Detonation Pit #20

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section I. General Conditions

A. Severability (Nevada Administrative Code (NAC) 445B.315.3(c))
Each of the conditions and requirements of this Operating Permit is severable and, if any are held invalid, the remaining conditions and requirements continue in effect.

B. Prohibited Acts (Nevada Revised Statute (NRS) 445B.470))
Permittee shall not knowingly:
1. Violate any applicable provision, the terms or conditions of any permit or any provision for the filing of information;
2. Fail to pay any fee;
3. Falsify any material statement, representation or certification in any notice or report; or
4. Render inaccurate any monitoring device or method, required pursuant to the provisions of NRS 445B.100 to 445B.450, inclusive, or 445B.470 to 445B.640, inclusive, or any regulation adopted pursuant to those provisions.

C. Prohibited Conduct: Concealment of Emissions (NAC 445B.225)
Permittee shall not install, construct, or use any device which conceals any emission without reducing the total release of regulated air pollutants to the atmosphere.

D. Compliance/Noncompliance (NAC 445B.315.3(d))
Permittee shall comply with all conditions of this Operating Permit. Any noncompliance constitutes a violation and is grounds for:
1. An action for noncompliance;
2. Revising, revoking, reopening and revising, or terminating the Operating Permit; or
3. Denial of an application for a renewal of the Operating Permit.

E. NAC 445B.315.3(e)
The need to halt or reduce activity to maintain compliance with the conditions of this Operating Permit is not a defense to noncompliance with any conditions of this Operating Permit.

F. NAC 445B.315.3(f)
The director may revise, revoke and reissue, reopen and revise, or terminate the operating permit for cause.

G. NAC 445B.315.3(g)
This Operating Permit does not convey any property rights or any exclusive privilege.

H. NAC 445B.315.3(h)
Permittee shall provide the Bureau of Air Pollution Control, within a reasonable time, with any information that the Bureau of Air Pollution Control requests in writing to determine whether cause exists for revising, revoking and reissuing, reopening and revising or terminating this Operating Permit or to determine compliance with the conditions of this Operating Permit.

I. Fees (NAC 445B.315.3(i))
Permittee shall pay fees to the Bureau of Air Pollution Control in accordance with the provisions set forth in NAC 445B.327 and 445B.331.

J. Right to Entry (NAC 445B.315.3(j))
Permittee shall allow the Bureau of Air Pollution Control personnel, upon the presentation of credentials, to:
1. Enter upon the premises of Permittee where:
   a. The stationary source is located;
   b. Activity related to emissions is conducted; or
   c. Records are kept pursuant to the conditions of this Operating Permit;
2. Have access to and copy, during normal business hours, any records that are kept pursuant to the conditions of this Operating Permit;
3. Inspect, at reasonable times, any facilities, practices, operations, or equipment, including any equipment for monitoring or controlling air pollution, that are regulated or required pursuant to this Operating Permit; and
4. Sample or monitor, at reasonable times, substances or parameters to determine compliance with the conditions of this Operating Permit or applicable requirements.

K. Certification (NAC 445B.315.3(k))
A responsible official of Permittee shall certify that, based on information and belief formed after reasonable inquiry, the statements made in any document required to be submitted by any condition of this Operating Permit are true, accurate and complete.

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section I. General Conditions (continued)

L. Testing and Sampling (NAC 445B.252)

1. To determine compliance with NAC 445B.001 to 445B.3689, inclusive, before the approval or the continuance of an operating permit or similar class of permits, the director may either conduct or order the owner of any stationary source to conduct or have conducted such testing and sampling as the director determines necessary. Testing and sampling or either of them must be conducted and the results submitted to the director within 60 days after achieving the maximum rate of production at which the affected facility will be operated, but not later than 180 days after initial startup of the facility and at such times as may be required by the director.
2. Tests of performance must be conducted and data reduced in accordance with the methods and procedures of the test contained in each applicable subsection of this section unless the director:
   a. Specifies or approves, in specific cases, the use of a method of reference with minor changes in methodology;
   b. Approves the use of an equivalent method;
   c. Approves the use of an alternative method, the results of which he has determined to be adequate for indicating whether a specific stationary source is in compliance; or
   d. Waives the requirement for tests of performance because the owner or operator of a stationary source has demonstrated by other means to the director's satisfaction that the affected facility is in compliance with the standard.
3. Tests of performance must be conducted under such conditions as the director specifies to the operator of the plant based on representative performance of the affected facility. The owner or operator shall make available to the director such records as may be necessary to determine the conditions of the performance test. Operations during periods of startup, shutdown and malfunction must not constitute representative conditions of a performance test unless otherwise specified in the applicable standard. (NAC 445B.252.3)
4. Permittee shall give notice to the director 30 days before the test of performance to allow the director to have an observer present. A written testing procedure for the test of performance must be submitted to the director at least 30 days before the test of performance to allow the director to review the proposed testing procedures. (NAC 445B.252.4)
5. Each test of performance must consist of at least three separate runs using the applicable method for that test. Each run must be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic means of results of the runs apply. In the event of forced shutdown, failure of an irreplaceable portion of the sampling train, extreme meteorological conditions or other circumstances with less than three valid samples being obtained, compliance may be determined using the arithmetic mean of the results of the other two runs upon the director's approval. (NAC 445B.252.5)
6. All testing and sampling will be performed in accordance with recognized methods and as specified by the director. (NAC 445B.252.6)
7. The cost of all testing and sampling and the cost of all sampling holes, scaffolding, electric power and other pertinent allied facilities as may be required and specified in writing by the director must be provided and paid for by the owner of the stationary source. (NAC 445B.252.7)
8. All information and analytical results of testing and sampling must be certified as to their truth and accuracy and as to their compliance with all provisions of NAC 445B.001 to 445B.3689, inclusive, and copies of these results must be provided to the director no later than 60 days after the testing or sampling, or both.

M. Maximum Opacity of Emissions (NAC 445B.22017)

1. Except as otherwise provided in this section and NAC 445B.2202, Permittee may not cause or permit the discharge into the atmosphere from any emission unit opacity equal to or greater than 20 percent. Opacity must be determined by one of the following methods:
   a. If opacity is determined by a visual measurement, it must be determined as set forth in Reference Method 9 in Appendix A of 40 C.F.R. Part 60.
   b. If a source uses a continuous monitoring system for the measurement of opacity, the data must be reduced to 6-minute averages as set forth in 40 CFR § 60.13(h).
2. The provisions of this section and NAC 445B.2202 do not apply to that part of the opacity that consists of uncombined water. The burden of proof to establish the application of this exemption is upon the person seeking to come within the exemption.

N. Exceptions for Stationary Sources (NAC 445B.2202)

The provisions of NAC 445B.22017 do not apply to:

1. Smoke from the open burning described in NAC 445B.22067;
2. Smoke discharged in the course of training air pollution control inspectors to observe visible emissions, if the facility has written approval of the commission;
3. Emissions from an incinerator as set forth in NAC 445B.2207;
4. Emissions of stationary diesel-powered engines during warm-up for not longer than 15 minutes to achieve operating temperatures.

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section I. General Conditions (continued)

O. Odors (NAC 445B.22087)
Permittee may not discharge or cause to be discharged, from any stationary source, any material or regulated air pollutant which is or tends to be offensive to the senses, injurious or detrimental to health and safety, or which in any way interferes with or prevents comfortable enjoyment of life or property.

P. Assertion of Emergency as Affirmative Defense to Action for Noncompliance (NAC 445B.326.1)
Permittee may assert an affirmative defense to an action brought for noncompliance with a technology-based emission limitation contained in the Operating Permit if the holder of the Operating Permit demonstrates through signed, contemporaneous operating logs or other relevant evidence that:

1. An emergency (as defined in NAC 445B.056) occurred and the holder of the Operating Permit can identify the cause of the emergency;
2. The facility was being properly operated at the time of the emergency;
3. During the emergency, the holder of the Operating Permit took all reasonable steps to minimize excess emissions; and
4. Permittee submitted notice of the emergency to the director within 2 working days after the emergency. The notice must contain a description of the emergency, any steps taken to mitigate emissions, and any corrective actions taken to restore the normal operation of the facility.
5. In any action for noncompliance, Permittee, by asserting the affirmative defense of any emergency, has the burden of proof.

Q. Revocation and reissuance (NAC 445B.3265)

1. This Operating Permit may be revoked if the control equipment is not operating. (NAC 445B.3265.1)
2. This Operating Permit may be revoked by the director upon determination that there has been a violation of NAC 445B.001 to 445B.3689, inclusive, or the provisions of 40 CFR § 52.21, or 40 C.F.R. Part 60 or 61, Prevention of Significant Deterioration, New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants adopted by reference in NAC 445B.221. (NAC 445B.3265.2)
3. The revocation is effective 10 days after the service of a written notice, unless a hearing is requested. (NAC 445B.3265.3)

*************End of General Conditions**************

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section II. General Construction Conditions

A. Notification (NAC 445B.250, NAC 445B.346.2)
The Bureau of Air Pollution Control will be notified in writing of any physical or operational change to an existing facility which may increase the emission rate of any regulated air pollutant to which a standard applies, unless that change is specifically exempted under an applicable section or in NAC 445B.239 or 445B.242 and the exemption is not denied under those sections. The notice must be postmarked 60 days or as soon as practicable before the change is commenced and must include information describing the precise nature of the change, present and proposed emission control systems, productive capacity of the facility before and after the change, and the expected completion date of the change. The director may request additional relevant information subsequent to this notice.

*************End of General Construction Conditions*********

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section III. General Operating Conditions

A. Facilities Operation (NAC 445B.227)
Permittee may not:
1. Operate a stationary source of air pollution unless the control equipment for air pollution which is required by applicable requirements or conditions of this Operating Permit is installed and operating.
2. Disconnect, alter, modify or remove any of the control equipment for air pollution or modify any procedure required by an applicable requirement or condition of this Operating Permit.

B. Excess Emissions (NAC 445B.232; NAC 445B.346.2)
1. Scheduled maintenance or testing or scheduled repairs which may result in excess emissions of regulated air pollutants prohibited by NAC 445B.001 to 445B.3689, inclusive, must be approved by the director and performed during a time designated by the director as being favorable for atmospheric ventilation.
2. The director must be notified in writing of the time and expected duration at least 24 hours in advance of any scheduled maintenance which may result in excess emissions of regulated air pollutants prohibited by NAC 445B.001 to 445B.3689, inclusive.
3. The director must be notified in writing or by telephone of the time and expected duration at least 24 hours in advance of any scheduled repairs which may result in excess emissions of regulated air pollutants prohibited by NAC 445B.001 to 445B.3689, inclusive.
4. The director must be notified of any excess emissions within 24 hours after any malfunction or upset of the process equipment or equipment for controlling pollution or during startup or shutdown of such equipment. The telephone number for the notification is (775) 687-4670.
5. Permittee, as the owner or operator of an affected facility, shall provide the director, within 15 days after any malfunction, upset, startup, shutdown, or human error which results in excess emissions, sufficient information to enable the director to determine the seriousness of the excess emissions. The information must include at least the following:
   a. The identity of the stack or other point of emission, or both, where the excess emissions occurred.
   b. The estimated magnitude of the excess emissions expressed in opacity or in units of the applicable limitation on emission and the operating data and methods used in estimating the magnitude of the excess emissions.
   c. The time and duration of the excess emissions.
   d. The identity of the equipment causing the excess emissions.
   e. If the excess emissions were the result of a malfunction, the steps taken to remedy the malfunction and the steps taken or planned to prevent the recurrence of the malfunction.
   f. The steps taken to limit the excess emissions.
   g. Documentation that the equipment for controlling air pollution, process equipment, or processes were at all times maintained and operated, to a maximum extent practicable, in a manner consistent with good practice for minimizing emissions.

C. Permit Revision (NAC 445B.287.1.b)
A revision of this operating permit is required pursuant to the requirements of NAC 445B.3465 before the stationary source may be modified.

*************End of General Operating Conditions*************

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section IV. General Monitoring and Recordkeeping

A. Records Retention (NAC 445B.315.3(b))
Permittee shall retain records of all required monitoring data and supporting information for 5 years from the date of the sample collection, measurement, report or analysis. Supporting information includes, but is not limited to, all records regarding calibration and maintenance of the monitoring equipment and all original strip-chart recordings for continuous monitoring instrumentation.

B. Reporting (NAC 445B.346.3)
Permittee will promptly report to the director any deviations from the requirements of this Operating Permit. The report to the director will include the probable cause of all deviations and any action taken to correct the deviations. For this Operating Permit, prompt is defined as submittal of a report within 15 days of the deviation. This definition does not alter any reporting requirements as established for reporting of excess emissions as required under NAC 445B.232 and under condition III.B of this permit.

C. Yearly Reports (NAC 445B.315.3(h), NAC 445B.346.2)
Permittee will submit yearly reports including, but not limited to, throughput, production, fuel consumption, hours of operation, and emissions. These reports will be submitted on the form provided by the Bureau of Air Pollution Control for all emission units/systems specified on the form. The completed form must be submitted to the Bureau of Air Pollution Control no later than March 1 annually for the preceding calendar year.

*********End of General Monitoring and Recordkeeping Conditions*********

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section V. Specific Operating Conditions

A. Emission Units F0.001 through F0.020 Location North 4,234.25 km, East 356.48 km, UTM (Zone 11, NAD 83)

System 1 - New Bomb Detonation Unit								
F	0.001	Open Detonation Pit #1	F	0.002	Open Detonation Pit #2	F	0.003	Open Detonation Pit #3
F	0.004	Open Detonation Pit #4	F	0.005	Open Detonation Pit #5	F	0.006	Open Detonation Pit #6
F	0.007	Open Detonation Pit #7	F	0.008	Open Detonation Pit #8	F	0.009	Open Detonation Pit #9
F	0.010	Open Detonation Pit #10	F	0.011	Open Detonation Pit #11	F	0.012	Open Detonation Pit #12
F	0.013	Open Detonation Pit #13	F	0.014	Open Detonation Pit #14	F	0.015	Open Detonation Pit #15
F	0.016	Open Detonation Pit #16	F	0.017	Open Detonation Pit #17	F	0.018	Open Detonation Pit #18
F	0.019	Open Detonation Pit #19	F	0.020	Open Detonation Pit #20			

1. Air Pollution Equipment (NAC 445B.308.7; NAC 445B.346.1)
   Emissions from **F0.001 through F0.020** shall be minimized by utilizing best operational practices. Best operational practices will consist, at a minimum, of the following:
   a. Detonations will occur only during times when the wind speed is between 3 and 20 miles per hour, with gusts up to 30 miles per hour.
   b. Detonations are not allowed when the cloud cover is greater than 80% and the cloud ceiling is less than 2,000 feet.
   c. Detonations are not allowed when visibility is less than one mile.
   d. Detonations are not allowed during precipitation events, electrical storms or thunder storms, or days when the chance of precipitation, electrical storms or thunderstorms exceeds 50 percent based on a current daily weather report from a Department of Defense weather station or National Weather Service office.

2. Emission Limits (NAC 445B.308.7; NAC 445B.346.1)
   On and after the date of startup of **F0.001 through F0.020**, Permittee will not discharge or cause the discharge into the atmosphere from **F0.001 through F0.020**, the following pollutants in excess of the following specified limits:
   a. The discharge of Hazardous Air Pollutants (HAPs) to the atmosphere will not exceed the emissions limitations specified in Section VI (Emission Cap) of this permit.

3. Operating Parameters (NAC 445B.308.7, NAC 445B.346.1)
   a. Munition items to be detonated in **F0.001 through F0.020** are limited to those munition items which cannot be processed at the Western Area Demilitarization Facility (WADF).
   b. Munition items to be detonated in **F0.001 through F0.020** are limited to only those items which are approved under the provisions of the Hazardous Waste Permit NEV HW0020.
   c. Items which will not be detonated in **F0.001 through F0.020** include, but are not limited to, the following:
      (1) Waste that is not approved in the Hazardous Waste Permit NEV HW0020,
      (2) Non-explosive wastes, with exception of incidental munition containers that cannot be separated from munition items prior to detonation due to safety hazards,
      (3) Chemical or biological munitions.
   d. The maximum allowable net explosive weight rate, for **F0.001 through F0.020** each, will not exceed 4,000 pounds per detonation.
   e. The maximum allowable net explosive weight rate, for **F0.001 through F0.020** combined, will not exceed 40,000 pounds per day.
   f. The maximum allowable net explosive weight rate, for **F0.001 through F0.020** combined, will not exceed 6,000,000 pounds per calendar year. *(Note: The net explosive weight rate is the sum of the waste explosive and the donor explosive).*
   g. The maximum allowable number of detonations, for **F0.001 through F0.020** combined, will not exceed 10 per day.
   h. Detonations in **F0.001 through F0.020** will occur only between 9:00 am and 30 minutes before sunset.

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section V. Specific Operating Conditions

A. Emission Units F0.001 through F0.020 - continued

4. Monitoring, Testing and Reporting (NAC 445B.308.7, NAC 445B.346.2)
The Department of the Army, Hawthorne Army Depot, upon the issuance date of this permit will:

a. Install, operate and calibrate a continuous meteorological monitoring system at the detonation site. The continuous meteorological monitoring system will be installed, operated and calibrated in accordance with the "*Meteorological Monitoring Plan*" submitted October of 1996. The continuous meteorological monitoring system shall, at a minimum, continuously measure the following:
(1) Horizontal wind speed,
(2) Horizontal wind direction,
(3) Ambient dry bulb temperature.

b. Install, operate and calibrate a PM_{10} sampling network at the detonation site. The PM_{10} sampling network shall, at a minimum, consist of one set of collocated PM_{10} samplers. The sampling network must operate on the EPA every 6-day schedule and at least one day each week a detonation occurs. The Permittee shall conform with the "*Ambient Air Quality Monitoring Guidelines*".

c. Utilizing the Munitions Items Disposition Action System (MIDAS) or military munitions items' manufacturer specifications, determine and record the following information for each munition item to be detonated on a daily basis:
(1) Munitions Nomenclature (official item name and model number).
(2) National Stock Number.
(3) Department of Defense Identification Code.
(4) Pyrotechnic, explosive and propellent formulations and weights.
(5) Casing compounds and weights.

d. Prepare and maintain on-site records indicating why the munition item must be detonated as apposed to other alternative disposal or recycling methods. A report summarizing these records must be updated on or before March 15th of each calendar year.

e. Monitor and record the following:
Ambient Meteorological and PM_{10} Sampling Information
(1) The horizontal wind speed, horizontal wind direction and ambient dry bulb temperature at the time of each day of detonation.
(2) The cloud cover percentage and cloud cover elevation at the time of each day of detonation.
(3) The distance of visibility at the time of each day of detonation.
(4) The current weather report at the time of each day of detonation.
(5) The PM_{10} sampler results on a quarterly basis.
Operational Information
(1) The date and time of each detonation.
(2) The net explosive weight rate of munition items, for **F0.001 through F0.020** each, on a per day detonation basis.
(3) The combined net explosive weight rate of munition items, for **F0.001 through F0.020** combined, on a per day basis.
(4) The combined annual net explosive weight rate of munition items, for **F0.001 through F0.020** combined, on a monthly basis.

f. The required monitoring and recordkeeping established in A.4.a. through A.4.e.above, will be maintained in a contemporaneous log containing, at a minimum, the following recordkeeping:
(1) The calendar date and time of any required monitoring.
(2) The munition items detonated, and the total number of detonations.
(3) The per day detonation net explosive weight rate in pounds, for **F0.001 through F0.020** each, for the corresponding date.
(4) The combined detonation net explosive weight rate in pounds, for **F0.001 through F0.020** combined, for the corresponding date.
(5) The corresponding annual net explosive weight rate in pounds per calendar year. The net explosive weight rate will be determined from the net explosive weight rate recorded in A.4.f.(4). of this Section and shall be maintained on a calendar month basis as the sum for the calendar year.

*************End of Specific Operating Conditions**************

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section VI. Emission Caps

A. **Cap for Emission Units F0.001 through F0.020**

1. Emission Limits

When operating under the provisions of Part A of this section, the emission limits specified in A.2 of Section V of this operating permit do not apply for those pollutants limited under this paragraph. On and after the date of startup of **F0.001 through F0.020** and during periods specified by Permittee as operating under the provisions of Part A of this section, Permittee will not discharge or cause the discharge into the atmosphere, the following pollutants in excess of the following specified limits:

a. The individual discharge of each single Hazardous Air Pollutant (HAP) to the atmosphere will not exceed 9.9 tons per calendar year.
b. The combined discharge of Hazardous Air Pollutants (HAP's) to the atmosphere will not exceed 24.9 tons per calendar year.
c. The emission limits in this paragraph apply at all times, including startups, shutdowns, and normal operations.

2. Monitoring, Recordkeeping, Reporting and Compliance

In addition to the monitoring and recordkeeping requirements contained in Section V of this operating permit, the Department of the Army, Hawthorne Army Depot will:

a. Monitor and record the following utilizing the Munitions Items Disposition Action System (MIDAS) or military munitions items' manufacturer specifications, determine and record the following information for each munition item to be detonated on a daily basis:
   (1) The individual total content for each single hazardous air pollutant (HAP) for each day of detonation, on a daily basis.
   (2) The combined total content for all hazardous air pollutants (HAPs) for each detonation, on a daily basis.
   (3) The cumulative annual total for each single hazardous air pollutant (HAP), on a monthly basis.
   (4) The cumulative annual total for the combined hazardous air pollutants (HAPs), on a monthly basis.
b. The required monitoring and recordkeeping established in A.2.a.(1) through A.2.a.(4) above, will be maintained in a contemporaneous log containing, at a minimum, the following recordkeeping:
   (1) The total of each individual hazardous air pollutant (HAP) for each day of detonation.
   (2) The total of all hazardous air pollutants (HAPs) for each day of detonation.
   (3) The cumulative annual total of each single hazardous air pollutant (HAP).
   (4) The cumulative annual total of combined hazardous air pollutants (HAPs).

*************End of Emission Caps***************

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section VII. Surface Area Disturbance Conditions

Surface area disturbance in excess of 20 acres – 3,000 acres of which 743 acres is disturbed for New Bomb Project.

A. Dust Control Plan (NRS 445B.230.6)
Permittee may not cause or permit the construction, repair, or demolition work, or the use of unpaved or untreated areas without applying all such measures as may be required by the Director to prevent particulate matter from becoming airborne.

1. Permittee will control fugitive dust in accordance with the dust control plan entitled "*Plan for Control of Fugitive Particulate Matter Emissions from Surface Area Disturbance Activities at Hawthorne Army Depot (HWAD) Newbomb Facility*", as submitted on April 27, 2011.

B. Fugitive Dust (NAC 445B.22037)
1. Permittee may not cause or permit the handling, transporting, or storing of any material in a manner which allows or may allow controllable particulate matter to become airborne.
2. Except as otherwise provided in subsection 4, Permittee person may not cause or permit the construction, repair, demolition, or use of unpaved or untreated areas without first putting into effect an ongoing program using the best practical methods to prevent particulate matter from becoming airborne. As used in this subsection, "best practical methods" includes, but is not limited to, paving, chemical stabilization, watering, phased construction, and revegetation.
3. Except as provided in subsection 4, Permittee may not disturb or cover 5 acres or more of land or its topsoil until Permittee has obtained an Operating Permit for surface area disturbance to clear, excavate, or level the land or to deposit any foreign material to fill or cover the land.
4. The provisions of subsections 2 and 3 do not apply to:
   a. Agricultural activities occurring on agricultural land; or
   b. Surface disturbances authorized by a permit issued pursuant to NRS 519A.180 which occur on land which is not less than 5 acres or more than 20 acres.

*************End of Surface Area Disturbance Conditions**************

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section VIII. Schedules of Compliance

A. N/A

**************End of Schedule of Compliance Conditions***************

Issued to: DEPARTMENT OF THE ARMY, HAWTHORNE ARMY DEPOT

Section IX. Amendments

July 8, 2011 – Application Log# 11AP0324, Class II Air Permit Renewal.

This permit:

1. **Is non-transferable. (NAC 445B.287.3)**
2. **Will be posted conspicuously at or near the stationary source. (NAC 445B.318.5)**
3. **Will expire and be subject to renewal five (5) years from: August 10, 2011 (NAC 445B.315)**
4. **A completed application for renewal of an operating permit must be submitted to the director on the form provided by him with the appropriate fee at least 70 calendar days before the expiration date of this operation permit. (NAC 445B.3473.2)**
5. **Any party aggrieved by the Department's decision to issue this permit may appeal to the State Environmental Commission (SEC) within ten days after the date of notice of the Department's action. (NRS 445B.340)**

THIS PERMIT EXPIRES ON: August 10, 2016

Signature
Issued by: Jeff Denison, P.E.
Supervisor, Permitting Branch
Nevada Bureau of Air Pollution Control

Phone: (775) 687-9336 Date: July 8, 2011

rp
07/11

APPENDIX E
SOIL SAMPLING DATA

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-1**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 131 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	70	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-2**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 192 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	83	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-3**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 224 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	113	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-4**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 240 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	83	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-5**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 248 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	100	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-6**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 256 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	97	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-7**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 256 TP - Duplicate
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	98	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-8**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 292 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	99	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-9**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 301 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	91	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-10**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 308 TP - Duplicate
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	34.7	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	102	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-11**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 308 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	51.1	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	100	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-12**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 335 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	96	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-13**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 358 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-21-2010	
Surrogate recovery – percent (1,2-DNB)	92	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-14**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 361 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	96	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-15**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 388 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	91	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-16**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 402 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	100	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-17**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 465 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	93	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-18**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 470 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	94	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-19**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 480 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	86	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-20**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 487 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	113	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-21**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 505 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	100	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-22**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 528 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	96	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-23**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: New Bomb
Client Sample ID: 592 TP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Add-ons		
Ammonium Picrate	<20	
PETN	<20	
Nitroglycerin	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery – percent (1,2-DNB)	98	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-24**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-A3
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	93	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-25**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-B4
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	88	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-26**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-B1
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	87	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-27**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-C3
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	98	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-28**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-E3
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	96	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-29**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-E3 - Duplicate
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	108	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0310-019-30**

Client: SOC LLC
Report To: Tad Williams
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7359
Fax: (775) 945-7782

Date Sampled: 3-18-2010
Date Submitted: 3-19-2010
Matrix: Soil
Number of Samples: One
Site/Project: Old Bomb
Client Sample ID: 0076-E4
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<5	
2-Nitrotoluene	<10	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	3-22-2010	
Surrogate recovery - percent (1,2-DNB)	116	

John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Nevada Analytical Services
Michael R. Genova
855 Mill Street, Suite 2A
Reno, NV 89502

Laboratory Report Identification: 0310072
Submission Date: 3/19/2010

Thursday, April 01, 2010

SOC
Tad Williams
39 South Main
Hawthorne, NV 89415

Dear Tad :

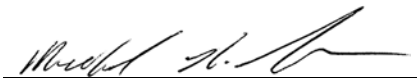
Results for the analytical test(s) submitted on the date above are detailed in the following report.

Unless it is otherwise noted in the preceding analytical report(s), all samples submitted for analysis were received within their acceptable hold times, properly preserved, and in acceptable condition for their respective analyses.

Thank you for choosing NAS for your analytical testing requirements.

Report Comments:
None

Sincerely,



4/1/2010
Date

Technical Director

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 131 B
Laboratory Sample Control Number: 0310072-2
Sampling Date: 3/18/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director — **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 131 B
Laboratory Sample Control Number: 0310072-2
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

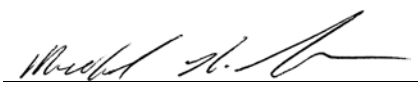
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	1.06	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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OL: Over Laboratory Established Limits

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 224 B
Laboratory Sample Control Number: 0310072-4
Sampling Date: 3/18/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director — **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 224 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-4 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

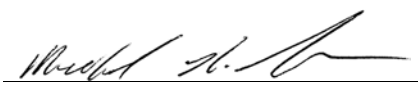
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	1.11	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 388 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-6 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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OL: Over Laboratory Established Limits

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 388 B
Laboratory Sample Control Number: 0310072-6
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

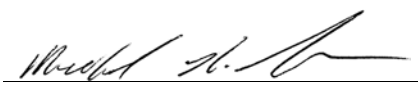
Note: Extracted using TCLP Method 1311

					Quality Control Data		
Analyses	**Result**	**Units**	**RL**	**Date Analyzed**	**Method Blank**	***CCV % Recovery**	**Date Analyzed**
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.77	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

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mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
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Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 240 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-8 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 240 B
Laboratory Sample Control Number: 0310072-8
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

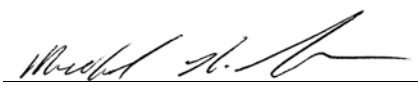
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.95	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

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mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
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Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 335 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-10 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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MDL: Method Detection Limit

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 335 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-10 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

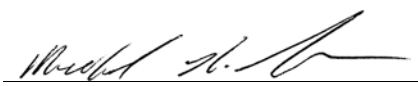
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.99	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	0.06	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.08	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 301 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-12 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
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Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 301 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-12 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

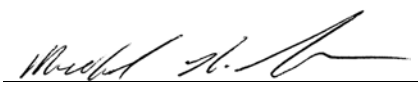
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	1.04	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 308 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-14 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 308 B
Laboratory Sample Control Number: 0310072-14
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

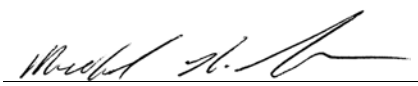
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.90	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	0.06	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.13	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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MDL: Method Detection Limit

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 308 B Dup **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-16 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 308 B Dup **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-16 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

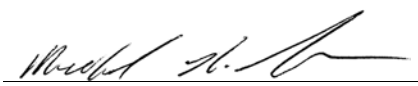
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.95	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	0.05	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.09	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 248 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-18 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

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855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 248 B
Laboratory Sample Control Number: 0310072-18
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

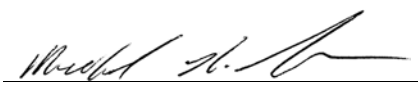
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.99	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

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ppm: Parts per million
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City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 292 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-20 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 292 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-20 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

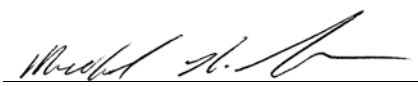
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.89	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

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City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 592 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-22 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 592 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-22 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

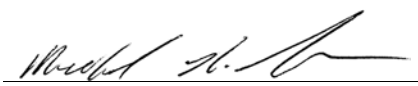
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.89	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

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* Analyzed by Contract Laboratory

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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 358 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-24 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 358 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-24 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

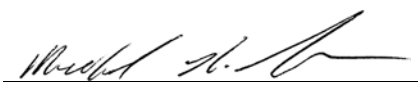
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	1.09	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	0.10	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.49	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

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mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 487 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-26 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 487 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-26 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

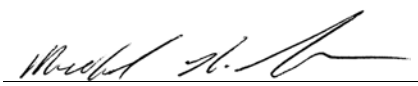
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.94	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.07	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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MDL: Method Detection Limit

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OL: Over Laboratory Established Limits

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Nevada Analytical Services

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 528 B
Laboratory Sample Control Number: 0310072-28
Sampling Date: 3/18/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 528 B
Laboratory Sample Control Number: 0310072-28
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

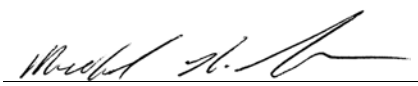
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.99	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	0.52	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.06	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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MDL: Method Detection Limit

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 402 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-30 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

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855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 402 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-30 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

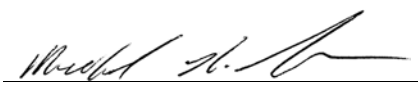
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.77	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.18	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 480 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-32 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 480 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-32 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

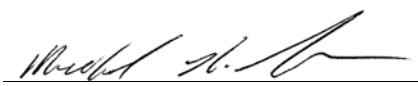
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.96	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.07	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 361 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-34 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 361 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-34 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

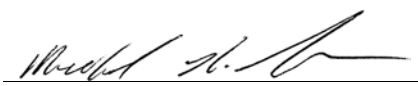
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.98	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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Nevada Analytical Services

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 192 TP **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-36 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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Nevada Analytical Services

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 192 TP **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-36 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

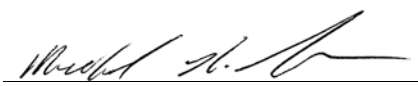
Note: Extracted using TCLP Method 1311

					Quality Control Data		
Analyses	**Result**	**Units**	**RL**	**Date Analyzed**	**Method Blank**	***CCV % Recovery**	**Date Analyzed**
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	1.34	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	0.11	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	0.39	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

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mg/kg: Milligrams/Kilogram (ppm)
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Nevada Analytical Services

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 256 b
Laboratory Sample Control Number: 0310072-38
Sampling Date: 3/18/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 256 b
Laboratory Sample Control Number: 0310072-38
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

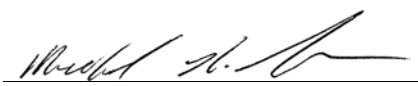
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.81	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director — **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 256 B DUP **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-40 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 256 B DUP **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-40 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

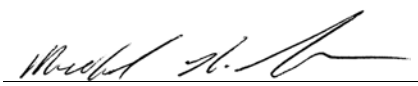
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.79	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 465 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-42 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 465 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-42 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

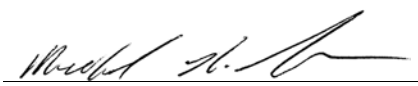
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.73	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 470 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-44 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 470 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-44 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

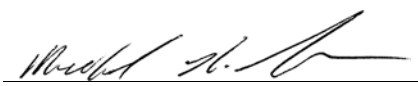
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.73	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 505 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310072-46 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	3/31/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310072
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/19/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	N/A
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Tad Williams

Client Identification: 505 B
Laboratory Sample Control Number: 0310072-46
Sampling Date: 3/18/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

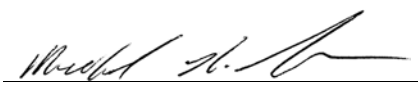
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Barium (Ba)	0.67	mg/L	0.1	3/31/2010	ND	105%	3/31/2010
Cadmium (Cd)	ND	mg/L	0.1	3/31/2010	ND	104%	3/31/2010
Chromium (Cr)	ND	mg/L	0.1	3/31/2010	ND	102%	3/31/2010
Lead (Pb)	ND	mg/L	0.1	3/31/2010	ND	103%	3/31/2010
Selenium (Se)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010
Silver (Ag)	ND	mg/L	0.1	3/31/2010	ND	101%	3/31/2010

QC Batch Identification: 033110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310072

Company/Client ~~DZHC~~ SOC

Report Address		Invoice Address (Same as report) X	
Contact:	TAD WILLIAMS	Contact:	
Address:	39 S' MAINE	Address:	
City:	HAWTHORNE	City:	
State:	NV	Zip: 89415	State: Zip:
Phone:	775-945-7359	Phone:	
Fax:		Fax:	
Email:	tad.williams10@	Email:	us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature → Tad Williams
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
P.O. Number:
Site: NEW BOMB
Project Name:

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 EXPLOSIVES	TCLP-8	EXPLOS - PETN	EXPLOS - NITROGLYCERIN	Explos - Ammonium perchlorate	SEE ATTACHED (Analysis List)
1	131 TP	3-18-10	0800	S	1	X		X	→		
2	131 B						X				
3	224 TP					X		X	→		
4	224 B						X				
5	388 TP					X		X	→		
6	388 B						X				
7	240 TP					X		X	X	X	
8	240 B						X				
9	335 TP					X		X	X	X	
10	335 B						X				

PRESERVATION (Laboratory Use Only) → Field Preserved → Laboratory Preserved

CONTAINER — Containers/Preservative

A	B	C	D	E	F	G	Z
None	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Hydrochloric Acid (HCl)	Sodium Hydroxide (NaOH)	Sodium Thiosulfate ($Na_2S_2O_3$)	Monochloroacetic Acid (MCA)	Cool (4 °C)

Normal Turnaround Time (TAT)

RUSH
R → Same Day
U → 24-Hour
S → 2-Day
H

Comments

Laboratory Use Only

Containers Intact?	Yes X	No	Receipt Temp (°C):		
Containers Labeled Properly?	Yes X	No	On Ice?	Yes	No
Custody Seal(s)?	Yes X	No	Cool-Down Started?	Yes	No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by	Print Yvonne Downs b	Signature Yvonne M Downs	2) Received by	Print Debra Jach	Signature Debra Jach
Company	DZHC	Date/Time 10:57 3/19/10	Company	NAS	Date/Time 03/19/10 10:57
3) Relinquished by	Print	Signature	4) Received by	Print	Signature
Company		Date/Time	Company		Date/Time

Certain circumstances will require samples submitted to Nevada Analytical Services LLC to be subcontracted to other certified laboratories in order to complete the required analysis. All sub-contracted data will be clearly noted on your analytical report. Samples are discarded thirty days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

White – Client Copy **Yellow** – Laboratory Copy **Pink** – Laboratory Administration Copy

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310072

Company/Client

Report Address		Invoice Address (Same as report) X	
Contact:	TAD WILLIAMS	Contact:	
Address:	39 S' MAINE	Address:	
City:	HAWTHORNE	City:	
State:	NV	Zip: 89415	State: / Zip:
Phone:	775-945-7359	Phone:	
Fax:		Fax:	
Email:	tad.williams10@	Email:	us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature → Tad
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
P.O. Number:
Site: NewBomB
Project Name:

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 EXPL	TCLP-8	EXPLOS- PETN	EXPLOS- NITROGLYCERIN	EXPLOS- Am. Perc.	SEE ATTACHED (Analysis List)
11	1 301 TP	3-18-10	0800	S	1	X		X	X	X	
12	2 301 B						X				
13	3 308 TP					X		X			
14	4 308 B						X				
15	5 308 TP DUP					X		X			
16	6 308 B DUP						X				
17	7 248 TP					X		X			
18	8 [redacted] 248 B						X				
19	9 292 TP					X		X			
20	10 292 B						X				

PRESERVATION (Laboratory Use Only)
→ Field Preserved
→ Laboratory Preserved

CONTAINER

A	B	C	D	E	F	G	Z

Containers/Preservative

None	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Hydrochloric Acid (HCl)	Sodium Hydroxide (NaOH)	Sodium Thiosulfate ($Na_2S_2O_3$)	Monochloroacetic Acid (MCA)	Cool (4 °C)

Normal Turnaround Time (TAT)

RUSH
R → Same Day
U → 24-Hour
S → 2-Day
H

Comments

Laboratory Use Only

Containers Intact?	Yes	No	Receipt Temp (°C):		
Containers Labeled Properly?	Yes	No	On Ice?	Yes	No
Custody Seal(s)?	Yes	No	Cool-Down Started?	Yes	No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by Print: Yvonne Downs	Signature: Yvonne M Downs	2) Received by Print: Debra Jack	Signature: Debra Jack
Company:	Date/Time: 10:57 3/19/10	Company: NAS	Date/Time: 03/19/10 10:52
3) Relinquished by Print:	Signature:	4) Received by Print:	Signature:
Company:	Date/Time:	Company:	Date/Time:

Certain circumstances will require samples submitted to Nevada Analytical Services LLC to be subcontracted to other certified laboratories in order to complete the required analysis. All sub-contracted data will be clearly noted on your analytical report. Samples are discarded thirty days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

White – Client Copy **Yellow** – Laboratory Copy **Pink** – Laboratory Administration Copy

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310072

Company/Client: DZHC

Report Address	Invoice Address (Same as report) X
Contact: TAD WILLIAMS	Contact:
Address: 39 S' MAINE	Address:
City: HAWTHORNE	City:
State: NV Zip: 89415	State: Zip:
Phone: 775-945-7359	Phone:
Fax:	Fax:
Email: tad.williams1@	Email: us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature → Tad Williams
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
P.O. Number:
Site: NEW BOMB
Project Name:

ANALYSIS

PRESERVATION (Laboratory Use Only) → Field Preserved → Laboratory Preserved

CONTAINER A B C D E F G Z

Containers/Preservative: None | Nitric Acid (HNO_3) | Sulfuric Acid (H_2SO_4) | Hydrochloric Acid (HCl) | Sodium Hydroxide (NaOH) | Sodium Thiosulfate ($Na_2S_2O_3$) | Monochloroacetic Acid (MCA) | Cool (4 °C)

Normal Turnaround Time (TAT)

RUSH → Same Day → 24-Hour → 2-Day

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 EXPLOS	TCLP-8	EXPLOS- PETN	EXPLOS- Nitroglycerin	EXPLOS- Am. PERC.	SEE ATTACHED (Analysis List)
21	1 592 TP	3-18-10	0800	S	1	X		X			
22	2 592 B						X				
23	3 358 TP					X		X			
24	4 358 B						X				
25	5 487 TP					X		X			
26	6 487 B						X				
27	7 528 TP					X		X			
28	8 528 B						X				
29	9 402 TP					X		X			
30	10 402 B						X				

Laboratory Use Only

Containers Intact?	Yes	No	Receipt Temp (°C):		
Containers Labeled Properly?	Yes	No	On Ice?	Yes	No
Custody Seal(s)?	Yes	No	Cool-Down Started?	Yes	No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by Print: Yvonne Dacons	Signature: Yvonne M Dacons	2) Received by Print: Debra Jach	Signature: Debra Jach
Company: DZHC	Date/Time: 10:57 3/19/10	Company: NAS	Date/Time: 03/19/10 10:57
3) Relinquished by Print:	Signature:	4) Received by Print:	Signature:
Company:	Date/Time:	Company:	Date/Time:

Certain circumstances will require samples submitted to Nevada Analytical Services LLC to be subcontracted to other certified laboratories in order to complete the required analysis. All sub-contracted data will be clearly noted on your analytical report. Samples are discarded thirty days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310072

Company/Client: DZHC

Report Address		Invoice Address (Same as report) X	
Contact:	TAD WILLIAMS	Contact:	
Address:	395 MAINE	Address:	
City:	HAWTHORNE	City:	
State:	NV	Zip: 89415	
Phone:	775-945-7359	Phone:	
Fax:		Fax:	
Email:	tad.williams10@	Email:	us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature → Tad W
P.O. Number:
Site: New Bom B
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
Project Name:

ANALYSIS

PRESERVATION (Laboratory Use Only) → Field Preserved → Laboratory Preserved

CONTAINER A B C D E F G Z — Containers/Preservative

RUSH R → Same Day; U → 24-Hour; S; H → 2-Day

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 Explos	TCLP-8	EX- PETN	EX- Nitroglycerin	Exp- Am. Pers.	SEE ATTACHED (Analysis List)	None	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Hydrochloric Acid (HCl)	Sodium Hydroxide (NaOH)	Sodium Thiosulfate ($Na_2S_2O_3$)	Monochloroacetic Acid (MCA)	Cool (4 °C)	Normal Turnaround Time (TAT)	Comments
31	1 480 TP	3-18-10	0800	S	1	X		X													
32	2 480 B						X														
33	3 361 TP					X		X													
34	4 361 B						X														
35	5 192 TP					X		X													
36	6 192 B						X														
37	7 256 TP					X		X													
38	8 256 B						X														
39	9 256 TP DUP					X		X													
40	10 256 B DUP						X														

Laboratory Use Only

Containers Intact?	Yes		No		Receipt Temp (°C):		
Containers Labeled Properly?	Yes		No		On Ice?	Yes	No
Custody Seal(s)?	Yes		No		Cool-Down Started?	Yes	No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by	Print: Yvonne Downs	Signature: Yvonne M Downs	
Company: DZHC		Date/Time: 16:57	3/19/10
2) Received by	Print: Debra Jach	Signature: Debra Jach	
Company: NAS J		Date/Time: 03/19/10	10:57
3) Relinquished by	Print:	Signature:	
Company:		Date/Time:	
4) Received by	Print:	Signature:	
Company:		Date/Time:	

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310072

Company/Client: SZHC

Report Address		Invoice Address (Same as report) X	
Contact:	TAD WILLIAMS	Contact:	
Address:	395 MAINE	Address:	
City:	HAWTHORNE	City:	
State:	NV	Zip: 89415	State: Zip:
Phone:	775-945-7359	Phone:	
Fax:		Fax:	
Email:	tad.williams10@	Email:	us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature → Tad Williams
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
P.O. Number:
Site: New Bomb
Project Name:

ANALYSIS

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 - Explo	TCLP8	Explos- PETN	Explos- NITROG.	Exp - Amm. perch.	SEE ATTACHED (Analysis List)
41	1 465 TP	3-18-10	0800	S	1	X		X			
42	2 465 B						X				
43	3 470 TP					X		X			
44	4 470 B						X				
45	5 505 TP					X		X			
46	6 505 B						X				
	7										
	8										
	9										
	10										

PRESERVATION (Laboratory Use Only)

→ Field Preserved
→ Laboratory Preserved

CONTAINER

A	B	C	D	E	F	G	Z
Containers/Preservative							
None	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Hydrochloric Acid (HCl)	Sodium Hydroxide (NaOH)	Sodium Thiosulfate ($Na_2S_2O_3$)	Monochloroacetic Acid (MCA)	Cool (4 °C)

Normal Turnaround Time (TAT)

RUSH

R → Same Day
U → 24-Hour
S → 2-Day
H

Comments

Laboratory Use Only

Containers Intact?	Yes		No		Receipt Temp (°C):	
Containers Labeled Properly?	Yes		No		On Ice?	Yes / No
Custody Seal(s)?	Yes		No		Cool-Down Started?	Yes / No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by	Print: Yvonne Downs	Signature: Yvonne Downs	
Company: SZHC	Date/Time: 10:57 3/19/10		
2) Received by	Print: Debra Jack	Signature: Debra Jack	
Company: NAS	Date/Time: 03/19/10 10:57		
3) Relinquished by	Print	Signature	
Company	Date/Time		
4) Received by	Print	Signature	
Company	Date/Time		

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Nevada Analytical Services
855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Nevada Analytical Services
Michael R. Genova
855 Mill Street, Suite 2A
Reno, NV 89502

Laboratory Report Identification: 0310083
Submission Date: 3/24/2010

Thursday, April 01, 2010

SOC
Tad Williams
39 South Main
Hawthorne, NV 89415

Dear Tad :

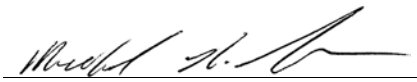
Results for the analytical test(s) submitted on the date above are detailed in the following report.

Unless it is otherwise noted in the preceding analytical report(s), all samples submitted for analysis were received within their acceptable hold times, properly preserved, and in acceptable condition for their respective analyses.

Thank you for choosing NAS for your analytical testing requirements.

Report Comments:
None

Sincerely,



4/1/2010
Date

Technical Director

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 870 B
Laboratory Sample Control Number: 0310083-2
Sampling Date: 3/24/2010
Matrix: Aqueous

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

Technical Director — **Date** 4/1/2010

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 870 B
Laboratory Sample Control Number: 0310083-2

Sampling Date: 3/24/2010
Matrix: Aqueous

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

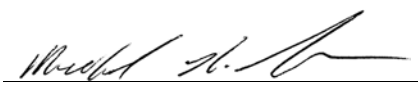
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.11	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Date

Technical Director

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 873 B **Sampling Date:** 3/16/2010
Laboratory Sample Control Number: 0310083-4 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 873 B
Laboratory Sample Control Number: 0310083-4
Sampling Date: 3/16/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

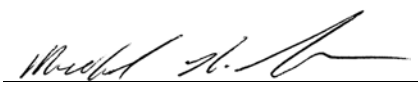
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.18	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director

4/1/2010
Date

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 867 B
Laboratory Sample Control Number: 0310083-6
Sampling Date: 3/16/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

Technical Director — **Date** 4/1/2010

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 867 B
Laboratory Sample Control Number: 0310083-6
Sampling Date: 3/16/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

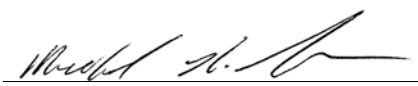
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.25	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director

4/1/2010
Date

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
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ND: Not Detected at RL
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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 890 B
Laboratory Sample Control Number: 0310083-8
Sampling Date: 3/16/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director — **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 890 B
Laboratory Sample Control Number: 0310083-8
Sampling Date: 3/16/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

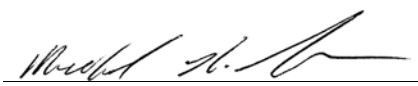
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.06	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Date

Technical Director

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 613 B
Laboratory Sample Control Number: 0310083-10
Sampling Date: 3/16/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

Technical Director — **Date** 4/1/2010

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 613 B **Sampling Date:** 3/16/2010
Laboratory Sample Control Number: 0310083-10 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

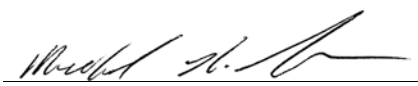
Note: Extracted using TCLP Method 1311

					Quality Control Data		
Analyses	**Result**	**Units**	**RL**	**Date Analyzed**	**Method Blank**	***CCV % Recovery**	**Date Analyzed**
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.32	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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MDL: Method Detection Limit

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OL: Over Laboratory Established Limits

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855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 663 B
Laboratory Sample Control Number: 0310083-12
Sampling Date: 3/16/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

Technical Director — **Date** 4/1/2010

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

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855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 663 B
Laboratory Sample Control Number: 0310083-12
Sampling Date: 3/16/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

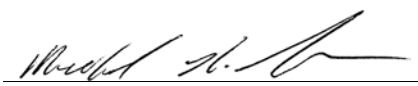
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.33	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	0.08	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 742 B **Sampling Date:** 3/16/2010
Laboratory Sample Control Number: 0310083-14 **Matrix:** Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

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Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 742 B **Sampling Date:** 3/16/2010
Laboratory Sample Control Number: 0310083-14 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

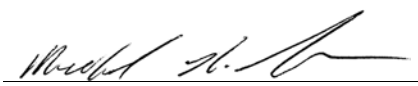
Note: Extracted using TCLP Method 1311

					Quality Control Data		
Analyses	**Result**	**Units**	**RL**	**Date Analyzed**	**Method Blank**	***CCV % Recovery**	**Date Analyzed**
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	0.92	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



4/1/2010
Technical Director **Date**

References:

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 671 B
Laboratory Sample Control Number: 0310083-16
Sampling Date: 3/16/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director — **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

* Analyzed by Contract Laboratory

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 671 B
Laboratory Sample Control Number: 0310083-16
Sampling Date: 3/16/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

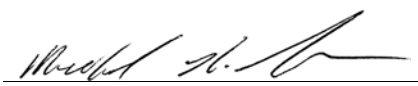
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.00	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director

4/1/2010
Date

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

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MDL: Method Detection Limit

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 888 B
Laboratory Sample Control Number: 0310083-18
Sampling Date: 3/16/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

Technical Director — **Date** 4/1/2010

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

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Nevada Analytical Services

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 888 B
Laboratory Sample Control Number: 0310083-18
Sampling Date: 3/16/2010
Matrix: Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	1.33	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	0.06	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025

Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
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Nevada Analytical Services

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 789 B
Laboratory Sample Control Number: 0310083-20
Sampling Date: 3/16/2010
Matrix: Aqueous

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

4/1/2010
Technical Director **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

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OL: Over Laboratory Established Limits

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NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 789 B **Sampling Date:** 3/16/2010
Laboratory Sample Control Number: 0310083-20 **Matrix:** Aqueous

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

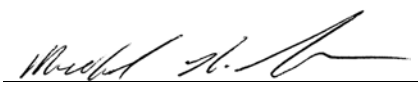
Note: Extracted using TCLP Method 1311

Analyses	Result	Units	RL	Date Analyzed	Quality Control Data: Method Blank	*CCV % Recovery	Date Analyzed
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	0.97	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 707 B
Laboratory Sample Control Number: 0310083-22
Sampling Date: 3/18/2010
Matrix: Solid

Analyses	Description	Result	Units	Date Analyzed	Method	RL	
Mercury (Hg)	Extracted Using TCLP Method	ND	mg/L	4/1/2010	EPA 7470A	0.05	* Contract Lab NV025

Remarks: None

Technical Director — **Date** 4/1/2010

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
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MDL: Method Detection Limit

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Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502 | Phone: 775.284.3970 | Fax: 866.755.7619
NV Laboratory ID: NV00923 | EPA Laboratory ID: NV00923

Contact:	Tad Williams	**Laboratory Report Identification:**	0310083
Company/Client:	SOC		
Address:	39 South Main	**Submission Date:**	3/24/2010
City:	Hawthorne	**Sampling Site:**	New Bomb
State:	NV	**Project:**	New Bomb
Zip:	89415	**Reference Number:**	N/A
Phone:	(775) 945-7582	**PO Number:**	N/A
Fax:		**Sampled By:**	Client

Client Identification: 707 B **Sampling Date:** 3/18/2010
Laboratory Sample Control Number: 0310083-22 **Matrix:** Solid

7 Metals

by Inductively Coupled Plasma / Atomic Emission Spectrometry (ICP/AES)
EPA Method 6010

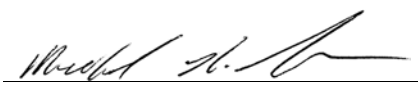
Note: Extracted using TCLP Method 1311

					Quality Control Data		
Analyses	**Result**	**Units**	**RL**	**Date Analyzed**	**Method Blank**	***CCV % Recovery**	**Date Analyzed**
Arsenic (As)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Barium (Ba)	0.70	mg/L	0.1	4/1/2010	ND	101%	4/1/2010
Cadmium (Cd)	ND	mg/L	0.1	4/1/2010	ND	100%	4/1/2010
Chromium (Cr)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Lead (Pb)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010
Selenium (Se)	ND	mg/L	0.1	4/1/2010	ND	98%	4/1/2010
Silver (Ag)	ND	mg/L	0.1	4/1/2010	ND	99%	4/1/2010

QC Batch Identification: 040110-1
CCV = Continuing Calibration Verification
* Continuing Calibration Verification (CCV) Percent Recovery Criteria: 90 - 110%.

QC Remarks: QC values within limits.

Remarks: Analyzed by Contract Laboratory NV025



Technical Director **4/1/2010** **Date**

References:

mg/L: Milligrams/Liter (ppm)
mg/kg: Milligrams/Kilogram (ppm)
ppm: Parts per million
* Analyzed by Contract Laboratory

ND: Not Detected at RL
RL: Reporting Limit (MDL)
MDL: Method Detection Limit

UL: Under Laboratory Established Limits
OL: Over Laboratory Established Limits

Reported analytical results relate only to the item(s) tested or to the sample(s) as received by the laboratory.

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310083

Page 1 of 3

Company/Client: ~~DZHC~~/SOC

Report Address		Invoice Address (Same as report) X
Contact:	TAD WILLIAMS	Contact:
Address:	395 MAINE	Address:
City:	HAWTHORNE	City:
State:	NV	Zip: 89415
Phone:	775-945-7359	Phone:
Fax:		Fax:
Email:	tad.williams10@	Email: us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature →
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
P.O. Number:
Site: New Bomb
Project Name: New Bomb

PRESERVATION (Laboratory Use Only)
→ Field Preserved
→ Laboratory Preserved

CONTAINER
A B C D E F G Z
Containers/Preservative

RUSH
R → Same Day
U → 24-Hour
S
H → 2-Day

ANALYSIS

Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 EXPL	TCLP-S	EXPLOS- PETN	EXPLOS- Nitroglycerin	Explos- Amm. perc.	SEE ATTACHED (Analysis List)	None	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Hydrochloric Acid (HCl)	Sodium Hydroxide (NaOH)	Sodium Thiosulfate ($Na_2S_2O_3$)	Monochloroacetic Acid (MCA)	Cool (4 °C)	Normal Turnaround Time (TAT)	Comments
1 870 TP	3-16-10	1030 HRS	S	1	X		X	→	→											
2 870 B						X														
3 873 TP					X		X	→	→											
4 873 B						X														
5 867 TP					X		X	→	→											
6 867 B						X														
7 890 TP					X		X	→	→											
8 890 B						X														
9 613 TP					X		X	→	→											
10 613 B						X														

Laboratory Use Only

Containers Intact?	Yes	No	Receipt Temp (°C):		
Containers Labeled Properly?	Yes	No	On Ice?	Yes	No
Custody Seal(s)?	Yes	No	Cool-Down Started?	Yes	No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by	Print: TAD Williams	Signature:	
Company: SOC DZHC		Date/Time: 3-22-10 0800	
2) Received by	Print: Debra Jack	Signature: Debra Jack	
Company: NAS		Date/Time: 03/24/10 10:30	
3) Relinquished by	Print:	Signature:	
Company:		Date/Time:	
4) Received by	Print:	Signature:	
Company:		Date/Time:	

Certain circumstances will require samples submitted to Nevada Analytical Services LLC to be subcontracted to other certified laboratories in order to complete the required analysis. All sub-contracted data will be clearly noted on your analytical report. Samples are discarded thirty days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

White – Client Copy **Yellow** – Laboratory Copy **Pink** – Laboratory Administration Copy

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 0310083

Company/Client

Report Address		Invoice Address (Same as report) X
Contact:	TAD WILLIAMS	Contact:
Address:	395 MAINE	Address:
City:	HAWTHORNE	City:
State:	NV	Zip: 89415
Phone:	775-945-7359	Phone:
Fax:		Fax:
Email:	tad.williams10@	Email: us.army.mil

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by →	Tad Williams	P.O. Number:	
Signature →	Tad Williams	Site:	
Sample Origin → NV X → CA → Other		Project Name:	
EPA/State Compliance? → Yes X → No			

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330- Explos.	TCLP-8	EXPL - PETN	EXPLOS - NITROGLYCERIN	Explos - Am. perc.	SEE ATTACHED (Analysis List)	None	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Hydrochloric Acid (HCl)	Sodium Hydroxide (NaOH)	Sodium Thiosulfate ($Na_2S_2O_3$)	Monochloroacetic Acid (MCA)	Cool (4 °C)	Normal Turnaround Time (TAT)	RUSH	Comments
11	1 663 TP	3-16-10	1030HRS	S	1	X		X		→												
12	2 663 B						X															
13	3 742 TP					X		X		→												
14	4 742 B						X															
15	5 671 TP					X		X		→												
16	6 671 B						X															
17	7 888 TP					X		X		→												
18	8 888 B						X															
19	9 789 TP					X		X		→												
20	10 789 B						X															

PRESERVATION (Laboratory Use Only)
→ Field Preserved
→ Laboratory Preserved

CONTAINER
A B C D E F G Z
Containers/Preservative

RUSH
R → Same Day
U → 24-Hour
S
H → 2-Day

Comments

Laboratory Use Only

Containers Intact?	Yes		No		Receipt Temp (°C):		
Containers Labeled Properly?	Yes		No		On Ice?	Yes		No	
Custody Seal(s)?	Yes		No		Cool-Down Started?	Yes		No	

Cooler ID(s):

Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by	Print: TAD Williams	Signature: Tad Williams	
Company:	02MC SOC	Date/Time:	3-22-10 0800
3) Relinquished by	Print:	Signature:	
Company:		Date/Time:	

2) Received by	Print: Debra Jack	Signature: Debra Jack	
Company:	NAS	Date/Time:	3/24/10 10:30
4) Received by	Print:	Signature:	
Company:		Date/Time:	

Certain circumstances will require samples submitted to Nevada Analytical Services LLC to be subcontracted to other certified laboratories in order to complete the required analysis. All sub-contracted data will be clearly noted on your analytical report. Samples are discarded thirty days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

White – Client Copy **Yellow** – Laboratory Copy **Pink** – Laboratory Administration Copy

Nevada Analytical Services

855 Mill Street, Suite 2B, Reno, NV 89502
Phone: 775.284.3970 | Fax: 866.755.7619
EPA Lab Code: NV00923 | NV Laboratory ID: NV00923

Chain of Custody/Analytical Request Form

Laboratory Use Only
Laboratory Identification: 03 10 083

Page 3 of 3

Company/Client

Report Address		Invoice Address (Same as report) X	
Contact: TAD WILLIAMS		Contact:	
Address: 39 S MAINE		Address:	
City: HAWTHORNE		City:	
State: NV	Zip: 89415	State:	Zip:
Phone: 775-945-7359		Phone:	
Fax:		Fax:	
Email: tad.williams1@		Email: us.army.mil	

Report Results Via: → E-Mail X → Fax → Regular Mail

SAMPLE INFORMATION

Sampled by → Tad Williams
Signature → Tad
Sample Origin → NV X → CA → Other
EPA/State Compliance? → Yes X → No
P.O. Number:
Site: New Bond
Project Name:

ANALYSIS

	Sample Identification (Name, Location, etc...)	Collection Date	Collection Time	Sample Matrix	Qty	8330 EXPLOS	TCLP-8	EXPLOS- PETN	EXPLOS- NITROGLYCERIN	Explos- Amm. PERC.	SEE ATTACHED (Analysis List)
21 1	707 TP	3-16-10	1030 H	S	1	X		X	→	→	
22 2	707 B	↓	↓	↓	↓		X				
3											
4											
5											
6											
7											
8											
9											
10											

PRESERVATION (Laboratory Use Only)

→ Field Preserved
→ Laboratory Preserved

CONTAINER A B C D E F G Z

Containers/Preservative: None; Nitric Acid (HNO_3); Sulfuric Acid (H_2SO_4); Hydrochloric Acid (HCl); Sodium Hydroxide (NaOH); Sodium Thiosulfate ($Na_2S_2O_3$); Monochloroacetic Acid (MCA); Cool (4 °C)

Normal Turnaround Time (TAT)

RUSH
→ Same Day
→ 24-Hour
→ 2-Day

Comments

Laboratory Use Only

Containers Intact?	Yes	No	Receipt Temp (°C):		
Containers Labeled Properly?	Yes	No	On Ice?	Yes	No
Custody Seal(s)?	Yes	No	Cool-Down Started?	Yes	No

Cooler ID(s):
Shipped by:

Sample Matrix Key

Aqueous	A
Soil/Solid	S
Oil	O

1) Relinquished by Print: TAD Williams	Signature: Tad Williams	2) Received by Print: Debra Jack	Signature: Debra Jack
Company: DZHC SOC	Date/Time: 3-22-10 0800	Company: NAS	Date/Time: 03/24/10 10:30
3) Relinquished by Print:	Signature:	4) Received by Print:	Signature:
Company:	Date/Time:	Company:	Date/Time:

Certain circumstances will require samples submitted to Nevada Analytical Services LLC to be subcontracted to other certified laboratories in order to complete the required analysis. All sub-contracted data will be clearly noted on your analytical report. Samples are discarded thirty days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

White – Client Copy **Yellow** – Laboratory Copy **Pink** – Laboratory Administration Copy

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Invoice

Date	Invoice #
6/19/2009	0609-006

Bill To	Requested By
SOC HAWTHORNE 9 S MAINE AVE HAWTHORNE, NV 89415	SOC HAWTHORNE 9 S MAINE AVE HAWTHORNE, NV 89415

GBL CONT. NO.	TERMS	DUE DATE	P. O. NUMBER	PROJECT
0609-006	Net 30	7/19/2009	09D021	New Bomb

DESCRIPTION	QTY	RATE	AMOUNT
8330	35	275.00	9,625.00
TCLP-8(As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	35	175.00	6,125.00

Total **$15,750.00**

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-1

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 764
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	98	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-2

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 829
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	22.3	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	96	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-3

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 857
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	96	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-4

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 791
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-5

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 887
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	97	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-6

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 912
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	94	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-7

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 916
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	94	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
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Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: **0609-006-8**

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 896
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	95	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Great Basin Laboratory Number: 0609-006-9

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 891
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	99	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Client:	SOC LLC
Report To:	Foster Kenton
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City:	Hawthorne
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Fax:	(775) 945-7782

Great Basin Laboratory Number: **0609-006-10**

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 917
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	97	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Great Basin Laboratory Number: 0609-006-11

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 869
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	92	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

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Great Basin Laboratory Number: **0609-006-12**

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 805
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	95	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

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Client: SOC LLC
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City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
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Great Basin Laboratory Number: 0609-006-13

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 805 DUP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	95	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

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Client:	SOC LLC
Report To:	Foster Kenton
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City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Great Basin Laboratory Number: **0609-006-14**

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 840
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	101	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
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Great Basin Laboratory Number: **0609-006-15**

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 935
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	101	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
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Phone: 775 323 4822
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Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
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Great Basin Laboratory Number: 0609-006-15 Dup

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 935
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-15-2009	
Surrogate recovery - percent (1,2-DNB)	98	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: 0609-006-16

Client:	SOC LLC		
Report To:	Foster Kenton	Date Sampled: 6-2-2009	PO Number: 07D069
Address:	39 South Maine Ave.	Date Submitted: 6-3-2009	Reference Number:
City:	Hawthorne	Matrix: Soil	Sampled By: Client
State:	NV Zip 89415	Number of Samples: One	
Phone:	(775) 945-7729	Site/Project:	
Fax:	(775) 945-7782	Client Sample ID: 871	
		Analysis: Nitroaromatics & Nitroamines	

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	99	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
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Great Basin Laboratory Number: **0609-006-17**

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 922
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
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Great Basin Laboratory Number: **0609-006-18**

Client:	SOC LLC				
Report To:	Foster Kenton	Date Sampled:	6-2-2009	PO Number:	07D069
Address:	39 South Maine Ave.	Date Submitted:	6-3-2009	Reference Number:	
City:	Hawthorne	Matrix:	Soil	Sampled By:	Client
State:	NV Zip 89415	Number of Samples:	One		
Phone:	(775) 945-7729	Site/Project:			
Fax:	(775) 945-7782	Client Sample ID:	872		
		Analysis:	Nitroaromatics & Nitroamines		

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-19

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 874
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-20

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 900
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	105	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
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Great Basin Laboratory Number: 0609-006-21

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 925
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	102	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

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Client: SOC LLC
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Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-22

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 846
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
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Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-23

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 875
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	102	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323-4968

Great Basin Laboratory Number: **0609-006-24**

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 850
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-17-2009	
Surrogate recovery - percent (1,2-DNB)	100	

1-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323-4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-25

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 820
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	103	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323-4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-26

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 650
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	89	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Great Basin Laboratory Number: 0609-006-27

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 786
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	98	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-28**

Client:	SOC LLC				
Report To:	Foster Kenton	Date Sampled:	6-2-2009	PO Number:	07D069
Address:	39 South Maine Ave.	Date Submitted:	6-3-2009	Reference Number:	
City:	Hawthorne	Matrix:	Soil	Sampled By:	Client
State:	NV Zip 89415	Number of Samples:	One		
Phone:	(775) 945-7729	Site/Project:			
Fax:	(775) 945-7782	Client Sample ID:	766		
		Analysis:	Nitroaromatics & Nitroamines		

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	102	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St., Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323-4968

Client:	SOC LLC
Report To:	Foster Kenton
Address:	39 South Maine Ave.
City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Great Basin Laboratory Number: 0609-006-29

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 439
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	104	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client:	SOC LLC
Report To:	Foster Kenton
Address:	39 South Maine Ave.
City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Great Basin Laboratory Number: 0609-006-30

Date Sampled:	6-2-2009	PO Number:	07D069
Date Submitted:	6-3-2009	Reference Number:	
Matrix:	Soil	Sampled By:	Client
Number of Samples:	One		
Site/Project:			
Client Sample ID:	406		
Analysis:	Nitroaromatics & Nitroamines		

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	104	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-31**

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 485
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-32**

Client:	SOC LLC
Report To:	Foster Kenton
Address:	39 South Maine Ave.
City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Date Sampled:	6-2-2009	PO Number:	07D069
Date Submitted:	6-3-2009	Reference Number:	
Matrix:	Soil	Sampled By:	Client
Number of Samples:	One		
Site/Project:			
Client Sample ID:	41		
Analysis:	Nitroaromatics & Nitroamines		

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	96	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-33**

Client:	SOC LLC
Report To:	Foster Kenton
Address:	39 South Maine Ave.
City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 73
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	102	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Client:	SOC LLC
Report To:	Foster Kenton
Address:	39 South Maine Ave.
City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Great Basin Laboratory Number: **0609-006-34**

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 73 DUP
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-35**

Client:	SOC LLC
Report To:	Foster Kenton
Address:	39 South Maine Ave.
City:	Hawthorne
State:	NV Zip 89415
Phone:	(775) 945-7729
Fax:	(775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 138
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	<20	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-18-2009	
Surrogate recovery - percent (1,2-DNB)	99	

6-24-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-36**

Client: SOC LLC
Report To: Jeff Wegworth
Address: 2 South Maine Ave. Bldg. 39
City: Hawthorne
State: NV Zip 89415
Phone: 775 945-7579
Fax: 775 945-7780

Date Sampled: 6-2-2009
Date Submitted: 6-2-2009
Matrix: Soil
Number of Samples: 35
Site/Project: New Bomb
Client Sample ID:
Method: 1311/6010B/3112B

PO Number: 07D069
Reference Number:
Sampled By: client
Analysis: TCLP-8

Sample ID	Hg (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Pb (ppm)	Se (ppm)	Ag (ppm)
764	ND	ND	ND	ND	1.04	ND	ND	ND
829	ND	ND	ND	ND	ND	ND	ND	ND
857	ND	ND	ND	ND	ND	ND	ND	ND
791	ND	ND	ND	ND	ND	ND	ND	ND
887	ND	ND	ND	ND	ND	ND	ND	ND
912	ND	ND	ND	ND	ND	ND	ND	ND
916	ND	ND	ND	ND	ND	ND	ND	ND
896	ND	ND	ND	ND	ND	ND	ND	ND
891	ND	ND	ND	ND	ND	ND	ND	ND
917	ND	ND	ND	ND	ND	ND	ND	ND
869	ND	ND	ND	ND	ND	1.46	ND	ND
805	ND	ND	ND	ND	ND	ND	ND	ND
805 Dup	ND	ND	ND	ND	ND	ND	ND	ND
840	ND	ND	ND	ND	1.16	ND	ND	ND
935	ND	ND	ND	ND	ND	ND	ND	ND
Method Reporting Limit	0.20	2.00	2.00	0.50	1.00	1.00	1.00	1.00
Date Analyzed	6-18-09	6-18-09	6-18-09	6-18-09	6-18-09	6-18-09	6-18-09	6-18-09

6-23-09
John Sabatini, Laboratory Director

Remarks:

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-37**

Client: SOC LLC
Report To: Jeff Wegworth
Address: 2 South Maine Ave. Bldg. 39
City: Hawthorne
State: NV Zip 89415
Phone: 775 945-7579
Fax: 775 945-7780

Date Sampled: 6-2-2009
Date Submitted: 6-2-2009
Matrix: Soil
Number of Samples: 35
Site/Project: New Bomb
Client Sample ID:
Method: 1311/6010B/3112B

PO Number: 07D069
Reference Number:
Sampled By: client
Analysis: TCLP-8

Sample ID	Hg (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Pb (ppm)	Se (ppm)	Ag (ppm)
871	ND	ND	ND	ND	ND	ND	ND	ND
922	ND	ND	ND	ND	ND	ND	ND	ND
872	ND	ND	ND	ND	ND	ND	ND	ND
874	ND	ND	ND	ND	ND	ND	ND	ND
900	ND	ND	ND	ND	1.39	ND	ND	ND
925	ND	ND	ND	ND	ND	ND	ND	ND
846	ND	ND	ND	ND	ND	ND	ND	ND
875	ND	ND	ND	ND	ND	ND	ND	ND
850	ND	ND	ND	ND	ND	ND	ND	ND
820	ND	ND	ND	ND	ND	ND	ND	ND
650	ND	ND	ND	ND	ND	ND	ND	ND
786	ND	ND	ND	ND	ND	ND	ND	ND
766	ND	ND	ND	ND	ND	ND	ND	ND
439	ND	ND	ND	ND	ND	ND	ND	ND
406	ND	ND	ND	ND	ND	ND	ND	ND
Method Reporting Limit	0.20	2.00	2.00	0.50	1.00	1.00	1.00	1.00
Date Analyzed	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09

6-23-09
John Sabatini, Laboratory Director

Remarks:

Great Basin Laboratories, Inc

855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323-4968

Client: SOC LLC
Report To: Jeff Wegworth
Address: 2 South Maine Ave. Bldg. 39
City: Hawthorne
State: NV Zip 89415
Phone: 775 945-7579
Fax: 775 945-7780

Great Basin Laboratory Number: **0609-006-38**

Date Sampled: 6-2-2009
Date Submitted: 6-2-2009
Matrix: Soil
Number of Samples: 35
Site/Project: New Bomb
Client Sample ID:
Method: 1311/6010B/3112B

PO Number: 07D069
Reference Number:
Sampled By: client

Analysis: TCLP-8

Sample ID	Hg (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Pb (ppm)	Se (ppm)	Ag (ppm)
485	ND	ND	ND	ND	ND	ND	ND	ND
41	ND	ND	ND	ND	ND	ND	ND	ND
73	ND	ND	ND	ND	ND	ND	ND	ND
73 Dup	ND	ND	ND	ND	ND	ND	ND	ND
138	ND	ND	ND	ND	ND	ND	ND	ND
Method Reporting Limit	0.20	2.00	2.00	0.50	1.00	1.00	1.00	1.00
Date Analyzed	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09	6-22-09

6-23-09
John Sabatini, Laboratory Director

Remarks:

Great Basin Laboratories, Inc
855 Mill St , Suite 2B
Reno, NV 89502
Phone: 775 323 4822
Fax: 323 4968

Great Basin Laboratory Number: **0609-006-24**

Client: SOC LLC
Report To: Foster Kenton
Address: 39 South Maine Ave.
City: Hawthorne
State: NV Zip 89415
Phone: (775) 945-7729
Fax: (775) 945-7782

Date Sampled: 6-2-2009
Date Submitted: 6-3-2009
Matrix: Soil
Number of Samples: One
Site/Project:
Client Sample ID: 850
Analysis: Nitroaromatics & Nitroamines

PO Number: 07D069
Reference Number:
Sampled By: Client

Analyte	Result (mg/Kg)	Found below project reporting limits (mg/Kg)
HMX	<20	
RDX	<20	
1,3,5-Trinitrobenzene	<20	
1,3-Dinitrobenzene	<20	
Tetryl	<20	
Nitrobenzene	<20	
2,4,6-Trinitrotoluene	<20	
4-Amino-2,6-Dinitrotoluene	<20	
2-Amino-4,6-Dinitrotoluene	<20	
2,6-Dinitrotoluene	<20	
2,4-Dinitrotoluene	198	
2-Nitrotoluene	<20	
4-Nitrotoluene	<20	
3-Nitrotoluene	<20	
Method	8330A	
Date Analyzed	6-25-2009	
Surrogate recovery - percent (1,2-DNB)	100	

6-26-09
John Sabatini, Laboratory Director

Remarks: Project reporting limits = 10 mg/Kg

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Phone: 775.323.4822 • Fax: 775.323.4968
www.greatbasinlabs.com

CHAIN OF CUSTODY

EPA Labcode: NV0025
NV Labcode: NV25

GBL Control Number: 0609-006

Sample Type: ____ Compliance
____ Self Monitoring

*Safe Drinking Water Act (SDWA) Certified *Resource Conservation and Recovery Act (RCRA) Certified *Clean Water Act (CWA) Certified

Contact Information

Company: SOC, LLC
Report To: FOSTER KENTON
Address: 39 SOUTH MAINE
City: HAWTHORNE
State: NEVADA Zip: 89415
Phone: (775) 945-7729
Fax:
Email:
Fax Results? Yes / No
Email Results? Yes / No

Sample Information

Site: NEW BOMB
Project Name:
P.O. Number: 09D021

Matrix Codes

AQ - Aqueous
S - Soil
O - Oil

Turn Around Time

STANDARD - 5 -day
48 HR - +50%
24 HR - +100%

LAB ID #	Collection Date	Collection Time	Matrix	SAMPLE IDENTIFICATION (Name, Location etc...)	Units	Volatile Organics	BTXE, MtBE, TPH-Volatile	TPH – Diesel	~~TPH~~ 8330 EXP, (A)	TCLP – 7/11	TCLP – 8 (B)	Profile I / Profile II	Other Analysis/ Comments
1	6/2/09		\	764	2				1	1	1		
2	6/2/09		\	829	2				1		1		
3	6/2/09		\	857	2				1		1		
4	6/2/09		\	791	2				1		1		
5	6/2/09		\	887	2				1		1		
6	6/2/09		\	912	2				1		1		
7	6/2/09		\	916	2				1		1		
8	6/2/09		\	896	2				1		1		
9	6/2/09		\	891	2				1		1		
10	6/2/09		\	917	2				1		1		
11	6/2/09		\	869	2				1		1		
12	6/2/09		\	805	2				1		1		

GBL Control Number: 0609-006

Sampled by (If other than contact):	**Receipt Temp (°C):**	**Custody Seal:** Yes No
Shipped by:	**Cooler ID(s):**	**Containers Intact:** Yes No

Relinquished by (print):	Signature:	Date/Time	Received by (print):	Signature:	Date/Time
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Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

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www.greatbasinlabs.com

CHAIN OF CUSTODY

EPA Labcode: NV0025
NV Labcode: NV25

GBL Control Number: 0609-006

Sample Type: ____ Compliance
____ Self Monitoring

*Safe Drinking Water Act (SDWA) Certified *Resource Conservation and Recovery Act (RCRA) Certified *Clean Water Act (CWA) Certified

Contact Information

Company: SOC, LLC		Phone: (775) 945-7729	
Report To: FOSTER KENTON		Fax:	
Address: 39 SOUTH MAINE		Email:	
City: HAWTHORNE		Fax Results?	Yes / No
State: NV	Zip: 89415	Email Results?	Yes / No

Sample Information	Matrix Codes		Turn Around Time	
Site: NEW BOMB	AQ -	Aqueous	STANDARD -	5-day
Project Name:	S -	Soil	48 HR -	+ 50%
P.O. Number: 09D021	O -	Oil	24 HR -	+100%

ANALYSIS

LAB ID #	Collection Date	Collection Time	Matrix	SAMPLE IDENTIFICATION (Name, Location etc...)	Units	Volatile Organics	BTXE, MtBE, TPH-Volatile	TPH – Diesel	~~TPH-Soil~~ 8330-EXP. (A)	TCLP – 7/11	TCLP – 8 (B)	Profile I / Profile II	Other Analysis/ Comments
13	6/2/09		✓	805 DUP	2				1		1		
14	6/2/09		✓	840	2				1		1		
15	6/2/09		✓	935	2				1		1		
16	6/2/09		✓	871	2				1		1		
17	6/2/09		✓	922	2				1		1		
18	6/2/09		✓	872	2				1		1		
19	6/2/09		✓	874	2				1		1		
20	6/2/09		✓	900	2				1		1		
21	6/2/09		✓	925	2				1		1		
22	6/2/09		✓	846	2				1		1		
23	6/2/09		✓	875	2				1		1		
24	6/2/09		✓	850	2				1		1		

Sampled by (If other than contact):	Receipt Temp (°C):	Custody Seal: Yes No
Shipped by:	Cooler ID(s):	Containers Intact: Yes No

Relinquished by (print):	Signature:	Date/Time	Received by (print):	Signature:	Date/Time
FOSTER KENTON	Foster Kenton	6/3/09	C Tunnell	[signature]	6/3/09 - 8:55 AM
Relinquished by (print):	Signature:	Date/Time	Received by (print):	Signature:	Date/Time

GBL Control Number: ____

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Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

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CHAIN OF CUSTODY

EPA Labcode: NV0025
NV Labcode: NV25

GBL Control Number: 0609-006

Sample Type: ____ Compliance
____ Self Monitoring

*Safe Drinking Water Act (SDWA) Certified *Resource Conservation and Recovery Act (RCRA) Certified *Clean Water Act (CWA) Certified

Contact Information

Company: SOG LLC
Report To: FOSTER KENTON
Address: 39 SOUTH MAINE
City: HAWTHORNE
State: NV Zip: 89415
Phone: (775) 945-7729
Fax:
Email:
Fax Results? (Yes) / No
Email Results? Yes / No

Sample Information

Site: NEW BOMB
Project Name:
P.O. Number: 09D021

Matrix Codes

AQ - Aqueous
S - Soil
O - Oil

Turn Around Time

STANDARD - 5 -day
48 HR - +50%
24 HR - +100%

LAB ID #	Collection Date	Collection Time	Matrix	SAMPLE IDENTIFICATION (Name, Location etc...)	Units	Volatile Organics	BTXE, MtBE, TPH-Volatile	TPH – Diesel	[illegible] 8330-5x P. (A)	[illegible]	TCLP – 8	Profile I / Profile II	Other Analysis/ Comments
25	6/2/09		,	820	2				1		1		
26	6/2/09		,	650	2				1		1		
27	6/2/09		,	786	2				1		1		
28	6/2/09		,	766	2				1		1		
29	6/2/09		,	439	2				1		1		
30	6/2/09		,	406	2				1		1		
31	6/2/09		,	485	2				1		1		
32	6/2/09		,	41	2				1		1		
33	6/2/09		,	73	2				1		1		
34	6/2/09		,	73 DUP.	2				1		1		
35	6/2/09		,	138	2				1		1		

GBL Control Number:

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Shipped by:		**Cooler ID(s):**	**Containers Intact:** Yes No
Relinquished by (print):	Signature: Date/Time	Received by (print):	Signature: Date/Time
FOSTER KENTON	Foster Kenton 6/3/09	UTurnette	6/3/09 - 8:50 AM
Relinquished by (print):	Signature: Date/Time	Received by (print):	Signature: Date/Time

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APPENDIX F
TEST STUDY

HEADQUARTERS
U.S. ARMY ARMAMENT,
MUNITIONS AND CHEMICAL COMMAND

FINAL REPORT

DEVELOPMENT OF METHODOLOGY AND TECHNOLOGY FOR IDENTIFYING AND QUANTIFYING EMISSION PRODUCTS FROM OPEN BURNING AND OPEN DETONATION THERMAL TREATMENT METHODS.

FIELD TEST SERIES A, B, AND C

VOLUME 1
TEST SUMMARY

JANUARY 1992

Maintenance Management Division
Demilitarization and Technology Branch
Rock Island, Illinois 61299-6000
DSN: 793-3980/5534
Commercial: 309-782-3980/5534

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6c. ADDRESS (*City, State, and ZIP Code*) 4600 East-West Highway, Suite 900 Bethesda, MD 20814	7b. ADDRESS (*City, State, and ZIP Code*) Dugway, Utah 84022-5000
8a. NAME OF FUNDING / SPONSORING ORGANIZATION U.S. Army Armament, Munitions and Chemical Command 8b. OFFICE SYMBOL (*If applicable*) AMSMC-DSM-D	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER Contract DAAD09-87-D-0008
8c. ADDRESS (*City, State, and ZIP Code*) Maintenance Management Division, Demilitarization and Technology Branch Rock Island, Illinois 61299-6000	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

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Development of Methodology and Technology for Identifying and Quantifying Emission Products from Open Burning and Open Detonation Thermal Treatment Methods. Field Test Series A, B, and C - Volume 1.

PERSONAL AUTHOR(S)
Mr. MacDonald Johnson

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17. COSATI CODES			18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)
FIELD	GROUP	SUB-GROUP	open burning; open detonation; OB/OD; TNT; double base propellant; manufacturers residue propellant; air emissions; thermal treatment; carbon balance; emission factor; (Cont'd on reverse)

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

The report covers the OB/OD field tests A, B, and C using the methodology and technology developed in the BangBox (BB) test for use on the fixed-wing aircraft (FWAC). Field test A was a checkout of the equipment and sampling selected from the BB test, and the development of procedures for sampling the TNT detonation crater soil, and the particle fallout in the surrounding area. Triple-base propellant was also burned in pans with the area sampled to 30-m with fallout pans. The analytes in both the air emission and the soil were identified and quantified. Field test B used TNT as the explosive and manufacturing residue as the burn material. Air sampling with the FWAC and soil sampling provided estimates of emission factors (EF) and soil contaminates that were detected above background levels. Suspended TNT detonations and manufacturing residue burns were also characterized for emission products. Phase C test using refinements in sampling and analysis from the previous phases provided data for TNT, composition B, explosive D, and RDX detonations and manufacturing residue single-base (M1,M6) propellant burns. The EF data from the TNT field tests were examined and compared with BB data; the results were comparable in the analytes detected and the level of analytes detected. The results indicate an efficiency for the detonation >92 percent (Continued on reverse)

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DD Form 1473, JUN 86 *Previous editions are obsolete.* SECURITY CLASSIFICATION OF THIS PAGE

18. (Cont'd)

supercritical fluid chromatography; SFC; demilitarization; munition disposal; explosive disposal; environment; BB; air building; explosive D; composition B; RDX; single-base propellant (M1,M6); triple-base propellant(M30).

19. (Cont'd)

based on the conversion of the carbon in the explosive material to CO_2. The semivolatiles in the soil were identified, quantified and a comparison made between background levels and after detonations levels. Similarity in analyte detected and the levels of analytes measured for TNT, RDX, explosive D, and composition B lead to the conclusion that OB/OD can be and effective means of treatment. Based on TNT the BB EF are comparable to field EF. The propellant burns all resulted in extremely efficient conversion of material carbon into CO_2 >99 percent.

FOREWORD

A test planning directive to conduct the OB/OD test in support of U.S. Army Armament, Munitions and Chemical Command (AMCCOM) was issued by U.S. Army Test and Evaluation Command (TECOM) on 28 April 1988[1]. A Technical Steering Committee Symposium was convened in July 1988. The requirement for identifying and quantifying emissions from the open detonation of explosives and open burning of propellants was discussed in detail by authorities from throughout the military, academic, and commercial communities. Conclusions and recommendations developed during the symposium are reported in proceedings of the symposium[2].

A series of TNT detonations and propellant burns were characterized in a BangBox (chamber) in December 1988 and January 1989 for the purpose of developing methodology and technology for large scale detonations and burns in the field. The BangBox test is reported in a three volume set. The report covers the details of the methods and technology development and would be useful for those desiring more detail on such things as the carbon balance method, the emission factors from a nonhomogeneous and homogeneous detonation or burn cloud, the samplers selected for future use in the fixed wing aircraft, and the techniques used in extracting and assaying samples.

The field tests took place in 1989 and 1990 and are reported in three volumes.

Volume 1. A summary which describes the planning phase, the conduct of trials, sample analyses and results, and the conclusions and recommendations. It is useful for those who need only a quick review (executive summary) and those who need a detailed description of the conduct and results of the Field Tests Phases A, B, and C.

Volume 2, Part A. A stand-alone document which covers the quality assurance and quality control procedures, the blind spiking of samples, the on site challenges of equipment and

---

[1]Letter, AMSTE-TA-F, Headquarters, U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland, 20 April 1988, subject: Test Planning Directive for Special Study of Open Burning/Open Detonation (OB/OD), Phase II, TECOM Project No 2-CO-210-000-017.

[2]*Proceedings of the Technical Steering Committee Symposium 6-8 July 1988*, Headquarters, United States Army Armament, Munitions and Chemical Command, Rock Island, Illinois, August 1991.

personnel, the conclusions, and the recommendations.

Volume 2, Part B. The quality assurance (QA) program plan which was developed specifically to support phase "C" field testing. While directed to phase "C" testing, it also represents the procedures and techniques and QA philosophies which were used during OB/OD field testing phases "A" and "B" and is based on experience gained during these two earlier field tests.

TABLE OF CONTENTS

Section	Title	Page
FOREWORD		i
ACKNOWLEDGEMENTS		xvii
ABSTRACT		xxi
EXECUTIVE SUMMARY		xxiii
	SECTION 1. INTRODUCTION	1-1
1.1	Demilitarization Stockpile Situation	1-1
1.1.1	Size, Storage, and Treatment	1-1
1.1.2	Environmental Issues and RCRA Permitting	1-1
1.1.3	Alternative Methods for Demilitarization	1-2
1.2	Background	1-2
1.2.1	Interim Study	1-2
1.2.2	Symposium - Technical Steering Committee	1-3
1.2.3	The BangBox Test Series	1-3
	SECTION 2 SCOPE OF TEST	2-1
2.1	Overall Test Program	2-1
2.1.1	Purpose	2-1
2.1.2	Objectives	2-1
2.2	BangBox Test	2-1
2.2.1	Purpose	2-1
2.2.2	Objectives	2-2
2.2.3	Test Matrix	2-3
2.3	Field Test Phase A	2-4
2.3.1	Purpose	2-4

2.3.2 Objectives 2-4
2.3.3 Test Matrix 2-4
2.4 Field Test Phase B 2-6
2.4.1 Purpose 2-6
2.4.2 Objectives 2-6
2.4.3 Test Matrix 2-7
2.5 Field Test Phase C 2-8
2.5.1 Purpose 2-8
2.5.2 Objectives 2-8
2.5.3 Test Matrix 2-9

SECTION 3. SPECIFICATIONS 3-1
3.1 Description of Facilities/Site 3-1
3.1.1 BangBox 3-1
3.1.2 DPG Test Grids 3-1
3.1.3 Sampling Platform - FWAC 3-19
3.1.4 Soil and Fallout Sampling 3-33
3.2 Explosive and Propellant Material 3-33
3.2.1 TNT 3-33
3.2.2 Composition B 3-36
3.2.3 Explosive D 3-37
3.2.4 RDX 3-38
3.2.5 Single-Base Propellant 3-39
3.2.6 Double Base Rocket Propellant 3-41
3.2.7 Triple-Base Propellant - Field Test Phase A 3-42
3.2.8 Composite Propellant - BangBox 3-43
3.2.9 Manufacturing Residue 3-43
3.3 Analyte List - Detection Levels 3-47
3.3.1 Discussion of Detection and Quantification Limits. 3-49
3.4 Sampling/Analysis 3-49
3.4.1 Volatile Organics 3-49
3.4.2 Semivolatile Organic Sampling and Analysis 3-50

3.4.3 Real-Time Gases 3-51
3.4.4 Airborne Particulate Matter 3-54
3.4.5 Aircraft-Based Video 3-55
3.4.6 Meteorology 3-55

SECTION 4 DATA COLLECTION, ANALYSIS, AND RESULTS 4-1
4.1 General Methods 4-1
4.1.1 Carbon-Balance Method 4-1
4.1.2 Analytical Methods for Semivolatile Organics 4-2
4.1.3 Soil and Fallout Samples 4-3
4.1.4 Emission Factors 4-5
4.2 Explosives 4-5
4.2.1 TNT Tests - Phases A, B, and C 4-6
4.2.2 Composition B Test - Phase C 4-29
4.2.3 Explosive D Test - Phase C 4-42
4.2.4 RDX Test - Phase C 4-55
4.3 Propellants 4-69
4.3.1 Single Base Tests - Phase C 4-69
4.3.2 Triple Base Test - Phase A 4-83
4.3.3 Manufacturing Residue Tests - Phases B and C 4-86
4.4 Comparison of BangBox and Field TNT Detonations 4-99
4.5 Dispersion Model Screening Analysis 4-102

SECTION 5. SUMMARY OF QA ACTIVITIES FOR OB/OD PROGRAM 5-1
5.1. Overview 5-1
5.2. Inorganic Gases 5-3
5.3. Flow Rate of Particulate and VOST Samplers 5-3
5.4. Volatile Organic Samplers 5-4
5.5. Semivolatile Organic Samplers 5-4
5.6. SVOCs Particulate from Sampler (Aircraft) and Fallout Pans 5-5
5.7. Metals by XRF 5-7
5.8. Eelemental and Volatilizable Carbon 5-8

5.9. Real Time Particle Measurements (Aircraft) 5-8
5.10. HCN, NH_3, HCL Samplers 5-8
5.11. Fallout and Burn Pan Sampler Placement and Recovery 5-8
5.12. Particulate Weight Determination 5-8

SECTION 6. CONCLUSIONS 6-1

6.1. Background 6-1
6.1.1. BangBox 6-1
6.1.2. Field Test Phase A 6-1
6.1.3. Field Test Phase B 6-2
6.1.4. Field Test Phase C 6-4
6.2. General Overall Test Program 6-5
6.2.1. Purpose 6-5
6.2.2. Objectives and Responses 6-5
6.3. Air Emissions 6-7
6.3.1. Detonation/Combustion Efficiency 6-7
6.3.2. Carbon Distribution 6-9
6.3.3. Scaling Issues 6-9
6.3.4. Source Pollutant Dispersion Modeling 6-10
6.4. Soil Deposition of OB/OD Emissions 6-11
6.4.1. OD Emissions 6-11
6.4.2. OB Emissions 6-11

SECTION 7. RECOMMENDATIONS 7-1

7.1. Multiple Continuous Detonations 7-1
7.2. Buried Detonations 7-1
7.3. Soil Extraction and Analysis 7-1
7.4. BangBox Design and Construction 7-1
7.5. Models 7-2
7.6. Technical Steering Committee 7-2
7.7. International Cooperation 7-2

LIST OF FIGURES

Figure	Title	Page
Figure 3.1	SNL BangBox Test Facility Containing Sampling and Real-Time Analysis Equipment.	3-3
Figure 3.2	SNL BangBox Interior OB/OD Sampling Instrumentation and Equipment.	3-5
Figure 3.3	BangBox Airlock Instrumentation and Sampling Equipment.	3-6
Figure 3.4	OB/OD Test Grid Location.	3-7
Figure 3.5	OB/OD Phase A Soil and Fallout Sampling Location.	3-9
Figure 3.6	OB/OD Phase B Surface TNT Detonation Location Relationships.	3-10
Figure 3.7	OB/OD Phase B Surface TNT Detonations Fallout Pan Layout.	3-11
Figure 3.8	OB/OD Phase B Soil Sampling Plan for Suspended TNT Detonations.	3-13
Figure 3.9	OB/OD Propellant Burn Grid Showing Sputter and Fallout Pan Layout.	3-14
Figure 3.10	Field Test Phase C Locations of Surface Detonations, Suspended Trials, and Propellant Burns.	3-16
Figure 3.11	Field Test Phase C Relationship of the Seven Surface Detonation Sites Contained in Sites A, B, C, and,D of Fig. 3.10.	3-17
Figure 3.12	Field Test Phase C Fallout Pan Layout for a Detonation.	3-18
Figure 3.13	SNL Twin Otter Instrumented Fixed-Wing Aircraft for Open-Air OB/OD Sampling and Real-Time Gas Analysis.	3-21
Figure 3.14	Schematic Diagram of Sampling Aircraft Instrumentation.	3-24
Figure 4.1	Ground Level Peak and 15 min Average Concentration of Benzo[a]pyrene Downwind of a 1000-kg Surface Detonation of TNT.	4-104

LIST OF TABLES

Table	Title	Page
Table 1	Explosive Detonations: Average Emission Factors for Inorganic, and Volatile Analytes.	xxx
Table 2	Explosive Detonations: Maximum Emission Factors for Semivolatile Analytes.	xxxi
Table 3	Explosive Detonations: Semivolatile Analytes Detected and Maximum Recovery in Soil Ejecta (ng/g).	xxxii
Table 4	Propellant Burns: Average Emission Factors for Inorganic and Volatile Analytes.	xxxiii
Table 5	Propellant Burns: Maximum Emission Factors for Semivolatile Analytes.	xxxiv
Table 6	Propellant Burns: Semivolatile Analytes Detected and Maximum Recovery in Fallout Pans (ng/g).	xxxv
Table 2.1	BangBox Test Schedule	2-3
Table 2.2	Field Test Phase A Test Matrix.	2-5
Table 2.3	Field Test Phase B Test Matrix.	2-7
Table 2.4a	Field Test Phase C Test Matrix.	2-9
Table 2.4b	Field Test Phase C Test Matrix.	2-10
Table 2.4c	OB/OD Phase C Test Matrix.	2-11
Table 3.1	Nominal Composition of Composition B Explosive.	3-37
Table 3.2	Nominal Composition of Explosive D.	3-38
Table 3.3	Nominal Composition of PBXN-6.	3-39
Table 3.4	Nominal Composition of M1 Propellant.	3-40
Table 3.5	Nominal Composition of M6 Propellant.	3-41
Table 3.6	Composition of NOSIH-AA-2 Propellant.	3-42
Table 3.7	M30 Triple-Base Gun Propellant Composition.	3-42
Table 3.8	NOSIH-EC Propellant Composition.	3-43
Table 3.9	Manufacturing Residues Burned in Field Test Phase B.	3-44
Table 3.10	NOSIH-AA6 Propellant Composition.	3-45
Table 3.11	"Propellant A" Composition.	3-45
Table 3.12	"Ignition Propellant" Composition.	3-46
Table 3.13	Cellulose Acetate Inhibitor Composition.	3-46

Table 3.14 Manufacturing Residues Burned in Field Test Phase C. 3-47
Table 3.15 Composition of N5 Propellant. 3-47
Table 3.16 Analyte List and Limits of Detection for Phases A, B, and C Tests. 3-48
Table 3.17 OB/OD Real-Time Continuous Monitors Installed on the Aircraft. 3-52
Table 4.2.1 Gas Emission Factors for Surface TNT Detonations. 4-7
Table 4.2.2 Gas Emission Factors for Suspended TNT Detonations. 4-7
Table 4.2.3 Summary of Total Particulate Mass Concentrations for Surface and Suspended TNT Detonations. 4-10
Table 4.2.4 Volatile Organic Compound Emission Factors for Surface TNT Detonations. 4-11
Table 4.2.5 Volatile Organic Compound Emission Factors for Suspended TNT Detonations. 4-12
Table 4.2.6 Maximum Semivolatile Organic Emission Factors Measured for Surface TNT Detonations. 4-13
Table 4.2.7 Maximum Semivolatile Organic Emission Factors Measured for Suspended TNT Detonations. 4-14
Table 4.2.8 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil. 4-16
Table 4.2.9 Summary of Phase A Pretest and Ejecta Soil Samples for Semivolatile Organics. 4-17
Table 4.2.10 Summary of Semivolatile Organic Concentrations from Phases B and C Pretest and Ejecta Soil Samples, Based on the Weight of Sample. 4-18
Table 4.2.11 Summary of Semivolatile Analyte Concentrations Detected in Soil Samples in Phase A TNT Detonations. 4-19
Table 4.2.12a Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Weight of Sample. 4-21
Table 4.2.12b Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Weight of Sample. 4-22
Table 4.2.13a Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Area Sampled. 4-24
Table 4.2.13b Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Area Sampled. 4-25

Table 4.2.14 Summary of Semivolatile Organic Concentrations from Phase B TNT Suspended Detonation Soil Samples. 4-26
Table 4.2.15 Summary of Fallout and 2,4-Dinitrotoluene Concentration by Weight and Area 4-27
Table 4.2.16 Concentration and Deposition Area Used to Determine Fallout Amount for 2,4-Dinitrotoluene. 4-28
Table 4.2.17 Gas Emission Factors for Composition-B Surface Detonations. 4-29
Table 4.2.18 Average Particulate Matter Concentrations Measured During Multiple Aircraft Sampling Passes of Composition-B Detonation Clouds. 4-30
Table 4.2.19 Volatile Organic Compound Emission Factors Measured for the Composition-B Detonation Tests. 4-31
Table 4.2.20 Maximum Semivolatile Organic Emission Factors Measured for Surface Composition B Detonations. 4-32
Table 4.2.21 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil for Composition B. 4-33
Table 4.2.22 Composition B, Summary of Semivolatile Organic Concentrations from Phase C Pretest and Ejecta Soil Samples, Based on the Weight of Sample. 4-34
Table 4.2.23a Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample. 4-36
Table 4.2.23b Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample. 4-37
Table 4.2.24a Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled. 4-40
Table 4.2.24b Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled. 4-41
Table 4.2.25 Gas Emission Factors for Explosive-D Surface Detonations. 4-42
Table 4.2.26 Average Particulate Matter Concentrations Measured During Multiple Aircraft Sampling Passes of Explosive-D Detonation Clouds. 4-43
Table 4.2.27 Volatile Organic Compound Emission Factors Measured for the Explosive-D Detonation Tests. 4-44
Table 4.2.28 Maximum Semivolatile Organic Emission Factors Measured for Surface Explosive D Detonations. 4-45

Table 4.2.29 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil for Explosive D. 4-46
Table 4.2.30 Explosive D: Summary of Semivolatile Organic Concentrations from Phase C Pretest and Ejecta Soil Samples, Based on the Weight of Sample. 4-47
Table 4.2.31a Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample. 4-49
Table 4.2.31b Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample. 4-50
Table 4.2.32a Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled. 4-53
Table 4.2.32b Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled. 4-54
Table 4.2.33 Gas Emission Factors for RDX Surface Detonations. 4-56
Table 4.2.34 Average Particulate Concentrations Measured During Multiple Aircraft Sampling Passes of RDX Detonation Clouds. 4-57
Table 4.2.35 Volatile Organic Compound Emission Factors Measured for the RDX Detonation Tests. 4-57
Table 4.2.36 Maximum Semivolatile Organic Emission Factors Measured for Surface RDX Detonations. 4-59
Table 4.2.37 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil for RDX. 4-60
Table 4.2.38 RDX, Summary of Semivolatile Organic Concentrations from Phase C Pretest and Ejecta Soil Samples, Based on the Weight of Sample. 4-61
Table 4.2.39a RDX, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample. 4-63
Table 4.2.39b RDX, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample. 4-64
Table 4.2.40a RDX, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled. 4-67
Table 4.2.40b RDX, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled. 4-68
Table 4.3.1 Gas and VOC Emission Factors for M-1 Single Base Propellant. 4-70

Table 4.3.2 Semivolatile Organic Emission Factors for M-1 Single Base Propellant. 4-72
Table 4.3.3 Summary of Semivolatile Organic Concentrations from M-1 Propellant Burn, Sputter Pan Sampling. 4-73
Table 4.3.4 Summary of Semi-volatile Analyte Concentrations from M-1 Propellant Burn, Fallout Pan Sampling. 4-74
Table 4.3.5 Summary of Semivolatile Analyte Concentrations from M-1 Propellant Burn, Burn Pan Residue. 4-75
Table 4.3.6 Gas and VOC Emission Factors for the M-6 Single Base Propellant. 4-77
Table 4.3.7 Semivolatile Organic Emission Factors for M-6 Single Base Propellants. 4-79
Table 4.3.8 Summary of Semivolatile Analyte Concentrations from M-6 Burn, Sputter Pan Sampling. 4-80
Table 4.3.9 Summary of Semivolatile Analyte Concentrations from M-6 Burn, Fallout Pan Sampling. 4-81
Table 4.3.10 Summary of Semivolatile Analyte Concentrations From M-6 Burn, Burn Pan Residue. 4-82
Table 4.3.11 Gas Emission Factors for Triple Base Propellants. 4-84
Table 4.3.12 Volatile Organic Compound Emission Factors for Triple-Base Propellant. 4-85
Table 4.3.13 Gas Emission Factors for Phase B Manufacturing Residue Burns. 4-88
Table 4.3.14 Volatile Organic Compound Emission Factors, Phase B, Manufacturing Residue Burns. 4-89
Table 4.3.15 Semivolatile Organic Emission Factors, Phase B, Manufacturing Residue Burns. 4-90
Table 4.3.16 Summary of Semivolatile Analyte Concentrations, Phase B, Manufacturing Residue Burn, Sputter Pan Sampling. 4-91
Table 4.3.17 Summary of Semivolatile Analyte Concentrations, Phase B, Manufacturing Residue Burn, Fallout Pan Sampling. 4-92
Table 4.3.18 Gas Emission Factors for the Phase C Manufacturing Residue Burns. .. 4-94
Table 4.3.19 Volatile Organic Compound Emission Factors for the Phase C Manufacturing Residue Burns. 4-95
Table 4.3.20 Maximum Semivolatile Organic Emission Factors Measured for the Phase C Manufacturing Residue Burns. 4-96

Table 4.3.21 Manufacturing Residue Burn: Summary of Semivolatile Organic Concentrations, Sputter Pan Sampling, Phase C. 4-97
Table 4.3.22 Manufacturing Residue Burn: Summary of Semivolatile Analyte Concentrations, Fallout Pan Sampling, Phase C. 4-98
Table 4.3.23 Manufacturing Residue Burn: Summary of Semivolatile Analyte Concentrations, Burn Pan Residue, Phase C. 4-99
Table 4.4.1 Average Emission Factors for the Volatile and Semivolatile Analytes from the BangBox and Open-Air Detonation with TNT. 4-100
Table 4.4.2 Distribution of Carbon Emissions by Pollutant Category for BangBox and Open-Air Surface and Suspended TNT Detonations. 4-102
Table 4.5.1 Input Data and Downwind Ground Level Pollutant Concentrations for Selected Cases Using the DPG Volume Source Dispersion Model. 4-105
Table 5.1 Schedule of Quality System Audits During OB/OD Program 5-10
Table 5.2 Schedule of EPA Quality Performance Audits During OB/OD Program. . . 5-11
Table B.1 OB/OD Phase B Soil Sample Data. B-2
Table C-1 Example of Voltage Data from Gas Instruments During Sampling from Bag Filled During M-1 Propellant Burn, Mon, 6 Sep 90. . . . . C-4
Table C-2a Summary Instrument Voltage Data From All Calibrations, Test Flights, and Background Flights Conducted on 6 Sep 90. . . . . C-5
Table C-2b Summary Instrument Voltage Data from All Calibrations, Test Flights, and Background Flights Conducted on 6 Sep 90. . . . . C-6
Table C-3a Summary Gas Instrument Data That Includes Zero, Span, and Sample Data For M-1 Propellant Burn on 6 Sep 90. . . . . C-7
Table C-3b Summary Gas Instrument Data That Includes Zero, Span, and Sample Data For M-1 Propellant Burn on 6 Sep 90. . . . . C-8
Table D-1 Filter Weight and Volume Data. D-2
Table D-2 Total Background Corrected Carbon Content in Air Samples. D-3
Table E-1a Volatile Organic Compound Background Data for M-1 Propellant E-3
Table E-1b Volatile Organic Compound Background Data for M-1 Propellant. E-4
Table E-1c Volatile Organic Compound Background Data for M-1 Propellant. E-5
Table E-2a Volatile Organic Compound Test Data for M-1 Propellant. E-6
Table E-2b Volatile Organic Compound Test Data for M-1 Propellant. E-7

Table E-2c Volatile Organic Compound Test Data for M-1 Propellant. E-8
Table F-1 Semivolatile Target Analyte Loadings on Background and Test Filters for 6 Sep 90 M-1 Propellant Test. F-4
Table F-2 Air Volume and Gas Concentration Data or 6 Sep 90 M-1 Propellant Test. . F-5
Table G.1 Sample Identification and Weight of Particles in Sample. G-2
Table G.2a Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations. G-3
Table G.2b Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations. G-4
Table G.2c Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations. G-5
Table G.2d Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations. G-6

LIST OF EQUATIONS

Equation	Title	Page
Equation 3.1	Gas Data Calculation.	3-53
Equation 4.1	Calculation of Emission Factor.	4-1
Equation 4.2	Volume of Crater	4-4
Equation A.1	Pitot Tube Velocity and Pressure.	A-1
Equation A.2	Density Correction Factor.	A-1
Equation A.3	Volumetric Flow rate.	A-2
Equation C.1	Bag Gas Concentration Calculation.	C-3
Equation C.2	Final Bag Gas Concentration Calculation.	C-3
Equation E.1	Emission Factor Calculation.	E-2
Equation F-1	Emission Factor Calculation for Semivolatiles.	F-2
Equation F-2	Calculation of Total Weighted Average Carbon Concentration.	F-3

LIST OF APPENDICES

Appendix	Title	Page
APPENDIX A	- FILTER SYSTEM FLOW MEASUREMENTS	A-1
APPENDIX B	- SOIL AND FALLOUT SEMIVOLATILE ORGANIC DATA	B-1
APPENDIX C	- GAS SAMPLE DATA REDUCTION PROCEDURES	C-1
APPENDIX D	- PARTICULATE MATTER DATA REDUCTION	D-1
APPENDIX E	- VOLATILE ORGANIC COMPOUND DATA-REDUCTION	E-1
APPENDIX F	- SEMIVOLATILE ORGANIC DATA REDUCTION	F-1
APPENDIX G	- SEMIVOLATILE ORGANIC ASSAY	G-1
APPENDIX H	- REFERENCES	H-1
APPENDIX I	- ABBREVIATIONS	I-1
APPENDIX J	- GLOSSARY	J-1
APPENDIX K	- OB/OD PROGRAM SYNOPSIS	K-1
APPENDIX L	- DISTRIBUTION	L-1

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ABSTRACT

The development, testing, and evaluation of a U.S. Environmental Protection Agency (Office of Solid Waste/Atmospheric Research and Exposure Assessment Laboratory) validated and accepted method for the characterization of emissions from open burning (OB) and open detonation (OD) thermal treatment operations is presented. The methodology utilizes an innovative carbon balance technique to calculate accurate emission factors (Efs) of combustion products in diffusing clouds and a combination of supercritical fluid chromatography (SFC), gas chromatography (GC), and mass spectrometry (MS) to detect and quantify potential air and soil contaminants. These methods were used to achieve maximum sensitivity/identification of volatiles and semivolatile organic compounds. The SFC-MS was able to measure the thermally labile semivolatile organics such as RDX and N-Nitrosodiphenylamine which are subject to breakdown into other compounds with GC-MS. Confirmation of the methodology included closed-chamber tests to check out instrumentation, technology, and analytical procedures proposed for follow-on large- scale open air tests conducted on a fixed wing aircraft flying through the plume. Comparable EFs were obtained from the BangBox (BB) and open air tests for TNT. Because of the similarity in analytes detected, EFs, and concentrations between TNT, composition B, explosive D and RDX, it is reasonable to expect that BB can provide results that will be useful in permit applications.

Materials characterized during the OB/OD study included the explosives TNT, RDX, Explosive D, and Composition B; propellant manufacturing residue; and single-, double-, triple-base, and composite types of propellant. The study and emerging results were briefed as part of a nation-wide EPA-sponsored seminar, on "Incineration and Alternative Treatment of Energetic Compounds to Minimize Effects to Air, Soil and Water Supplies". The seminar was presented to all EPA regions during the period of April-September 1990. The study has confirmed the methodology, technology, and procedures necessary to obtain a portion of data required to obtain permits under provisions of the Resource Conservation and Recovery Act (RCRA), subpart X. Such permitting is required for continuation of all Department of Defense OB/OD operations after 8 November 1992. It is recommended that the methodology and procedures be used in a follow-on program to acquire characterization data on specific munitions, explosives, and propellants that are included in the DoD inventory.

The data obtained will be used to demonstrate that OB/OD units can be operated in a manner so as to meet the environmental performance standards.

EXECUTIVE SUMMARY

Open burning (OB) and open detonation (OD), thermal treatment methods are currently the primary means of demilitarization employed by the Department of Defense (DoD) for the treatment of explosive residue, propellants, and munitions. Increasingly stringent requirements for environmental documentation of potential pollution/contamination from combustion products under such acts as the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act (RCRA), resulted in a critical need for technology development to be able to collect data to use as a basis for making informed decisions to determine: (1) the limitations/restrictions of OB/OD thermal treatment methods, (2) the development of alternative treatment methods for munitions/propellants for which OB/OD is not acceptable, and (3) developing and maintaining the most effective, economical, and environmentally safe means of accomplishing required demilitarization/treatment.

The objective of this phase (I) of the OB/OD thermal emission study was to develop and demonstrate the utility of the technologies and methodologies needed to provide the data required for these critical decisions. (See Appendix K)

Under the sponsorship of the Single Manager for Conventional Ammunition within the DoD, a symposium was conducted in July 1988 (Reference 1) to develop planning concepts necessary to address the technical problems associated with an accurate environmental characterization of the OB/OD processes. Authorities from governmental, academic, and private research organizations discussed sampling and sample analysis technologies, data analysis processes, test organization, and preparation of reports that would be acceptable to Federal and State environmental regulatory agencies. Expertise represented included field sampling, instrumentation, field and laboratory analyses, environmental documentation, atmospheric dispersion modeling and sampling, data management, combustion and explosive phenomenology, and quality assurance/quality control. A technical steering committee composed of recognized experts in their respective disciplines was formed under the leadership of the U.S. Army Armament, Munitions and Chemical Command Program Manager.

A list of volatile and semivolatile organic compounds and metals which are potentially hazardous contaminants if they were produced in either the soil or atmosphere from OB/OD processes was developed. A closed chamber (BangBox or BB) test was conducted at Sandia National Laboratories (See Reference 2) to check out instrumentation, technology, methodology, and analytical procedures that were proposed for follow-on large scale field tests to be sampled by a fixed-wing aircraft (FWAC) flying through OB/OD-generated plumes. Representatives of the U.S. Environmental Protection Agency (EPA) (Office of Solid Waste at Washington DC, Region VIII at Denver, CO, and the Quality Assurance Division at Research Triangle Park, NC) served as members of the technical steering committee to provide technical guidance and quality assurance/quality control support during test planning and execution phases, and to review data collection and analytical procedures throughout the entire program. In addition, representatives from the Office of Solid and Hazardous Waste from the State of Utah participated throughout the entire planning and testing period. Real-time and near real-time particulate and gaseous concentration measurements were achieved. These data were correlated with the samples collected on filters and gaseous containers and held for subsequent laboratory analysis. A methodology of using carbon balance to calculate EF factors of combustion products in diffusing clouds was developed. Laboratory analyses of samples utilized innovative supercritical fluid chromatography (in addition to gas chromatography) and mass spectrometry, one of the techniques which attain the lowest possible detection limits for the selected semivolatile analytes.

The BB tests evaluated EF from the open detonation of 2,4,6 trinitrotoluene (TNT), and open burning of a double-base and a composite propellant. The tests confirmed the technologies, methodologies, and analytical procedures employed. These processes were further successfully proven during the conduct of large-scale tests during field tests Phases A, B, and C.

Emissions and residues from propellant manufacturing residue, single- and triple-base, and composite propellants; and TNT, explosive D, RDX and composition B were characterized during the field trials conducted at Dugway Proving Ground (DPG) between June 1989 and September 1990.

Emerging results of the current study were briefed as part of a nationwide EPA-sponsored seminar on "Incineration and Alternative Treatment of Energetic Compounds to Minimize Effects to Air,

Soil, and Water Supplies." The seminar was presented to all EPA regions within the continental United States during the period of April to September 1990. The EPA representatives have accepted the methodology, technology, and procedures as an effective approach to obtain data required for permitting of DoD OB/OD thermal treatment operations.

Results of the study that have direct application to critical decisions on future planning and funding of the DOD demilitarization/treatment program are summarized below:

Comparable EFs were found during BB and field testing for TNT. Additional similarities of the EF, combustion products, and combustion product concentration levels resulting from the OD of TNT, composition B, explosive D, and RDX were observed during large-scale field testing. These two sets of relationships indicate that small-scale BB-type OD tests may be capable of providing the data needed for characterizing large-scale field OD thermal treatment operations and supporting permit applications.

The study also suggests that the bulk explosives and propellants examined during field testing may be treated in an environmentally safe manner by surface OB/OD methods. While these results are encouraging, site-specific testing is needed to provide data to support risk assessments. Only after these risk assessments are completed may a definitive statement be made concerning the effect (if any) OB/OD operations have on human health and the environment.

The advantages of conducting tests in properly designed chambers as opposed to field testing include:

(1) Costs are reduced and can be more precisely controlled.

(2) The test environment can be standardized.

(3) Results may be obtained rapidly.

(4) Sampling may continue until sufficient quantities of targeted analytes obtained have been collected to meet or exceed minimum quantification level of the analytical methods being used.

(5) Secondary reactions and the decay rate of primary and secondary products of combustion can be studied.

(6) The number of samples necessary for calculating statistically valid EFs (and the uncertainty (imprecision) associated with these EFs) can be acquired under repeatable and well controlled conditions. With this information, a very conservative EF such as the maximum probable EF (upper 95% tolerance level) can be calculated.

(7) Testing delays caused by adverse weather conditions will be minimized.

(8) PEP materials requiring alternative treatment technologies can be rapidly identified.

For those materials that cannot be safely treated by other modes of treatment, the results obtained from chamber testing can be combined with dispersion modeling and health risk assessment information to determine the following:

(1) The type and quantities of pollutants that will be released to the environment from specific PEP items.

(2) Identification of PEP materials for which OB/OD thermal treatment methods are environmentally acceptable.

(3) Those PEP materials that cannot be safely treated in an environmentally safe manner by OB/OD thermal treatment methods, require the development of alternative technologies.

(4) Effective focussing of alternative technologies development.

(5) The design and placement of the monitoring systems that will be required to ensure that the quantities of pollutants released to the environment from permitted OB/OD thermal treatment operations remain at or below the levels specified in the OB/OD permit.

(6) The types of monitoring equipment that must be used and the number of samples of each type that must be taken and the target analytes that must be measured, when chamber studies are inconclusive and an assessment must be made through field testing.

(7) The kinds and quantities of pollutants released from OB/OD thermal treatment operations as the type, quantity, configuration (buried/surface), physical condition (bulk, munition type, old, new), and composition (supplemental oxidants added/not added) is varied.

This combination of testing and modeling will provide the data required to improve/optimize the current OB/OD technology and the environmental sampling and analysis methods employed for monitoring pollutant releases.

The EFs obtained from the BB tests and from the field tests for OD of explosives and OB of propellants is presented in Tables 1, 2, 4, and 5.

Table 1 presents the average EFs for inorganic gases, and volatile organic compounds; Table 2 presents the maximum EFs for semivolatile organic compounds obtained when 225 gram quantities of bulk TNT were detonated in a 1000-m^3 BangBox chamber, and results from the trials of three field tests in which 4000 to 10000 lb of bulk TNT, composition B, explosive D, or RDX were detonated on soil at DPG.

The TNT data show that the BB generated EFs are comparable to those obtained in the field. All TNT tests show a very efficient conversion of carbon to CO_2 (>92 percent).

The striking thing about the data in these tables is the very efficient conversion of carbon to CO_2 for all four explosives and the comparable low level of the volatiles and semivolatiles.

A summary of the semivolatile analytes detected in the ejecta soil from the detonations is presented in Table 3. The analytes that were measured after detonation in concentrations greater than those observed in the pretest background are marked with an asterisk. The data shows very few of the analytes detected above background. The parent compound TNT showed elevated levels after the detonations of TNT and composition B.

The results are encouraging because:

(1) they document the utility of the BB in estimating air emissions in large scale field tests, and

(2) they indicate that the concentrations of inorganic compounds, volatile organic and semivolatile compounds generated from OD operations may be more predictable than previously supposed.

(3) they indicate that soil contamination from large-scale high order detonations are very small.

The comparability of EFs obtained for propellants burned in trays at the BB and at DPG parallels the degree of comparability between BB and field detonations. The BB testing of double-base and composite propellants generally yielded EFs that approximated or exceeded those obtained in the field tests, and EFs generated during the OB field testing did not substantially differ from each other. Over 99 percent of the total carbon contained in tested propellants was accounted for in the form of carbon dioxide following the burn event. The semivolatile organics detected were propellant specific, e.g., no semivolatile organic were detected for the M30 (triple-base) propellant burn, but nine semivolatile compounds were detected for the phase B propellant manufacturing residues.

The analyses of samples collected in the fallout and the sputter pans (burns) indicate that the propellants used in this program did not add measurable levels of contamination to the soil beyond 12 m from the propellant burns. The analytes detected and the maximum concentration level of the analyte in the fallout material are shown in Table 6.

The DPG real time volume source dispersion model (RTVSM) was used to estimate ground-level concentrations of selected analytes that would be expected from a 1 metric ton (1000 kg) surface detonation of TNT. Test cases run for typical EFs measured for surface detonated TNT such as CO (EF= 50×10^{-3}), benzene (EF= 0.1×10^{-3}), and benzo[a]pyrene (EF= 0.1×10^{-6}) reveals that maximum ground level peak and 15-minute average concentrations would be indistinguishable from background levels of these pollutants.

The follow on program will obtain emission characterization data for specific munitions and other PEP items in the DoD inventory. Obtaining these critical data and the required permits will eliminate the potential for costly and time consuming litigious actions, and will ensure the continuation of an effective integrated PEP demilitarization/treatment program.

Table 1 Explosive Detonations: Average Emission Factors[a] for Inorganic, and Volatile Analytes.

Analyte	TNT BangBox	TNT Surface Detonations			Phase C Surface Detonations		
		Phase A	Phase B	Phase C	Comp B	Exp D	RDX
Percent Carbon Converted to CO_2	97.1	92.6	94.9	94.1	94.5	92.5	96.6
Carbon dioxide (Theoretical EF[b])	1.36	1.36	1.36	1.36	0.921	1.07	0.59
INORGANIC COMPOUNDS							
Carbon dioxide (Empirical EF)	1.32	1.26	1.29	1.28	0.87	0.99	0.57
Carbon monoxide	4.9×10^{-3}	61×10^{-3}	42×10^{-3}	49×10^{-3}	31×10^{-3}	53×10^{-3}	31×10^{-3}
Nitrogen oxide	11×10^{-3}	0.70×10^{-3}	1.4×10^{-3}	1.4×10^{-3}	0.8×10^{-3}	0.9×10^{-3}	0.9×10^{-3}
Nitrogen dioxide	0.56×10^{-3}	3.6×10^{-3}	1.1×10^{-3}	1.4×10^{-3}	1.0×10^{-3}	1.1×10^{-3}	0.6×10^{-3}
VOLATILE COMPOUNDS							
Methane	0.025×10^{-3}	1.5×10^{-3}	1.2×10^{-3}	1.5×10^{-3}	0.6×10^{-3}	2.4×10^{-3}	0.2×10^{-3}
Total Nonmethane hydrocarbons	0.057×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	2.1×10^{-3}	1.2×10^{-3}	2.0×10^{-3}	1.3×10^{-3}
Benzene	2.4×10^{-6}	94×10^{-6}	93×10^{-6}	100×10^{-6}	62×10^{-6}	110×10^{-6}	69×10^{-6}

[a]Emission factor--a dimentionless number that, when multiplied by the weight of explosive or propellant material, detonated or burned, results in the weight of analyte expected.
[b]Theoretical EF (emission factor) if all carbon is converted to CO_2.

Table 2 Explosive Detonations: Maximum Emission Factors[a] for Semivolatile Analytes.

Analyte	TNT BangBox	TNT Surface Detonations			Phase C Surface Detonations		
		Phase A	Phase B	Phase C	Comp B	Exp D	RDX
SEMIVOLATILE COMPOUNDS							
2,4-Dinitrotoluene	170×10^{-9}	150×10^{-9}	8400×10^{-9}	BD[b]	450×10^{-9}	590×10^{-9}	210×10^{-9}
2,6-Dinitrotoluene	140×10^{-9}	19×10^{-9}	7100×10^{-9}	BD	24×10^{-9}	80×10^{-9}	41×10^{-9}
2,4,6-Trinitrotoluene	620×10^{-9}	220×10^{-9}	150×10^{-9}	60×10^{-9}	250×10^{-9}	44×10^{-9}	98×10^{-9}
2-Nitronaphthalene	160×10^{-9}	80×10^{-9}	270×10^{-9}	BD	86×10^{-9}	43×10^{-9}	49×10^{-9}
N-Nitrosodiphenylamine	200×10^{-9}	BD	4.4×10^{-9}	BD	36×10^{-9}	58×10^{-9}	BD
1,3,5-Trinitrobenzene	0.45×10^{-9}	BD	BD	BD	59×10^{-9}	18×10^{-9}	44×10^{-9}
2-Nitrodiphenylamine	NA[c]	BD	NA	BD	72×10^{-9}	58×10^{-9}	34×10^{-9}
1-Nitropyrene	BD	BD	39×10^{-9}	BD	56×10^{-9}	11×10^{-9}	50×10^{-9}
RDX	NA	NA	NA	NA	BD	NA	2100×10^{-9}
Picric acid	NA	NA	NA	NA	NA	50×10^{-9}	NA
Naphthalene	28000×10^{-9}	BD	3700×10^{-9}	2600×10^{-9}	420×10^{-9}	630×10^{-9}	200×10^{-9}
Benz[a]anthracene	BD	2.2×10^{-9}	160×10^{-9}	100×10^{-9}	7.4×10^{-9}	19×10^{-9}	93×10^{-9}
Benzo[a]pyrene	360×10^{-9}	BD	240×10^{-9}	BD	14×10^{-9}	38×10^{-9}	140×10^{-9}
Pyrene	32×10^{-9}	BD	NA	220×10^{-9}	210×10^{-9}	180×10^{-9}	220×10^{-9}
Phenol	9900×10^{-9}	BD	5200×10^{-9}	BD	—[d]	---	---
Dibenzofuran	150×10^{-9}	BD	85×10^{-9}	180×10^{-9}	BD	110×10^{-9}	2000×10^{-9}
Diphenylamine	BD	NA	7.7×10^{-9}	170×10^{-9}	66×10^{-9}	19×10^{-9}	310×10^{-9}

[a]Emission factor--a dimentionless number that, when multiplied by the weight of explosive or propellant material, detonated or burned, results in the weight of analyte expected.
[b]BD - below detection limit.
[c]NA - not a target analyte.
[d]Phenol was lost in the extraction of the semivolatile.

Table 3 Explosive Detonations: Semivolatile Analytes Detected and Maximum Recovery in Soil Ejecta (ng/g)[a].

	TNT	Comp B	Exp D	RDX
SEMIVOLATILE COMPOUNDS				
2,4-Dinitrotoluene	8.0	17	1.3	2.0
2,6-Dinitrotoluene	2.3	1.0	0.14	0.90
2,4,6-Trinitrotoluene	360 *[b]	14 *	7.4	0.67
2-Nitronaphthalene	1.8	0.39	0.11	0.90
N-Nitrosodiphenylamine	1.1	0.39	0.090	1.7
1,3,5-Trinitrobenzene	39 *	0.39	0.14	0.77
2-Nitrodiphenylamine	BD[c]	0.60	0.24	0.19
1-Nitropyrene	1.2	0.14	0.12	0.23
RDX	NA[d]	BD	NA	15
Picric acid	NA	NA	BD	NA
Naphthalene	210	13	11	5.3 *
Benz[a]anthracene	11 *	1.9	5.4	2.4
Benzo[a]pyrene	BD	0.55	0.67	0.41
Pyrene	53 *	4.5	5.2 *	5.3 *
Phenol	69 *	—[e]	—	—
Dibenzofuran	18	1.6	1.0	0.95
Diphenylamine	0.79	1.6	0.26	0.48

[a]Represents ng of analyte per g of soil.
[b]The asterisk indicates that the analyte was detected above background level (P >0.95).
[c]BD - below detection limit.
[d]NA - not a target analyte.
[e]Phenol was lost in the extraction of the semivolatile.

Table 4 Propellant Burns: Average Emission Factors[a] for Inorganic and Volatile Analytes.

Analyte	BangBox		Phase A	Manufacturing Residue		Phase C	
	Double Base	Composite	Triple Base	Phase B	Phase C[a]	M-1	M-6
Percent Carbon Converted to CO_2	103	111	102	unknown	99.5	99.1	99.1
Carbon dioxide (Theoretical EF[b])	0.94	0.88	0.65	unknown	1.005	1.11	1.07
INORGANIC COMPOUNDS							
Carbon dioxide (Empirical EF)	0.97	0.42	0.66	0.77	1.0	1.1	1.1
Carbon monoxide	0.91×10^{-3}	0.29×10^{-3}	0.025×10^{-3}	0.49×10^{-3}	0.7×10^{-3}	0.25×10^{-3}	0.095×10^{-3}
Nitrogen oxide	0.14×10^{-3}	3.0×10^{-3}	5.2×10^{-3}	2.8×10^{-3}	2.6×10^{-3}	1.2×10^{-3}	2.4×10^{-3}
Nitrogen dioxide	0.88×10^{-3}	0.61×10^{-3}	2.1×10^{-3}	0.51×10^{-3}	0.15×10^{-3}	0.47×10^{-3}	0.52×10^{-3}
VOLATILE COMPOUNDS							
Methane	67×10^{-6}	20×10^{-6}	BD[c]	BD	750×10^{-6}	8000×10^{-6}	46×10^{-6}
Total nonmethane hydrocarbons	160×10^{-6}	33×10^{-6}	1.5×10^{-6}	45×10^{-6}	560×10^{-6}	460×10^{-6}	13×10^{-6}
Benzene	11×10^{-6}	5.7×10^{-6}	BD	BD	16×10^{-6}	4.8×10^{-6}	1.7×10^{-6}

[a]Emission factor--a dimentionless number that, when multiplied by the weight of explosive or propellant material, detonated or burned, results in the weight of analyte expected.
[b]Theoretical EF (emission factor) if all carbon is converted to CO_2.
[c]BD - below detection limit.

Table 5 Propellant Burns: Maximum Emission Factors[a] for Semivolatile Analytes.

Analyte	BangBox		Phase A	Manufacturing Residue		Phase C	
	Double Base	Composite	Triple Base	Phase B	Phase C[e]	M-1	M-6
SEMIVOLATILE COMPOUNDS							
2,4-Dinitrotoluene	BD[b]	10×10^{-9}	BD	BD	160×10^{-9}	1.2×10^{-9}	1.0×10^{-9}
2,6-Dinitrotoluene	14×10^{-9}	3.7×10^{-9}	BD	BD	140×10^{-9}	BD	0.077×10^{-9}
2,4,6-Trinitrotoluene	50×10^{-9}	BD	BD	BD	64×10^{-9}	BD	BD
2-Nitronaphthalene	54×10^{-9}	13×10^{-9}	BD	3.7×10^{-9}	83×10^{-9}	BD	BD
N-Nitrosodiphenylamine	1500×10^{-9}	35×10^{-9}	BD	19×10^{-9}	27×10^{-9}	BD	0.14×10^{-9}
1,3,5-Trinitrobenzene	NA[c]	NA	BD	NA	5.3×10^{-9}	BD	BD
2-Nitrodiphenylamine	BD	NA	BD	BD	13×10^{-9}	BD	BD
4-Nitrophenol	0.69×10^{-6}	0.41×10^{-6}	BD	BD	NA	NA	NA
1-Nitropyrene	BD	20×10^{-9}	BD	NA	BD	BD	BD
Naphthalene	BD	1400×10^{-9}	BD	1500×10^{-9}	540×10^{-9}	19×10^{-9}	75×10^{-9}
Benz[a]anthracene	BD	BD	BD	38×10^{-9}	140×10^{-9}	BD	BD
Benzo[a]pyrene	900×10^{-9}	BD	BD	23×10^{-9}	81×10^{-9}	BD	BD
Pyrene	NA	NA	BD	71×10^{-9}	320×10^{-9}	BD	BD
Phenol	4400×10^{-9}	3800×10^{-9}	BD	8000×10^{-9}	---[d]	3.4×10^{-9}	1.5×10^{-9}
Dibenzofuran	0.26×10^{-6}	0.28×10^{-6}	BD	0.26×10^{-6}	120×10^{-6}	BD	BD
Diphenylamine	BD	BD	BD	20×10^{-9}	310×10^{-9}	0.11×10^{-9}	0.026×10^{-9}

[a]Emission factor--a dimentionless number that, when multiplied by the weight of explosive or propellant material, detonated or burned, results in the weight of analyte expected.
[b]BD - below detection limit.
[c]NA - not a target analyte.
[d]---Phenol was lost in the extraction of the semivolatile.

Table 6 Propellant Burns: Semivolatile Analytes Detected and Maximum Recovery in Fallout Pans (ng/g).

Analyte	Phase A	Manufacturing Residue		Phase C	
	Triple Base	Phase B	Phase C[a]	M-1	M-6
SEMIVOLATILE COMPOUNDS					
2,4-Dinitrotoluene	BD	700	58	900	410
2,6-Dinitrotoluene	BD	BD	7.9	36	BD
2,4,6-Trinitrotoluene	BD	BD	120	0.38	1.0
2-Nitronaphthalene	BD	BD	8.8	0.14	0.18
N-Nitrosodiphenylamine	BD	6.7	BD	BD	20
1,3,5-Trinitrobenzene	BD	BD	18	BD	0.009
2-Nitrodiphenylamine	BD	17	BD	0.29	1.1
4-Nitrophenol	BD	BD	NA[c]	NA	NA
1-Nitropyrene	BD	BD	BD	BD	0.009
Naphthalene	BD	390	34	5.5	9.6
Benz[a]anthracene	BD	BD	94	0.51	2.2
Benzo[a]pyrene	BD	BD	8.4	BD	1.1
Pyrene	BD	510	17	BD	0.36
Phenol	190,000	16	---[d]	BD	0.15
Dibenzofuran	BD	29	80	BD	53
Diphenylamine	BD	2.7	21	6.9	26
Ethyl centralite	96,000	NA	NA	NA	NA
Nitroglycerin	43,000	310	BD	NA	NA
Nitroguanidine	55,000	BD	NA	NA	NA

[a]represents ng of analyte per g of fallout material.
[b]BD - below detection limit.
[c]NA - not a target analyte.
[d]---Phenol was lost in the extraction of the semivolatile.

SECTION 1. INTRODUCTION

1.1 Demilitarization Stockpile Situation

1.1.1 Size, Storage, and Treatment

The military services possess a massive munitions demilitarization inventory which has reached 200,000 short tons and grows by 25,000 short tons annually, despite ongoing demilitarization operations. The stockpile's growth is expected to accelerate as an expected drawdown of U.S. forces in Europe begins and stocks in our European depots are retrograded. The ammunition logistics support network is presently experiencing several consequences. First, the storage capacity of depot igloo facilities has reached saturation, prompting the need for outdoor storage. Second, many munitions and propellants deteriorate with age and are subject to spontaneous detonation or ignition, with the attendant safety and environmental risks. As the triservice manager for demilitarization, the U.S. Army continues to cope with this problem, traditionally using open burning (OB) and open detonation (OD) thermal treatment procedures. OB and OD have historically proven to be the fastest, safest, most reliable, and least expensive of any demilitarization procedures within existing technology and are well understood by depot munitions specialists.

1.1.2 Environmental Issues and RCRA Permitting

Within the past several years, OB/OD operations have been faced with increasing restrictions. Part of these requirements include the need to obtain permits under provisions of the Resource Conservation and Recovery Act (RCRA), subpart X. Because of the absence of definitive data concerning explosive and propellant combustion products, especially trace organics, RCRA permits have been granted an interim status in many instances, and OB/OD activities closed in others. Unless permitted under RCRA subpart X prior to 8 November 1992, all OB/OD operating sites are subject to closure, and the armed forces may lose their only operating means of reducing a significant part of the demilitarization inventory. Additionally, ordnance manufacturing and processing facilities need OB/OD capabilities to treat their reactive waste streams. Without OB/OD data to support permit application evaluation, these permits will be in jeopardy.

1.1.3 Alternative Methods for Demilitarization

A number of alternative methods have been proposed for demilitarization operations. Some have proven environmentally unsound, e.g., washout which produces contaminated wastewater; others have a low thruput or are severely limited in the quantities or types of ordnance which can be treated; and some are exceedingly expensive or are not technologically mature. Most alternative methods being considered to replace OB/OD will not be operational for at least 5 to 7 years. Until these alternative methods are fully developed, tested, and permitted, stocks will grow to unmanageable proportions, unless OB/OD thermal treatment methods continue at an accelerated pace. It is estimated that OB/OD thermal treatment methods can safely and economically process a large part of the current inventory without serious impact to the environment. Once proven environmentally acceptable, OB/OD thermal treatment methods can work in concert with emerging alternative technologies, to solve the current and future demilitarization problems.

1.2 Background

1.2.1 Interim Study

In 1986, an interim field test was conducted at Tooele Army Depot (TEAD), Utah. The purpose of that test was to evaluate several new testing, sampling, and analysis procedures. A wide variety of material was detonated or burned, ranging from hand grenades to 227 kg (500-lb) bombs to artillery propellants. While most detonations were conducted on the surface, a limited number of buried detonations were conducted. The combustion products of these events were sampled by collectors for subsequent laboratory analyses or analyzed by real-time instruments mounted aboard a UH1-D helicopter. While some valuable data were collected on criteria gases, the real benefit of this test was the evaluation of equipment and procedures. The test revealed that the helicopter was unsuitable as an aerial sampling platform because of the vibration, engine vulnerability to airborne particulate matter, and inability to catch some fast-moving plumes. The test also demonstrated that existing assay technologies were not sufficiently refined to detect the very low levels of emittants desired by environmental regulators.

1.2.2 Symposium - Technical Steering Committee

1.2.2.1 In 1988, the U.S. Army Armament, Munitions and Chemical Command (AMCCOM) convened a technical symposium at Salt Lake City, Utah. This symposium drew internationally recognized authorities from the military services, U.S. Environmental Protection Agency (EPA), academia, not-for-profit organizations, and private enterprise. The symposium included representatives with expertise in analytical chemistry, sampling, modeling, explosives and propellants, statistical analysis, and quality assurance. The technical challenges of the earlier tests were reviewed, and alternate strategies and technologies for the next phases of the study were discussed (reference 1). A Technical Steering Committee (TSC) was formed from selected symposia participants, including the EPA. The initial product of the TSC was the list of target analytes from propellant, explosive, and pyrotechnic (PEP) combustion that were of foremost environmental interest.

1.2.3 The BangBox Test Series

The BangBox test provided the initial assessment of state-of-the-art technologies recommended by the TSC as candidates for use during field testing. These technologies highlighted supercritical fluid chromatography/mass spectrometry (SFC-MS), the carbon balance method for determining combustion product emission factors, micropolished stainless steel (SS) evacuated canisters and tanks for collecting air samples believed to contain volatile organic compounds, a sophisticated reflux-extraction process used to extract volatile organic compounds from the SS tanks/canisters, a high-volume sampling train to trap semivolatile organic compounds, and a fixed-wing aircraft (FWAC) package of real-time analyzers, samplers, and collectors.

1.2.3.1 Test Facility

1.2.3.1.1 The test facility selected to test the samplers, collectors, and real-time analyzers was an inflatable building located at Kirtland Air Force Base, Albuquerque, New Mexico. The facility is operated by the Sandia National Laboratories (SNL) and is known as the BangBox (BB). The flexible nature of the building permitted enclosed detonations of small quantities of explosives (227 g (0.5 lb)) and burns of small quantities of propellants (454 g (1.0 lb)) without violating

structural integrity and allowed any combustion products to be sampled for an extended period of time. Equipment used in the BB was that proposed by the TSC.

1.2.3.1.2 As a permanent fixed facility, the BB facilitated the accurate characterization of combustion products. Test personnel were able to calculate the BB volume and determine background levels of species targeted for individual subtests. Since its size was determined, it permitted precise comparison of the carbon-balance method to the more traditional cloud volume method in calculating emission factors.

1.2.3.1.3 The building was serviced with water and electricity. This permitted technicians to clean the test chamber and prevent cross-contamination between subtests, operate all collection and analytical equipment, and document events with high-speed motion picture cameras and video recorders.

1.2.3.2 Test Results

1.2.3.2.1 The highly satisfactory results of the test were published in a final report (reference 3). In addition to providing data on emission products, several important conclusions were drawn.

a. Those sampling, collecting, and analyzing systems selected for subsequent use are capable of providing complete and accurate data. The semivolatile organic sampling train could not be used for field testing because the throughput was much to low for the short duration of sampling the cloud.

b. Trace organic compounds can be accurately and consistently identified and quantified by the SFC-MS. This was confirmed by spiked samples submitted by the EPA's Atmospheric Research and Exposure Assessment Laboratory and analyzed by the chromatography laboratory.

c. The carbon-balance method performed better than the cloud volume method for calculating emission factors (EF) using samples of homogeneous and nonhomogeneous chamber air.

SECTION 2 SCOPE OF TEST

2.1 Overall Test Program (See Appendix K)

2.1.1 Purpose

Although the individual tests each had their own specific purpose and objectives, the broad overall program purpose is to supply waste characterization data for OB/OD permit applications under RCRA subpart X.

2.1.2 Objectives

2.1.2.1 Identify and validate sampling and analytical technology, instrumentation, and procedures needed to provide RCRA subpart X data characterization.

2.1.2.2 Identify and quantify emissions and residues produced by OB/OD thermal treatment methods.

2.1.2.3 Provide input for development and validation of an OB/OD dispersion model.

2.1.2.4 Identify specific items that can be treated by OB/OD thermal treatment methods without adverse environmental impact.

2.2 BangBox Test

2.2.1 Purpose

The OB/OD BB test series was designed to develop and verify the OB/OD thermal treatment method test methods and technology.

2.2.2 Objectives

2.2.2.1 Characterize the BB chamber volume, ventilation rate, and combustion product cloud homogeneity level.

2.2.2.2 Develop and improve proposed air sampling equipment and sample analysis procedures to be used in later phases on the FWAC, for sampling product clouds from large-scale follow-on outdoor OB/OD trials.

2.2.2.3 Refine, standardize, and compare supercritical-fluid chromatography (SFC) and gas chromatography (GC) techniques for extracting and analyzing resins, filters, and soils for trace quantities of semivolatile organic OB/OD combustion products and residues, using mass spectrometer (MS) detectors.

2.2.2.4 Verify adequacy of other standard analytical methods to be used for analyses of gases, particulates, volatile organic compounds, metals, and nonmetals.

2.2.2.5 Identify and quantify specific target analytes for TNT, a double-base propellant, and a composite propellant.

2.2.2.6 Assess polychlorinated dibenzodioxins (PCDDs) and dibenzofurans (PCDFs) levels generated from burning the composite propellant containing high concentration of NH_4ClO_4.

2.2.2.7 Provide information on the morphology, composition, and size distributions of airborne particulate material generated by OB/OD operations in the BB.

2.2.2.8 Examine, using data produced under controlled conditions, the validity of the proposed Carbon Balance method of calculating emission factors; compare the results with those calculated using the more-conventional Cloud Volume times Concentration method.

2.2.2.9 Identify or develop appropriate program-specific QA/QC procedures.

2.2.2.10 Establish procedures for transport and storage of sample specimens.

2.2.3 Test Matrix

Table 2.1 BangBox Test Schedule

Subtest	Date Conducted
Homogeneity and chamber volume	1 Dec 88
Ventilation rate	5 Dec 88
Equipment and procedure selection	7 Dec 88
Single detonation - 1	31 Jan 89
Single detonation - 2	2 Feb 89
Single detonation - 3	6 Feb 89
Extended background sampling	7 Feb 89
Multiple detonation	8 Feb 89
Double-base propellant burn	9 Feb 89
Foam-attenuated detonation	13 Feb 89
Multiple-tank sampling	15 Feb 89
Composite propellant burn	16 Feb 89

2.3 Field Test Phase A

2.3.1 Purpose

Phase A was designed to be an operational readiness inspection (ORI) conducted under conditions expected during further testing, to verify the field suitability of instruments and procedures selected pursuant to the BangBox test.

2.3.2 Objectives

2.3.2.1 Evaluate the performance of the instrumented FWAC as a sampling platform during large-scale field OB/OD tests.

2.3.2.2 Determine if target species can be adequately sampled and measured above background levels.

2.3.2.3 Evaluate the utility of the carbon-balance method in the field testing environment.

2.3.2.4 Evaluate soil sampling, handling, and assay procedures (e.g. SFC-MS) for field OB/OD tests.

2.3.3 Test Matrix

Table 2.2 Field Test Phase A Test Matrix.

Date (mo-day-yr)	Trial Number[a]	OB or OD Time (MDT)	Amount Fuel (kg-lb)	Length Burn (s)	Comment
06-13-89	M30-OB-O-P1	13:23:00	1424-3140	19	No primer used
	M30-OB-O-P2	15:44:40	1597-3520	17	
06-14-89	M30-OB-1-P1	10:07:19	3144-6980	21	1.4 kg (3.0 lb) M3A1 propellant used as primer
	M30-OB-1-P2	10:20:58	3193-7040	20	
06-20-89	TNT-ODS-O-A	14:28:46	921-2030	NA[b]	Bulk 32-kg (70-lb) blocks
	TNT-ODS-O-B	14:55:24			
06-21-89	TNT-ODS-1-V	09:58:52	898-1980		Flake material
	TNT-ODS-1-II	10:12:12			
	TNT-ODS-1-III	10:22:42			
	TNT-ODS-1-IV	10:43:46			
	TNT-ODS-1-I	10:54:18			

[a]Abbreviations used within trial number:
Group 1 Fuel used.
M30 - Triple-base propellant.
TNT - 2,4,6-trinitrotoluene.
Group 2 Type of trial.
OB - Open burning.
ODS - Open detonation - surface.
Group 3 Trial number.
O - Operational readiness inspection.
1 - Trial number.
Group 4 Site number.
P1, P2 - Burn site number.
A, B, I, II, etc - Detonation site number.
[b]NA - not applicable.

2.4 Field Test Phase B

2.4.1 Purpose

Field Test Phase B was conducted to confirm selections of instruments and procedures made as a result of Phase A, and to determine if there is a relationship between the BB test data and the field test data.

2.4.2 Objectives

2.4.2.1 Sample and analyze the combustion products of large-scale OB/OD operations which were conducted in a manner representing treatment site practices.

2.4.2.2 Sample and analyze the combustion products of large-scale OB/OD operations which were conducted from suspended detonations.

2.4.2.3 Determine if the field test detonation data can be related to the BB test detonation data.

2.4.2.4 Provide the foundation for establishing a database on TNT and selected propellant combustion products.

2.4.3. Test Matrix

Table 2.3 Field Test Phase B Test Matrix.

Date (mo-day-yr)	Trial Number[a]	OB or OD Time (MDT)	Amount Fuel (kg-lb)	Length Burn (s)	Comment[b]
10-16-89	TNT-ODS-O-1	14:44:00	904-1998	NA[c]	1.8 kg (4.0 lb) of TNT used as primer.
10-17-89	TNT-ODS-1-4	12:41:32			
	TNT-ODS-1-6	12:55:36			
	TNT-ODS-1-2	13:13:04			
10-18-89	TNT-ODS-2-5	11:56:00			
	TNT-ODS-2-3	12:13:00			
	TNT-ODS-2-7	12:28:50			
10-19-89	BMR-OB-0-P1	14:03:27	3017-6652	173	ABL casting powder used as primer.
10-25-89	BMR-OB-1-P1	09:26:00	2993-6598	180	Smokeless powder used as primer.
	BMR-OB-1-P2	09:37:00	3000-6614	240	
	TNT-ODA-O-0	11:13:00	907-2000	NA	1.8 kg (4.0 lb) of TNT used as primer.
10-31-89	TNT-ODA-1-3	10:48:58	909-2004		
	TNT-ODA-1-5	11:02:00			
	TNT-ODA-1-1	11:17:00			
	TNT-ODA-2-4	14:55:00			
	TNT-ODA-2-2	15:09:00			
	TNT-ODA-2-6	15:23:00			

[a]Abbreviation used within trial number:

Group 1 Fuel used.
- TNT - 2,4,6-Trinitrotoluene.
- BMR - Propellant manufacturing residue.

Group 2 Type of trial.
- ODS - Open detonation - surface.
- OB - Open burning.
- ODA - Open detonation - suspended.

Group3 Trial number.
- O - Operational readiness inspection.
- 1, 2 - Trial number.

Group 4 Site number.
- P1, P2 - Burn site number.
- 0,1,etc - Detonation site number.

[b]Primer in addition to fuel amount.

[c]NA - not applicable.

2.5 Field Test Phase C

2.5.1 Purpose

Field Test Phase C was conducted to supplement the developing database on TNT and selected propellant combustion products, and to include additional explosives and propellants in the test program.

2.5.2 Objectives

2.5.2.1 Conduct additional TNT detonations to facilitate relating BB test results to field test results.

2.5.2.2 Conduct additional TNT test to establish the reproducibility (between test precision) of TNT OD emissions.

2.5.2.3 Sample and analyze the explosive decomposition products of composition B (comp B) explosive.

2.5.2.4 Sample and analyze the explosive decomposition products of explosive D.

2.5.2.5 Sample and analyze the explosive decomposition products of RDX explosive.

2.5.2.6 Sample and analyze the combustion products of M1 and M6 single-base propellants.

2.5.2.7 Sample and analyze the combustion products of propellant manufacturing residue.

2.5.3 Test Matrix

Table 2.4a Field Test Phase C Test Matrix.

Date (mo-day-yr)	Trial Number[a]	OB or OD Time (MDT)	Amount Fuel (kg-lb)	Length Burn (s)	Comment[b]
08-07-90	TNT-ODS-1-C5	11:41:00	900-1984	NA[c]	1.8 kg (4.0 lb) TNT as primer.
08-08-90	EXD-ODS-O-A0	10:05:53	839-1850		9.1 kg (20 lb) of C4 used as primer.
	TNT-ODS-O-SB	11:36:12	680-1500		1.8 kg (4.0 lb) TNT as primer.
08-09-90	TNT-ODA-1-OA	09:14:21	895-1974		
	TNT-ODA-1-OC	09:26:57			
	TNT-ODA-1-OB	09:41:55			
	TNT-ODS-1-C1	12:53:56	900-1984		
	TNT-ODS-1-C3	13:12:53			
	TNT-ODS-1-CO	15:38:00			
08-13-90	TNT-ODS-2-C6	11:07:53	895-1974		
	TNT-ODS-2-C4	11:24:10			
	TNT-ODS-2-C2	11:35:18			
08-14-90	BMR-OB-1-P1	09:42:30	2253-4968	66	0.23 kg (0.5 lb) Unique® powder as primer.
	BMR-OB-1-P2	09:54:55	2184-4814	63	
	EXD-ODS-1-A6	12:28:30	916-2020	NA	9.1 kg (20 lb) of C4 used as primer.
	EXD-ODS-1-A2	12:41:55			
	EXD-ODS-1-A4	12:54:30			

[a]Abbreviations used within trial number:

Group 1 Fuel used.
- TNT - 2,4,6-Trinitrotoluene.
- EXD - Explosive D.
- BMR - Propellant manufacturing residue.

Group 2 Type of trial.
- ODS - Open detonation - surface.
- ODA - Open detonation - suspended.
- OB - Open burning.

Group 3 Trial number.
- O - Operation readiness inspection.
- 1, 2 - Trial number.

Group 4 Site number.
- C5,A0,etc - Detonation site number.
- P1, P2 - Burn site number.

[b]Primer amount in addition to fuel amount.

[c]NA - not applicable.

Table 2.4b Field Test Phase C Test Matrix.

Date (mo-day-yr)	Trial Number[a]	OB or OD Time (MDT)	Amount Fuel (kg-lb)	Length Burn (s)	Comment[b]
08-15-90	BMR-OB-2-P1	08:31:04	2218-4890	67	0.23 kg (0.5 lb) Unique® powder + 1.35 kg (3.0 lb) M2 propellant primers/P1 and P2.
	BMR-OB-2-P2	08:47:57	2218-4890	68	
	EXD-ODS-2-A1	10:52:00	916-2020	NA[c]	9.1 kg (20 lb) C4 as primer.
	EXD-ODS-2-A5	11:03:35			
	EXD-ODS-2-A3	11:24:28			
08-16-90	RDX-ODS-1-D1	09:17:45	871-1920		1.8 kg (4 lb) TNT primer.
	RDX-ODS-1-D5	09:32:55	875-1930		2.27 kg (5.0 lb) C4 primer.
	RDX-ODS-1-D3	09:46:10	880-1940		
	RDX-ODS-2-D6	13:06:35			
	RDX-ODS-2-D2	13:20:45	899-1982		
	RDX-ODS-2-D4	13:42:10	880-1940		
08-27-90	CMB-ODS-1-B1	13:19:20	907-2000		
	CMB-ODS-1-B5	13:35:30			
	BM6-OB-1-P1	15:17:25	3184-7020	ND[d]	1.35 kg (3.0 lb) M1 propellant primer
	BM6-OB-1-P2	15:26:40		17	
	BM6-OB-1-P3	15:38:00		12	
08-28-90	BM6-OB-2-P1	12:04:20		12	
	BM6-OB-2-P2	12:15:20		13	
	BM6-OB-2-P3	12:25:35		13	

[a]Abbreviations used within trial number:

Group 1 Fuel used.
- BMR - Propellant manufacturing residue.
- EXD - Explosive D.
- RDX - 1,3,5-trinitrohexahydro-1,3,5-triazine.
- CMB - Composition B.
- BM6 - M6 propellant.

Group 2 Type of trial.
- OB - Open burning.
- ODS - Open detonation - surface.

Group 3 Trial number.
- 1, 2 - Trial number.

Group 4 Site number.
- P1, P2 - Burn site number.
- A1,A5,etc - Detonation site number.

[b]Primer amount in addition to fuel amount.
[c]NA - not applicable.
[d]ND - no data.

Table 2.4c OB/OD Phase C Test Matrix.

Date (mo-day-yr)	Trail Number[a]	OB or OD Time (MDT)	Amount Fuel (kg-lb)	Length Burn (s)	Comment[b]
08-29-90	BM6-OB-3-P1	09:32:00	3184-7020	18	1.35 kg (3.0 lb) M1 propellant as primer.
	BM6-OB-3-P2	09:44:00		17	
	BM6-OB-3-P3	09:58:00		21	
08-30-90	BM6-OB-4-P1	10:32:30	3320-7320	14	1.35 kg (3.0 lb) M1 propellant as primer.
	BM6-OB-4-P2	10:48:10		12	
	BM6-OB-4-P3	11:01:20		12	
09-05-90	BM1-OB-1-P2	11:38:15	3159-6965	17	0.23 kg (0.5 lb) of Unique® powder as primer.
	BM1-OB-1-P1	11:52:25		16	
	BM1-OB-1-P3	12:03:50		16	
09-06-90	BM1-OB-2-P1	12:14:00		19	
	BM1-OB-2-P2	12:28:01		17	
	BM1-OB-2-P3	12:40:00		16	
09-18-90	CMB-ODS-1-B0	10:46:05	907-2000	NA[c]	2.27 kg (5.0 lb) C4 as primer.
	CMB-ODS-1-B3	11:04:00	916-2020		
	CMB-ODS-1-D0	11:18:30	907-2000		
	CMB-ODS-2-B6	15:17:50			
	CMB-ODS-2-B2	15:31:05			
	CMB-ODS-2-B4	15:46:20			

[a]Abbreviations used within trial number:

Group 1 Fuel used.
- BM6 - M6 propellant.
- BM1 - M1 propellant.
- CMB - Composition B.

Group 2 Type of trial.
- OB - Open burning.
- ODS - Open detonation - surface.

Group 3 Trial number.
- 1,2,3,4 - Trial number.

Group 4 Site number.
- P1,P2,P3 - Burn site number.
- B0,B3,etc - Detonation site number.

[b]Primer amount in addition to fuel amount.

[c]NA - not applicable.

SECTION 3. SPECIFICATIONS

3.1 Description of Facilities/Site

3.1.1 BangBox

The BB consists of two major segments: a test chamber and an airlock (Fig. 3.1). The test chamber is a 16-meter diameter hemisphere constructed of plastic-coated nylon fabric, which is supported on a concrete pad by blower-injected air. The chamber volume is maintained at approximately 927 m^3 by adjusting a damper through which air is provided by the blower. The airlock is constructed of wood and is connected directly to the chamber. Passage to the chamber is through a power-operated garage door, which is closed during testing. Airlock doors to the outside atmosphere are airtight, so that chamber pressure can be maintained when the airlock access door is open. Both the airlock and the chamber have electric service, and the chamber has water connections. Figures 3.2 and 3.3 schematically show test chamber and airlock instrumentation, respectively.

3.1.2 DPG Test Grids

DPG was selected for the test location as a result of its available manpower experience in OB/OD operations, the availability of Michael Army Air Field (MAAF) as a staging area for instrumented aircraft, and the availability of munitions at nearby TEAD. DPG is located in the Great Basin, 129 km (80 mi) southwest of Salt Lake City at an altitude of about 1325 m (4347 ft) above mean sea level. The terrain is similar to that encountered in much of the Great Basin region of the western United States, with large expanses of relatively flat terrain interrupted by occasional rugged mountainous regions. The only conspicuous terrain feature in the immediate vicinity of the test grid (Fig. 3.4) is a mountainous area to the northwest, known as Granite Peak.

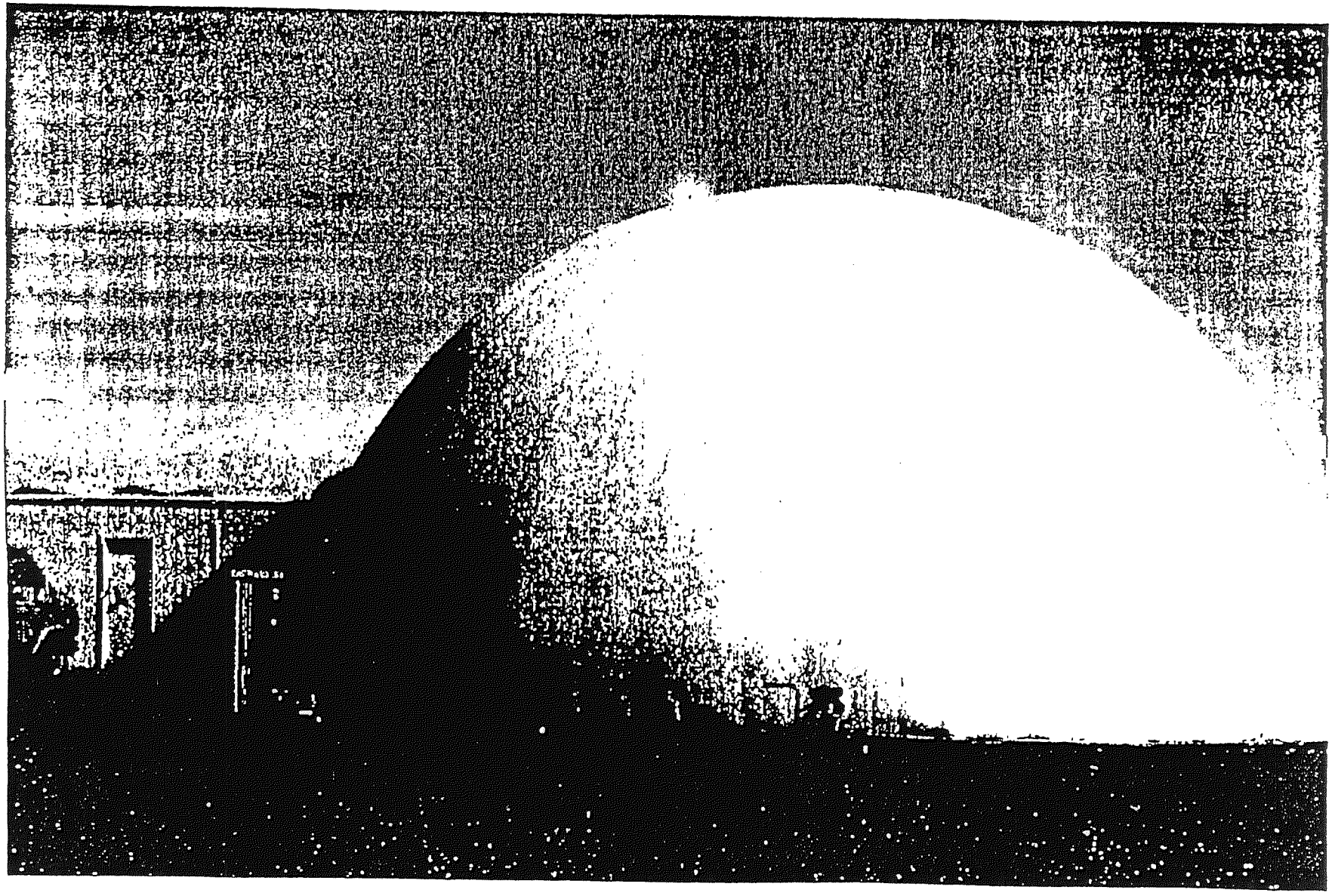

Figure 3.1 SNL BangBox Test Facility Containing Sampling and Real-Time Analysis Equipment.

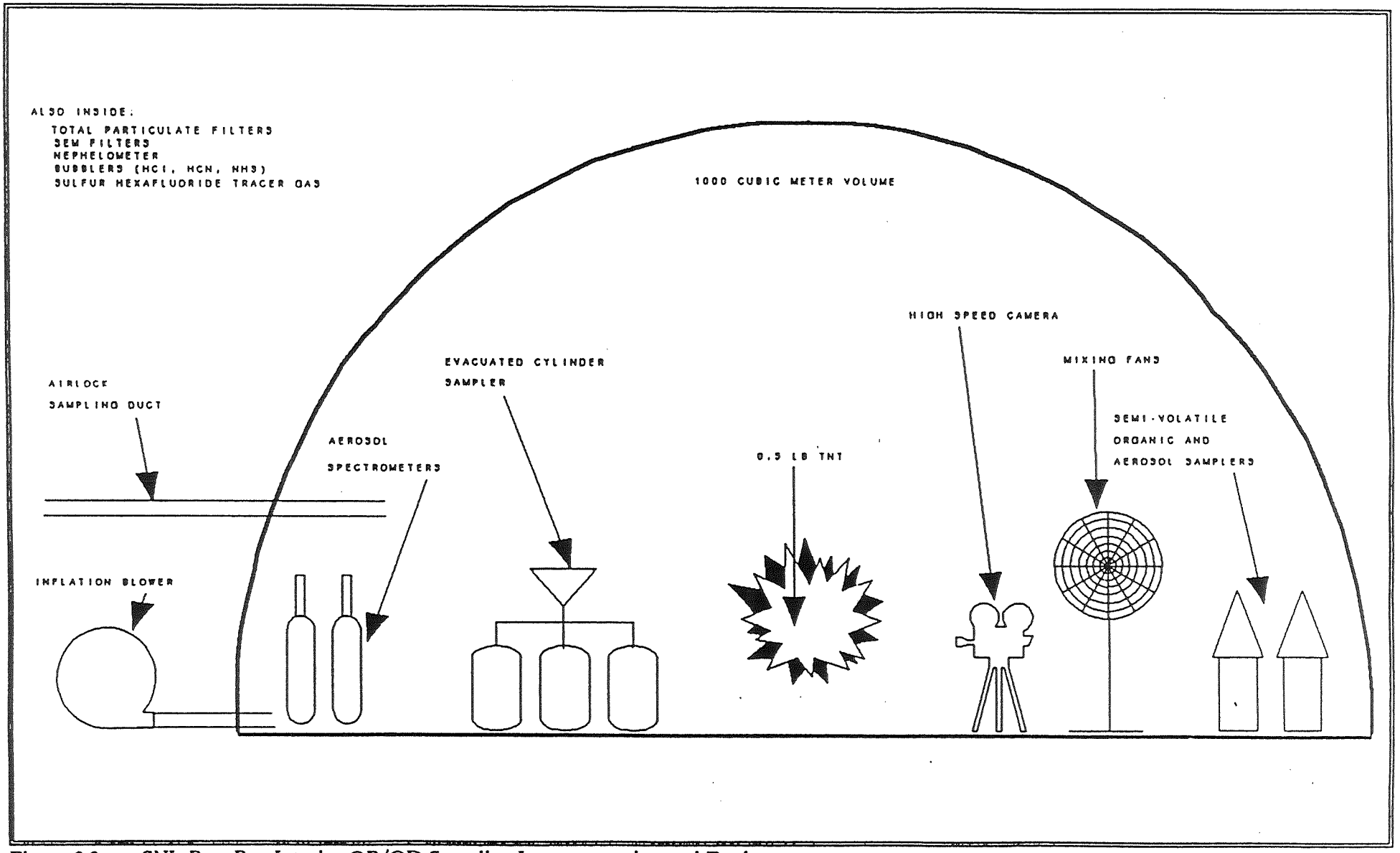

Figure 3.2 SNL BangBox Interior OB/OD Sampling Instrumentation and Equipment.

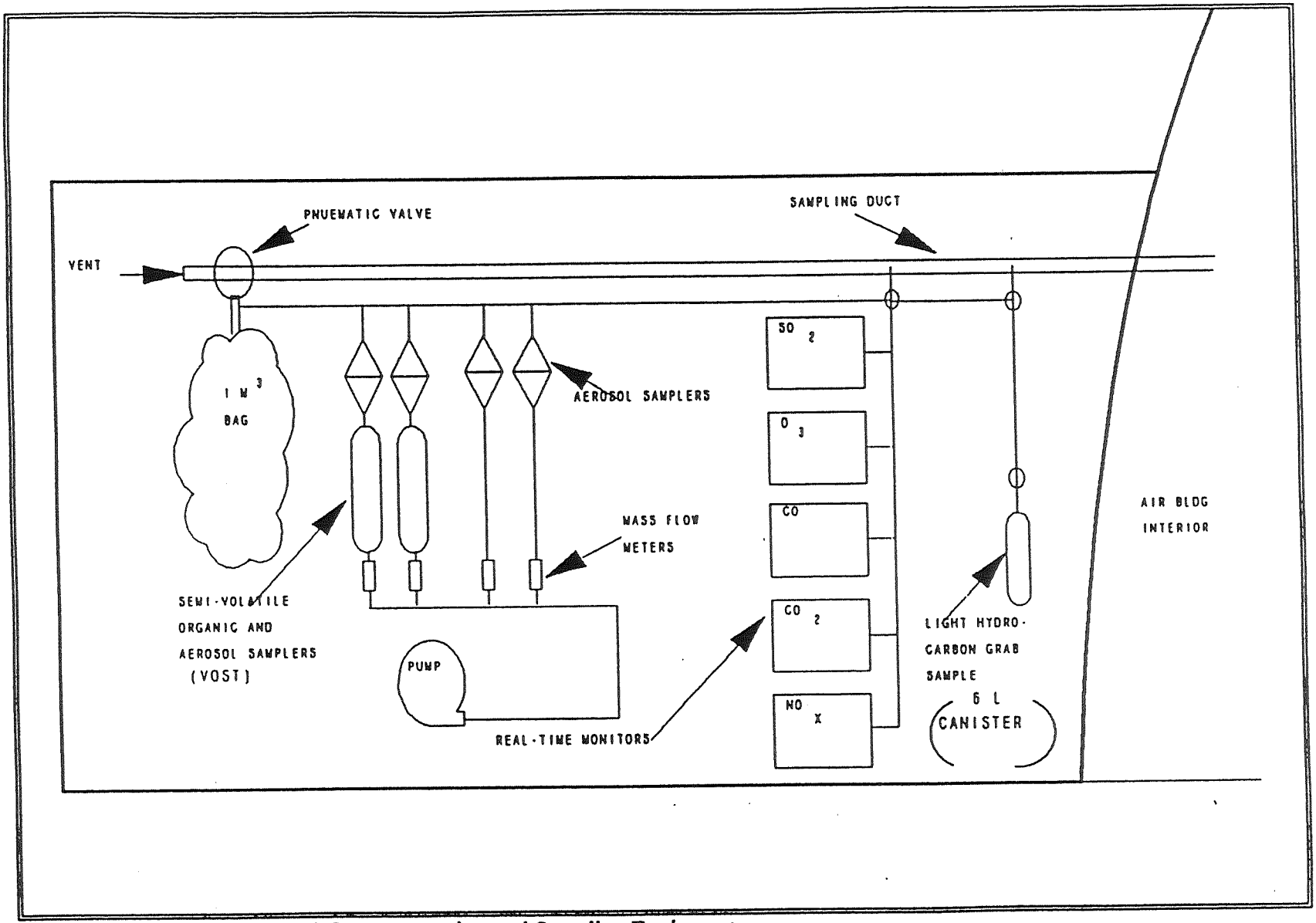

Figure 3.3 BangBox Airlock Instrumentation and Sampling Equipment.

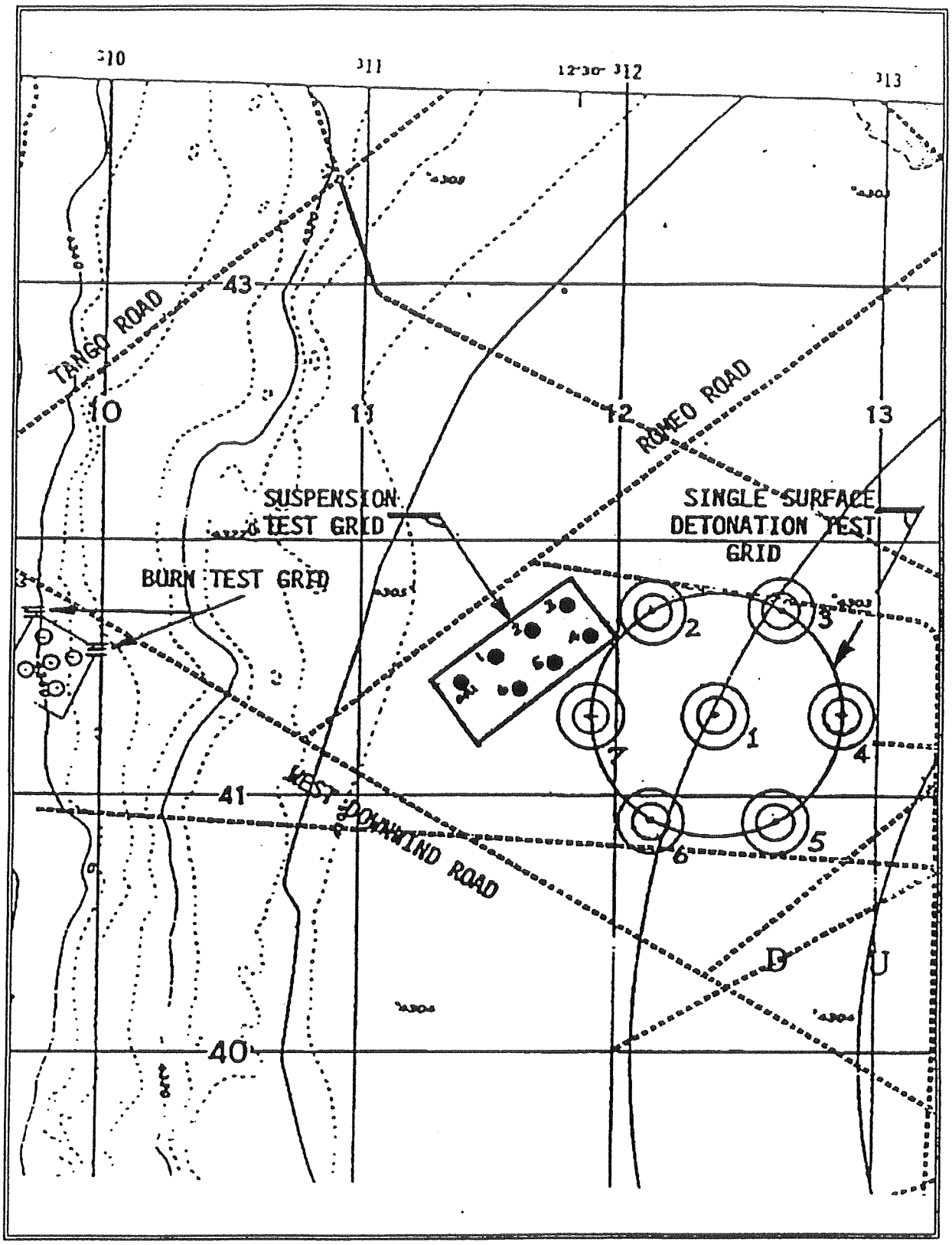

Figure 3.4 OB/OD Test Grid Location.

3.1.2.1 Field Test Phase A

The test grid for the triple-base propellant burn was located in an area southwest of the intersections of Tango Road and Romeo Road with West Downwind Road. The TNT detonations were located east of the intersection of Romeo Road and West Downwind Road. This is approximately 15 km (9 mi) from MAAF. The grid was 300 m^2 (3228 ft^2) with sampler positions for TNT located at coordinate points located 50 m (164 ft) apart. Surface soil was sampled at each fallout sampler pan location (Fig. 3.5). The detonation points and burn sites are shown in Figure 3.4.

3.1.2.2 Field Test Phase B

The test grid, with areas designated for the surface detonations, suspended detonations, and propellant burns is shown in Figure 3.4.

3.1.2.2.1 The location relationship of the seven single TNT surface detonation sites is shown in Figure 3.6. Two pretest core samples were taken within 1 m (3.3 ft) of each other to a depth of 2.1 m (7 ft) at the center of each of the seven detonation sites. The layout of the 1 m^2 (10.8 ft^2) fallout pan samples at each of these sites is shown in Figure 3.7. The sampling on the 150 and 200 m (492 and 656 ft) sampling rings was deleted after the ORI test, because quantities of fallout material too small to be useful were collected at these distances during the ORI. However, sampling on the 150- and 200-meter rings was reinstituted in phase C because the concentrations of pollutants in the more distant rings were higher, even though the quantities of fallout were smaller than for the rings at 50 and 100 meters.

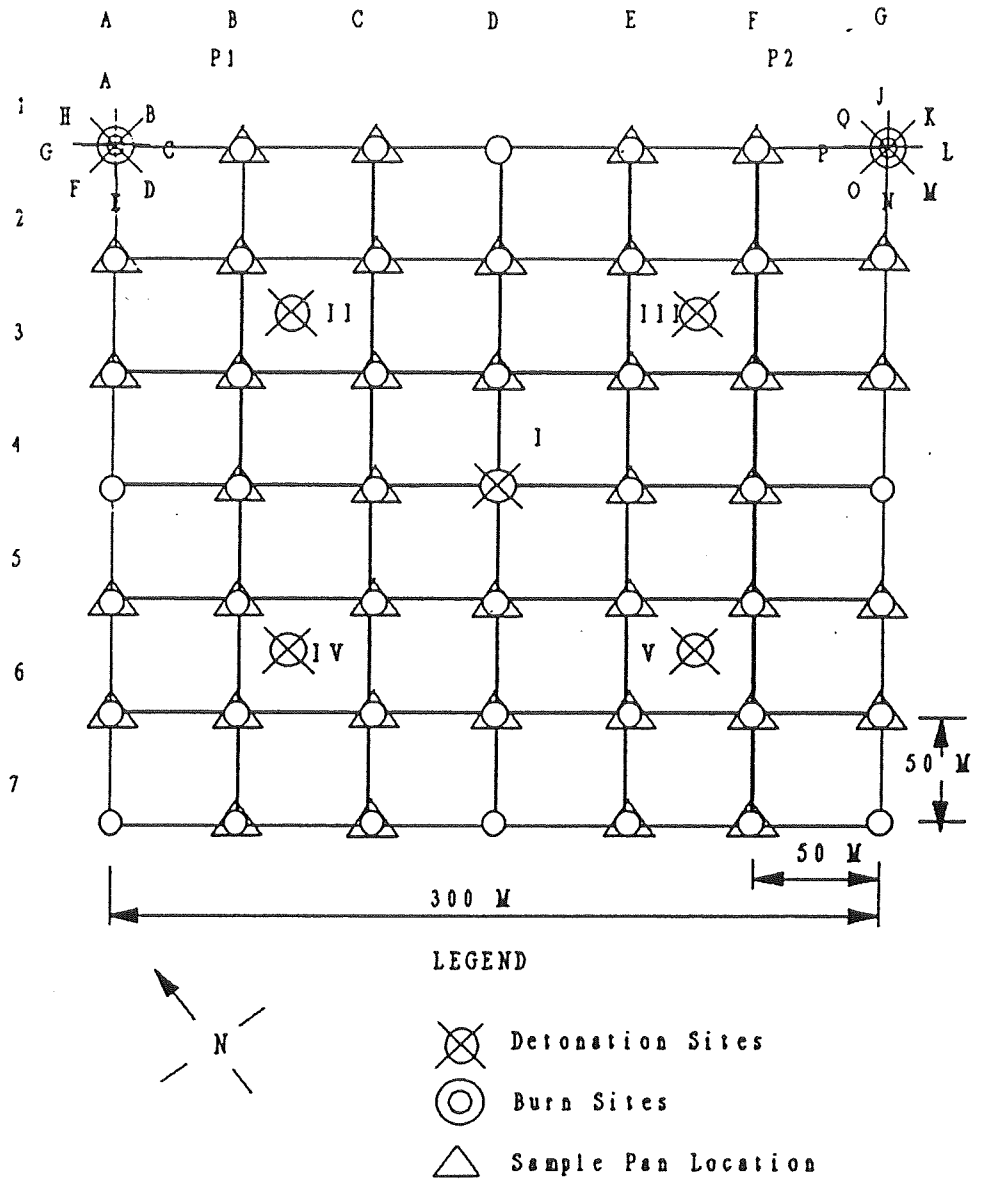

Figure 3.5 OB/OD Phase A Soil and Fallout Sampling Location.

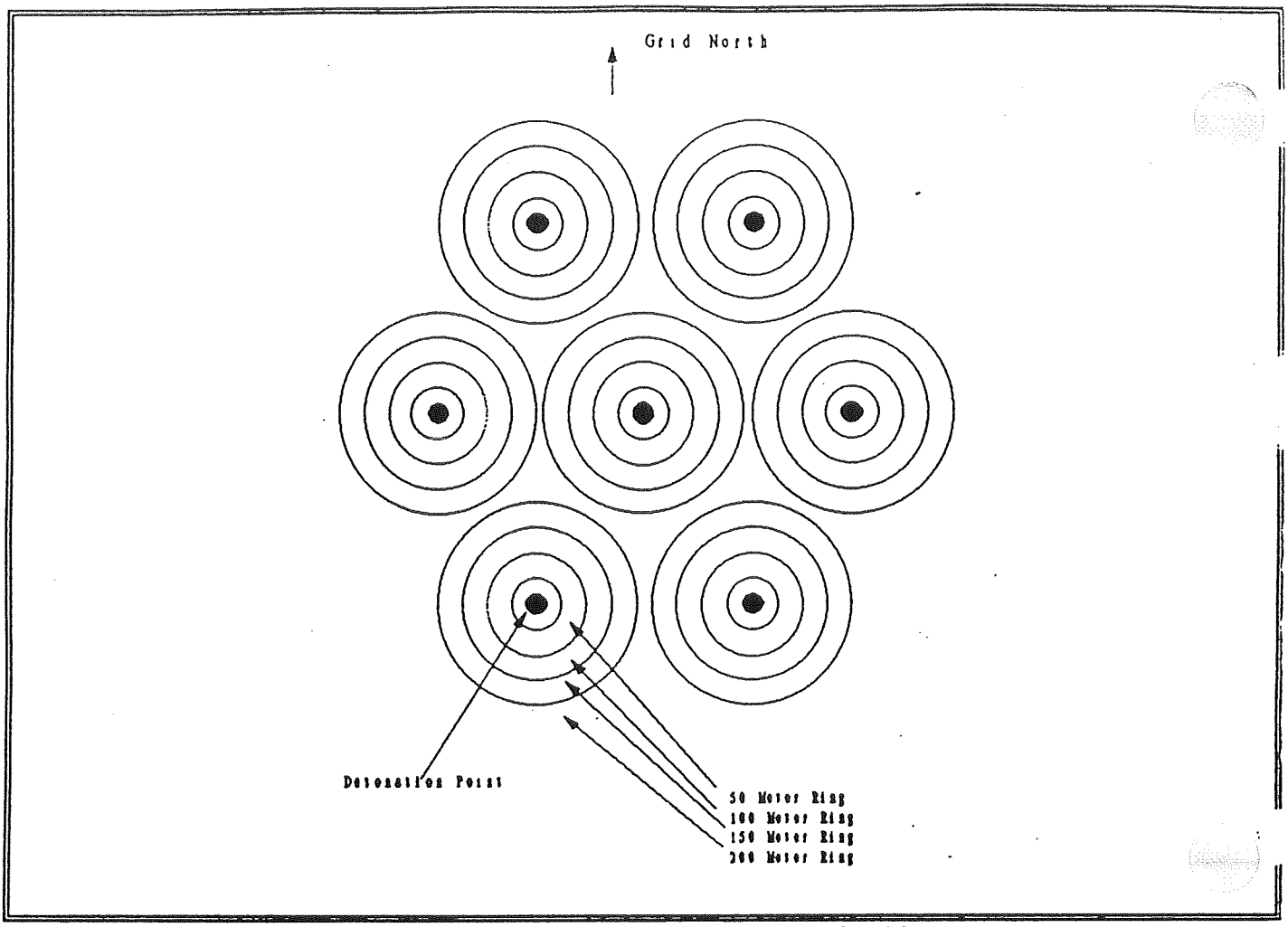

Figure 3.6 OB/OD Phase B Surface TNT Detonation Location Relationships.

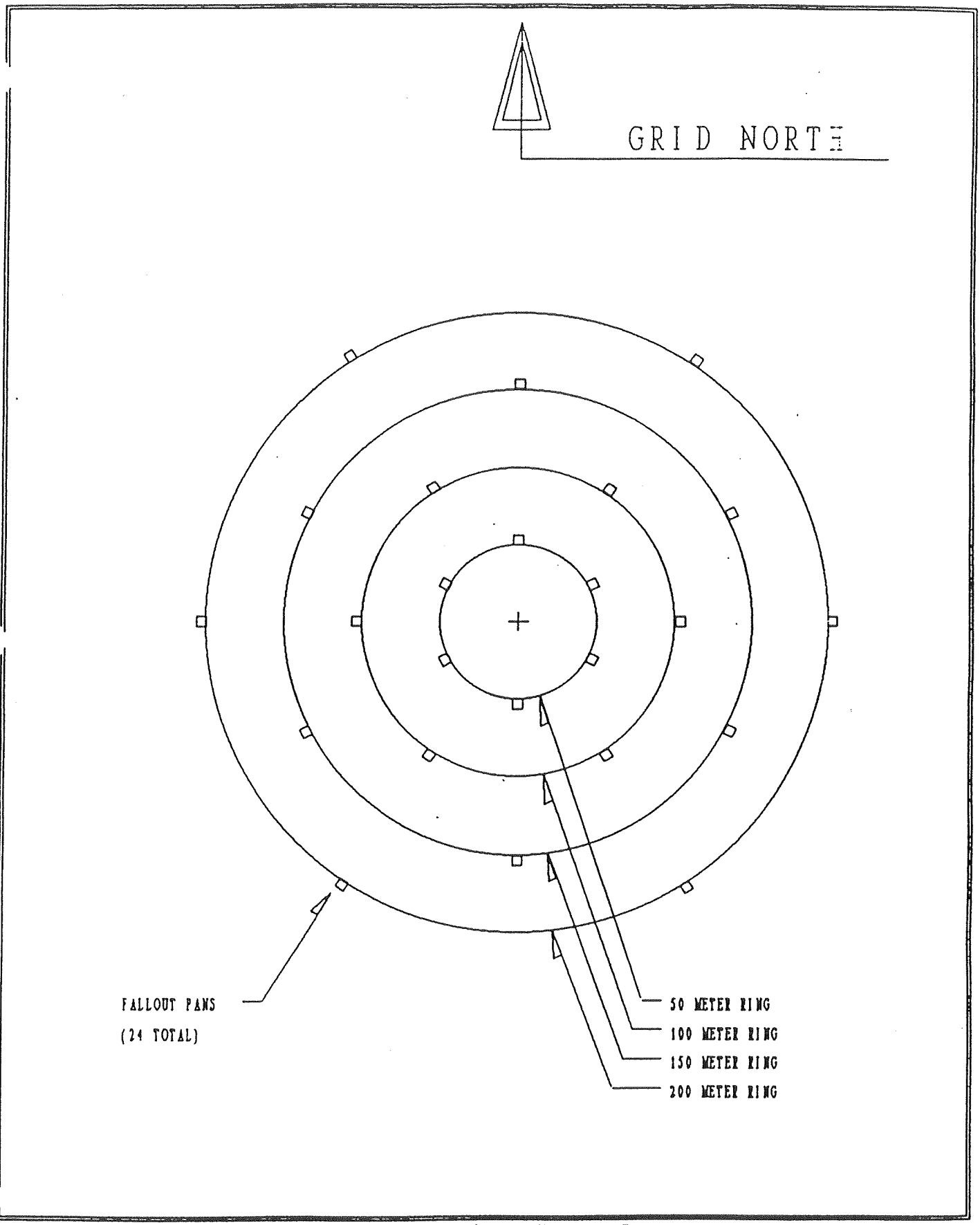

Figure 3.7 OB/OD Phase B Surface TNT Detonations Fallout Pan Layout.

3.1.2.2.2 Posttest samples of the crater and ejecta were taken as follows:

a. Center of the crater (one sample).

b. Three meters (9.8 ft) from the center of the crater on four diagonal lines established at 45-degree intervals from grid north (four samples).

c. One meter (3.3 ft) from the rim of the crater on the diagonal lines (four samples).

d. Four meters (13.1 ft) from the rim of the crater on the diagonal lines (four samples).

3.1.2.2.3 The sites for the seven single TNT suspended detonations are shown in Figure 3.4. The locations of the pretest and posttest sampling for a typical site are shown in Figure 3.8. This figure also shows the suspension pole locations. The 907 kg (2000 lb) of TNT was suspended approximately 12 meters (40 ft) above the ground, centered between the two poles.

3.1.2.2.4 The locations at a burn site of the 1 m^2 sputter pans and fallout pan samples are shown in Figure 3.9. Three burn pans were located at each site, each pan 1.2-m (4-ft) wide by 11-m (36-ft) long, and 0.3-m (1-ft) deep. All three pans of propellant at each site were ignited simultaneously.

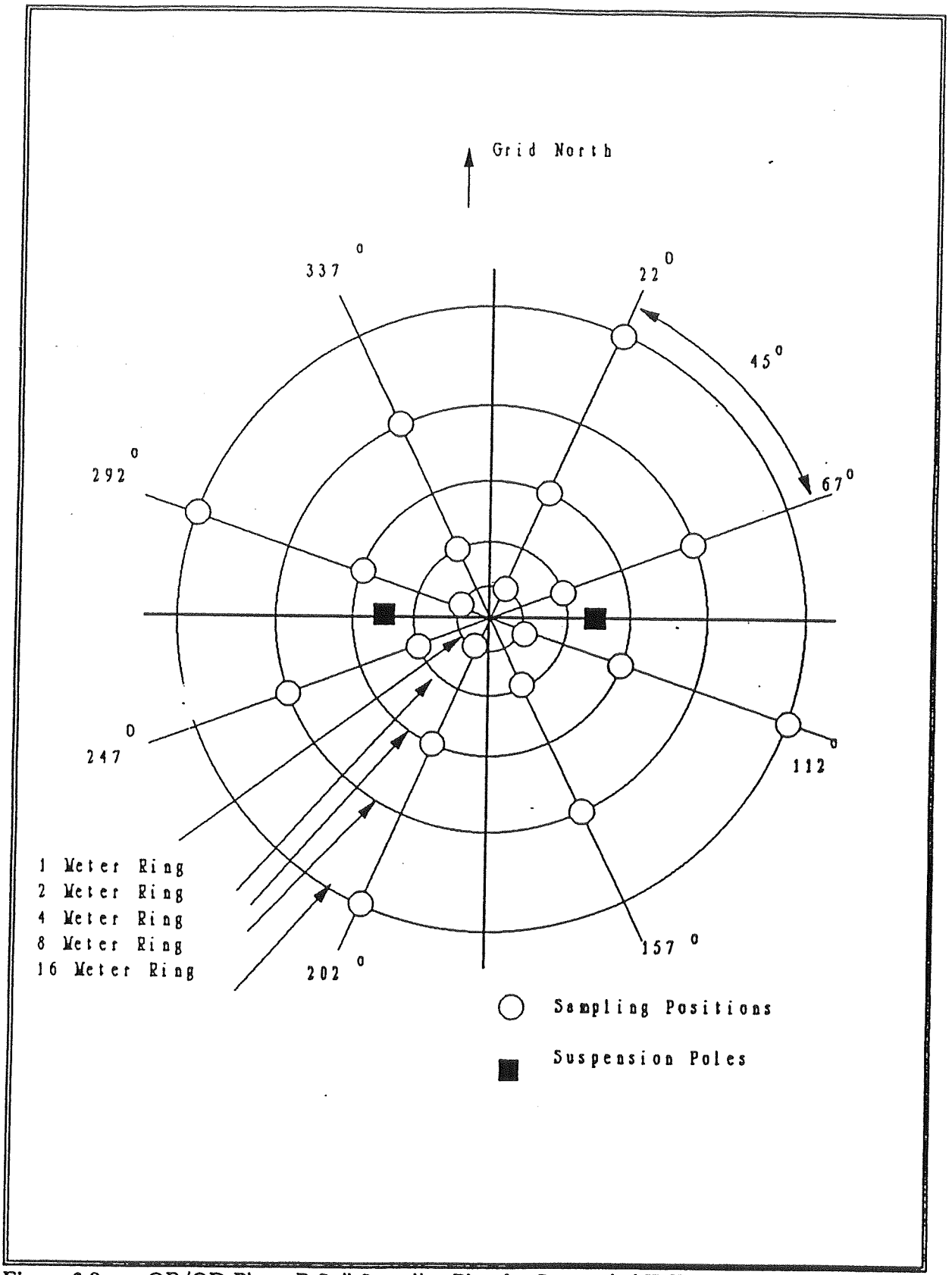

Figure 3.8 OB/OD Phase B Soil Sampling Plan for Suspended TNT Detonations.

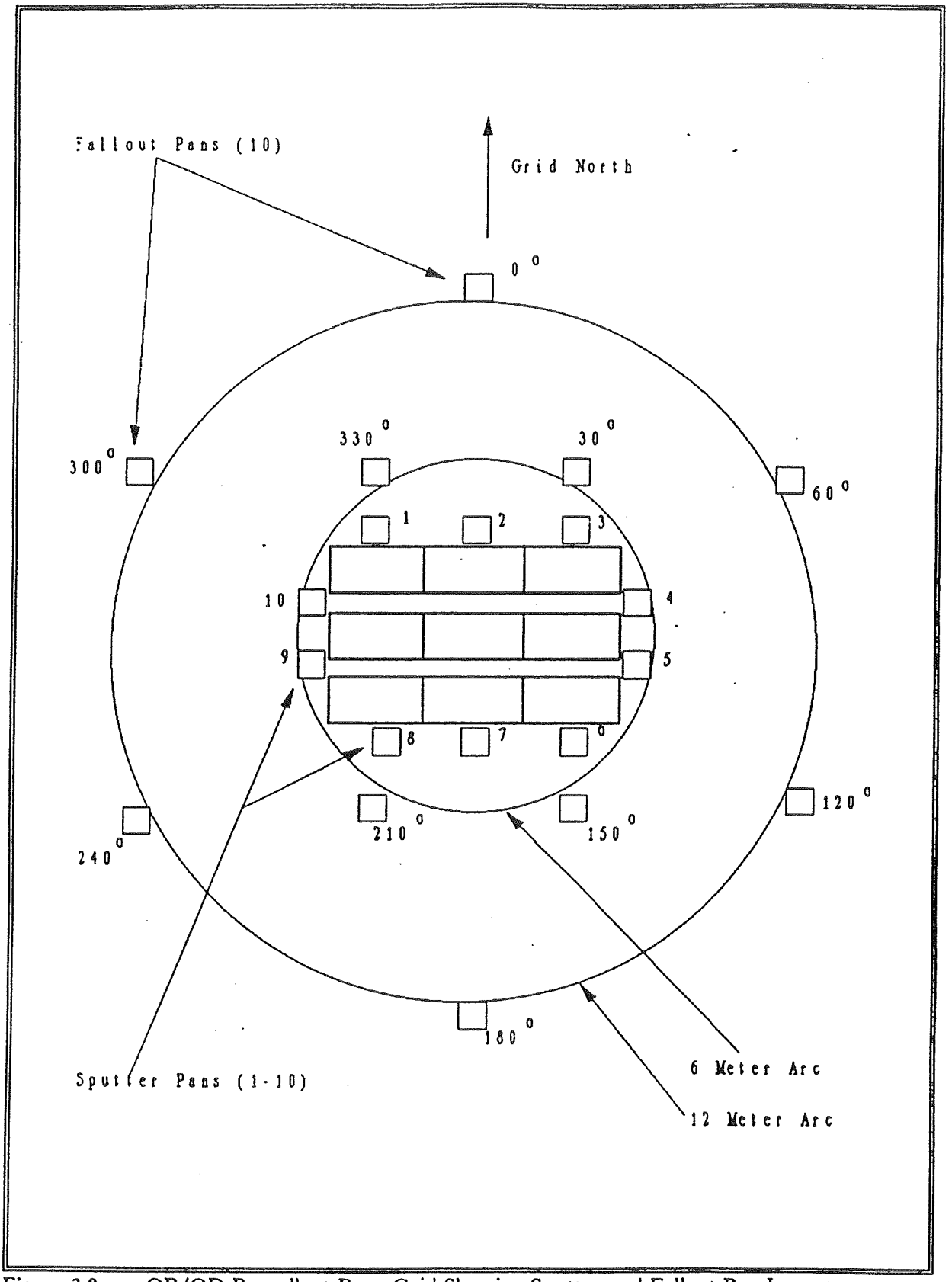

Figure 3.9 OB/OD Propellant Burn Grid Showing Sputter and Fallout Pan Layout.

3.1.2.3 Field Test Phase C.

The test grids for the Phase C trials are shown in Figure 3.10. Surface explosive detonation sites A, B, C, and D were used, respectively, for explosive D, composition B, TNT, and RDX. Only TNT was used at the suspended (aerial) detonation site (Fig 3.10).

3.1.2.3.1 The seven single detonation sites which are in a surface explosive detonation site are shown in Figure 3.11. The fallout pan sampler layout for one of these sites is shown in Figure 3.12.

a. Pretest samples were taken to a depth of 15 cm (6 in), using a 5-cm diameter (2-in) core sampler, as follows:

(1) Four samples were taken 1 meter (3.3 ft) from grid center at 0, 90, 180, and 270 degrees.

(2) Four samples were taken 3 meters (9.8 ft) from grid center at 45, 135, 225, and 315 degrees.

(3) The posttest ejecta sampling of material inside the crater and immediately adjacent to it was taken to a depth where undisturbed soil was encountered.

b. The samples were taken at locations:

(1) Three meters (9.8 ft) from the lowest visible point of the crater at 0, 90, 180, and 270 degrees from grid north.

(2) One meter (3.3 ft) from the rim of the crater at 45, 135, 225, and 315 degrees from grid north.

3.1.2.3.2 The suspended explosive detonations, were in the area shown in Figure 3.10. Three detonations were made, each suspended 12 meters (40 ft) above the ground. No sampling of fallout was planned.

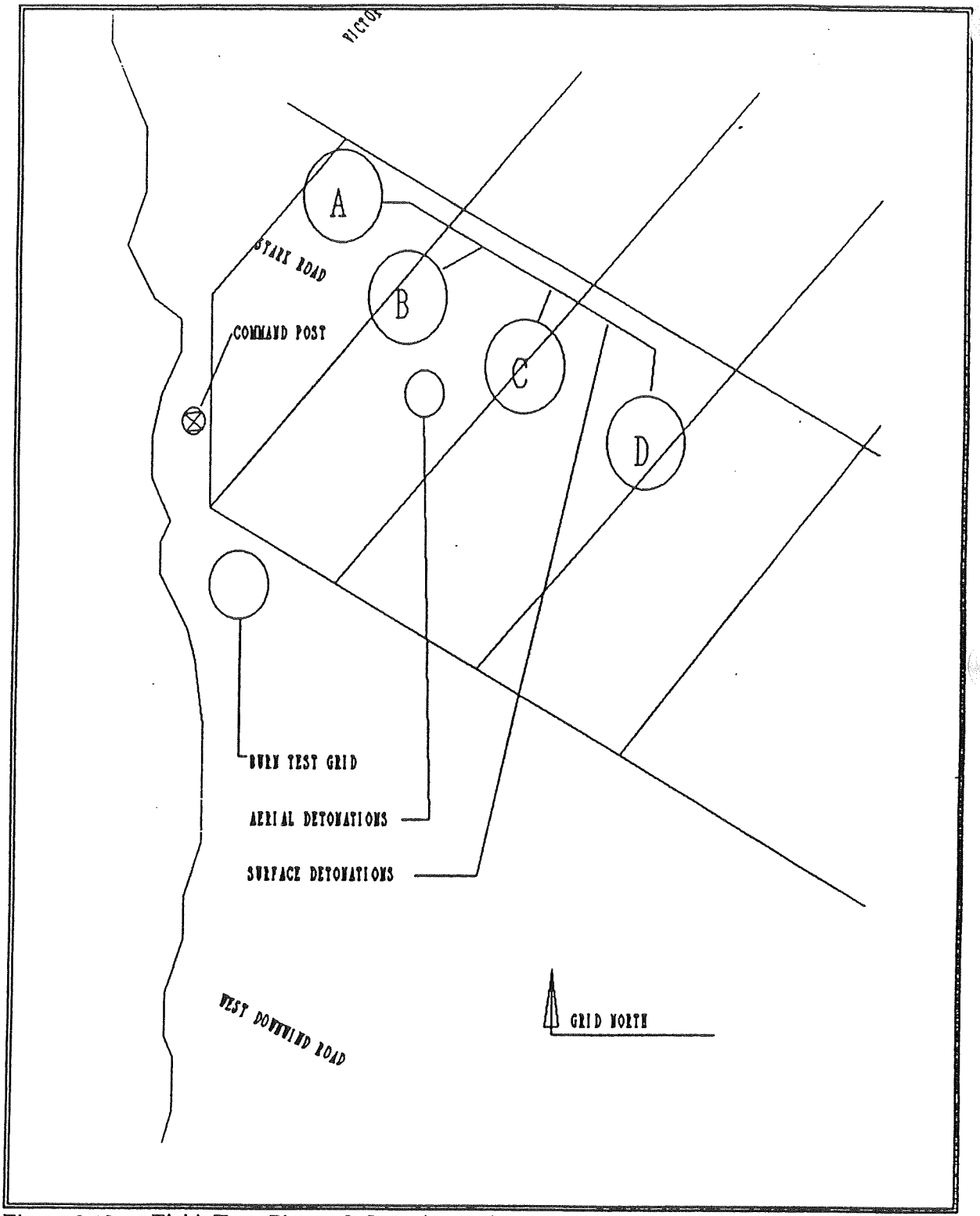

Figure 3.10 Field Test Phase C Locations of Surface Detonations, Suspended Trials, and Propellant Burns.

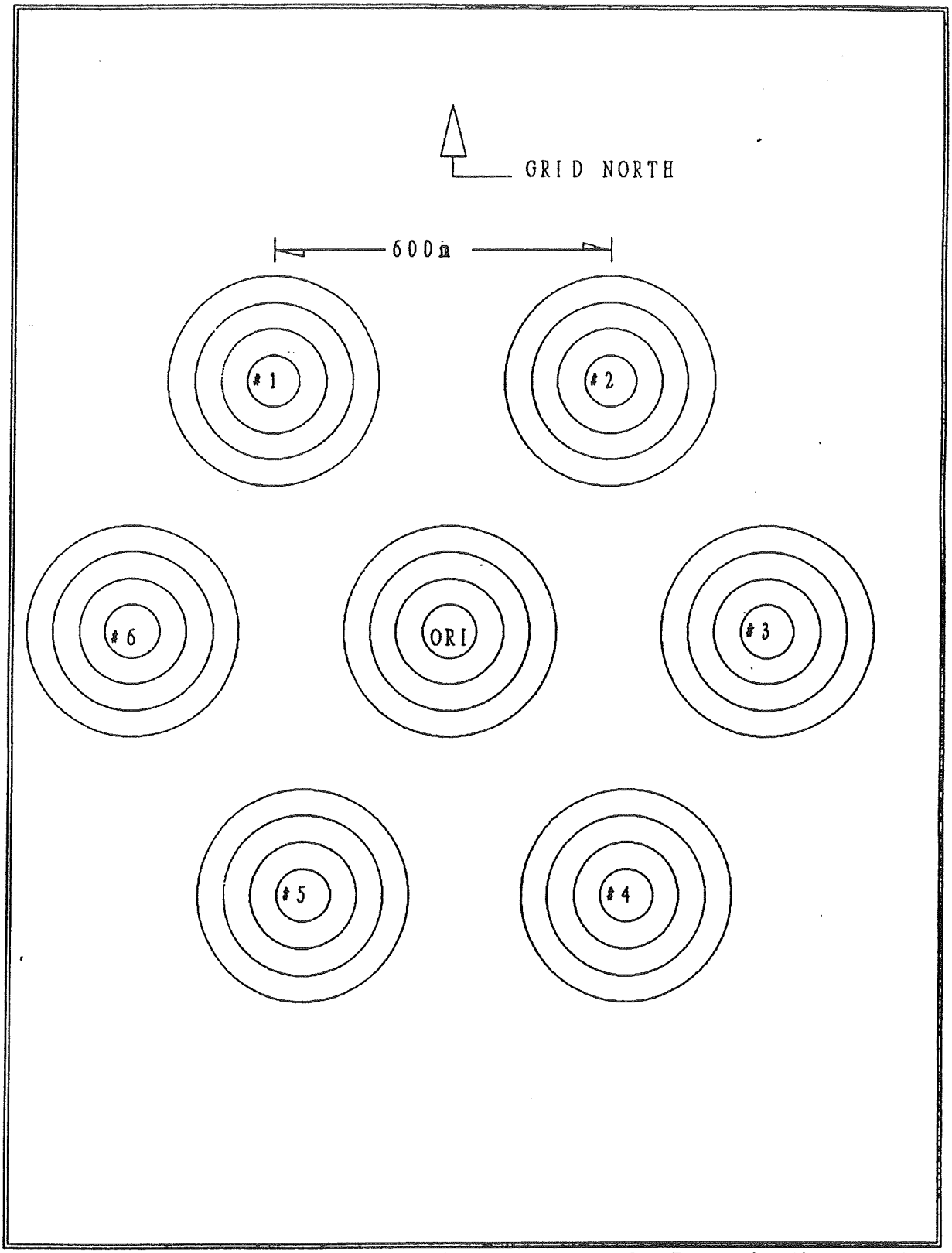

Figure 3.11 Field Test Phase C Relationship of the Seven Surface Detonation Sites Contained in Sites A, B, C, and,D of Fig. 3.10.

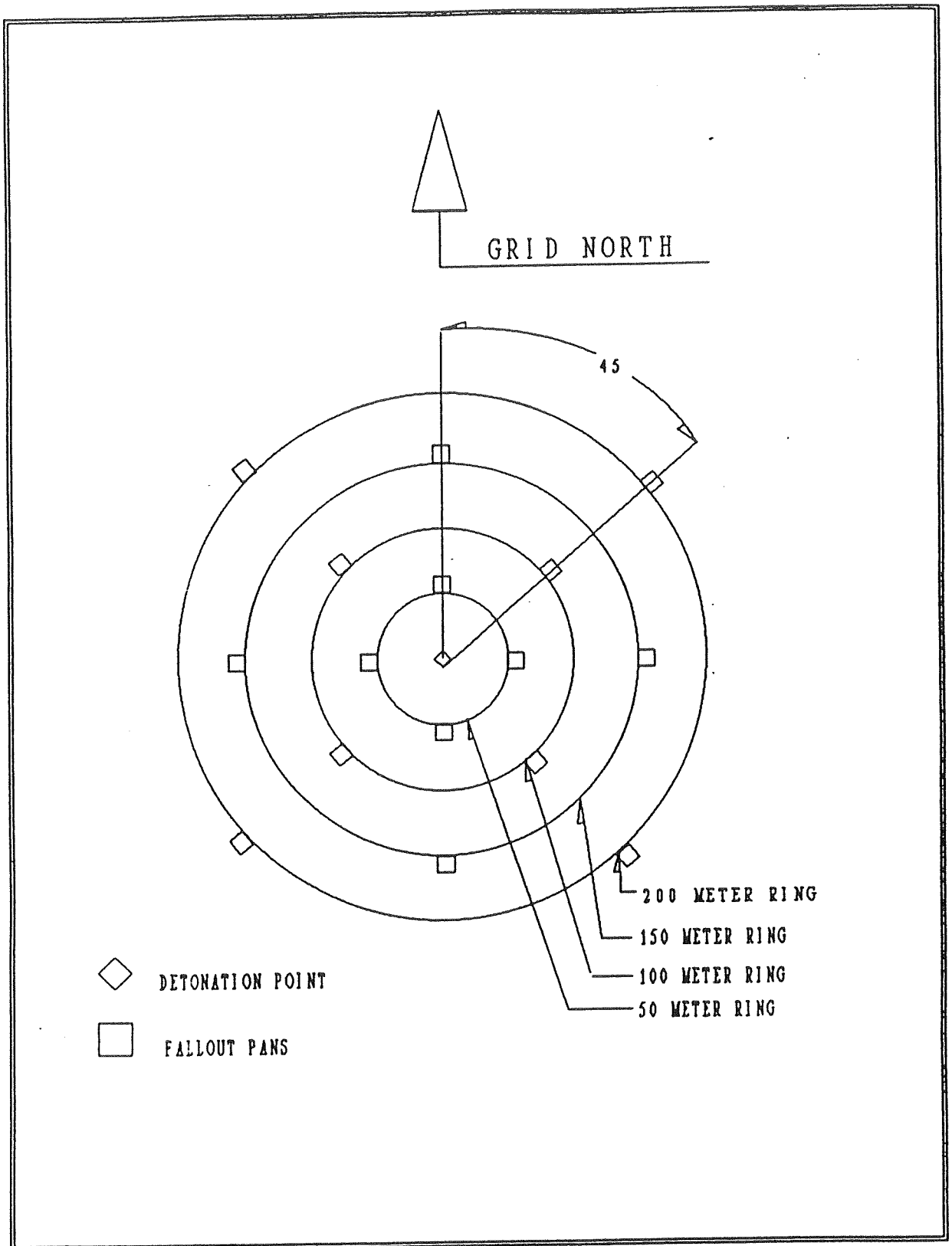

Figure 3.12 Field Test Phase C Fallout Pan Layout for a Detonation.

3.1.2.3.3 The burn test grid area along West Downwind Road had three burn sites, each configured for sampling as shown in Figure 3.9.

3.1.3 Sampling Platform - FWAC

3.1.3.1 Aircraft System Description

The aircraft, instrumented and operated by SNL during this test series, was a Boeing Canada, de Havilland Division, DHC-6 series 300 (Twin Otter) as shown in Fig.3.13. The Twin Otter is a twin-turboprop short take-off and landing, 20-passenger transport aircraft. Maximum take-off weight is 5,670 kg (12,500 lb) and maximum equipment payload, including technical crew, is approximately 1.000 kg (2205 lb). The aircraft has been modified with fastening points to accommodate exterior-mounted instrument packages under both wings and the fuselage. The aircraft is flown with DC-to-AC power inverters onboard, so that conventional instrumentation requiring 115-VAC power can be easily accommodated. Instrumentation is normally carried in up to five standard racks arranged along one side of the aircraft. During the Phase B and C tests, the aircraft was equipped with a "forward-looking" video camera, so that the detonation or burn test and the resulting cloud formation could be recorded during flight. The aircraft accommodates up to five technical-crew members, in addition to a full load of instrumentation and two flight-crew members. A complete description of the various sampling and analysis systems is given below.

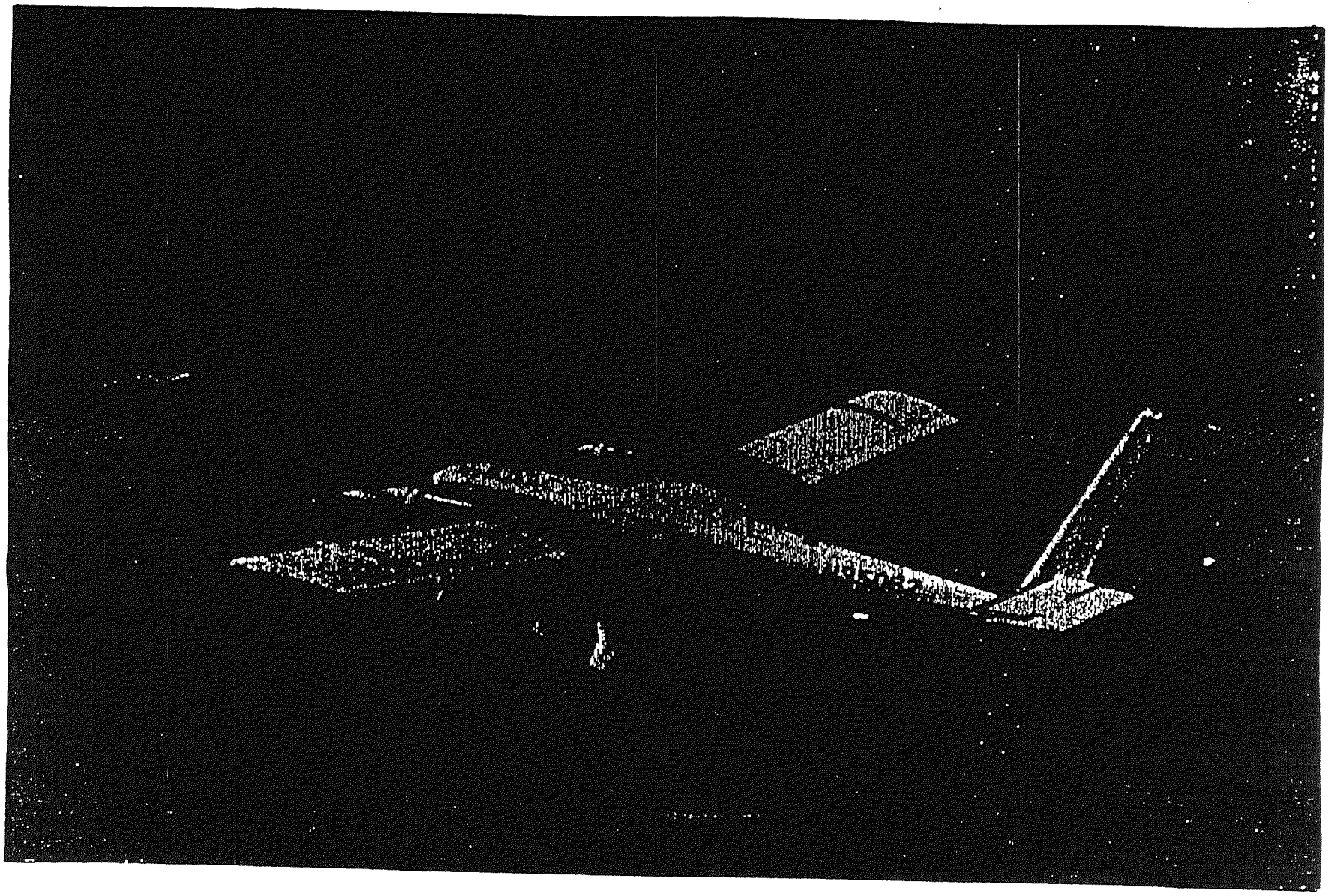

Figure 3.13 SNL Twin Otter Instrumented Fixed-Wing Aircraft for Open-Air OB/OD Sampling and Real-Time Gas Analysis.

3.1.3.2 Aircraft Gas and Aerosol Sampling Probe

The aircraft was equipped with an exterior-mounted inlet sampling probe for collection of both gas and particle samples. The sampling and transport system is shown schematically in Figure 3.14. The probe system was designed to provide a continuous flow of exterior air to the analytical instruments in the aircraft cabin. In addition to supplying the various continuous monitoring instruments, the tube is used to supply input to other sampling systems, such as evacuated canisters, sampling bags, and filter ports. The sampling system consists of five main components: (1) the external probe, (2) the transport tube, (3) the sampling valve, (4) the filter sampling section, and (5) a grab sampling bag. In addition, a transition section joins the probe and transport tube and provides a gradual transition between the different tube diameters of these two components. The sampling probe is an aluminum tube with an 8-cm (3-in) outside diameter and 0.3-mm (1/8-in) walls, that extends outside the aircraft boundary layer at a position forward and above the copilot windshield. A pair of long radius bends are included in the probe section to bring it through the roof of the aircraft and into the passenger cabin, so that particle deposition losses are minimized during air transport through the tube.

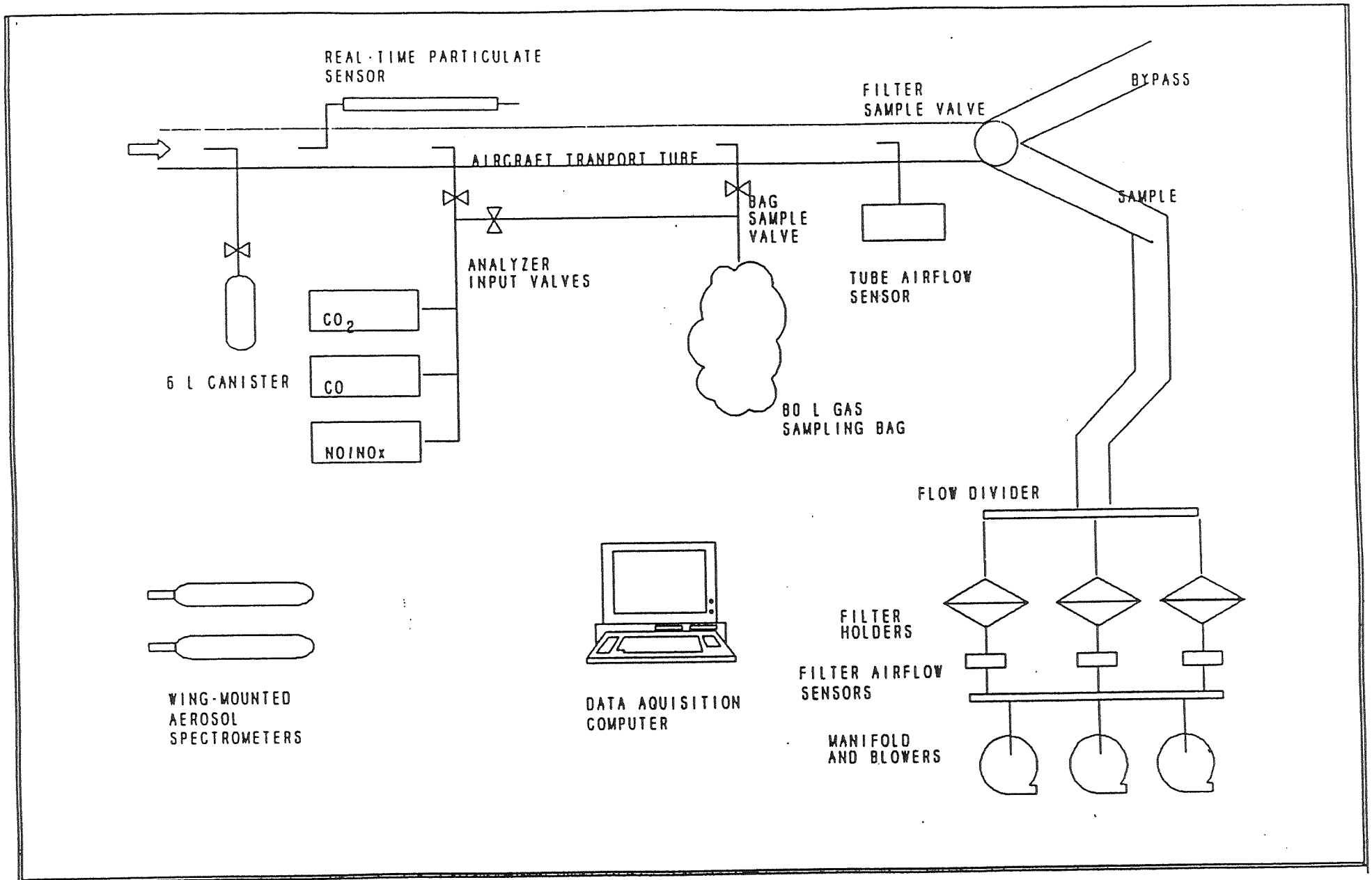

Figure 3.14 Schematic Diagram of Sampling Aircraft Instrumentation.

3.1.3.3 Aircraft Gas and Aerosol Transport Tube

The transport tube, also aluminum, has a 10-cm (4-in) outside diameter and 0.3-mm (1/8-in) walls. It consists of two end-jointed straight sections, each approximately 1.7-m (5.6-ft) long, a total length of 11.2 feet, that terminate in a long-radius 30-degree bend. The straight sections carry the sample flow through the cabin, and the bend leads through the rear cabin bulkhead into the baggage compartment which contains the sampling valve and filter units. The probe, transition, and transport tube sections and valve are joined with compression clamps (Morris Coupling Co., Erie, PA) that provide an essentially smooth interior wall surface from the probe inlet to the sampling valve. Specially designed connections and small probes provide a versatile method for diverting air flow from the transport tube to the analytical instruments and specialized samplers in the aircraft cabin.

3.1.3.4 Aircraft Aerosol Sampling Valve

The sampling valve is a standard 60-degree sliding gate valve (Salina Vortex Corp., Salina, Kansas) and is designed for use in pneumatic conveying applications. The valve body is aluminum, as is the valve plate which slides between nylon pressure plates. The valve position is controlled by a double-acting pneumatic cylinder with quick dump exhaust valves. Control air for the cylinder is supplied through electrically actuated solenoids. One discharge port of the valve is connected to the filter sampling section and the other discharges directly into the rear compartment. The inlet probe and transport tube is continually flushed through a bypass outlet whenever filter sampling is not in progress.

3.1.3.5 Aircraft Filter Port

The filter sampling section consists of three parts: (1) the flow divider, (2) the filter holders, and (3) the vacuum manifold and blowers. The flow divider is attached directly to one port of the sampling valve. It provides for the symmetrical attachment of three 20 by 25-cm (8 by 10-inch) clamshell-type filter holders. These are standard high-volume sampler filter holders (General Metal Works, Village of Cleves, Ohio), except that the inlets have been modified to allow them to be easily connected to and disconnected from the flow divider. The filter holders are constructed of

electro-polished stainless steel and are used with closed-cell urethane foam gaskets and special retaining straps to prevent the closure system from vibrating loose in flight. A vacuum manifold provides uniform suction for the three filters. The manifold is equipped with a bypass inlet, consisting of a pneumatically-actuated ball valve with an inside diameter of 1 cm (0.5 in.) The actuator for this valve is connected in parallel with that for the sampling valve, but with the opposite sense. Thus, when the sampling valve is closed (bypass position), the manifold bypass valve is in the open position. This prevents overloading the blower motors when not sampling, and when sampling is abruptly stopped, it prevents system backflow that could possibly rupture the filters. Air suction is generated by three 0.56 kW (3/4-HP) straight radial blade electric blowers attached to the manifold. (These blowers were manufactured by Gelman Instrument Company, Ann Arbor, Michigan, but they are no longer available from this manufacturer.)

3.1.3.6 Transport Tube Flow Measurement Instrumentation

The total flow through the transport tube was monitored using a Pitot tube mounted well downstream from most of the specialized instrument sampling connections and aligned on the centerline of the transport tube. The differential pressure was monitored on a magnehelic needle gauge (Dwyer Instruments, Inc., Michigan City, Indiana) and was continuously measured with a pressure transducer (Validyne Engineering Corp., Northridge, California) that provided a voltage signal for the analog data collection system. Voltage output from this sensor was proportional to air velocity through the transport tube. The electronic pressure transducer for the Pitot tube was subjected to periodic calibration checks against an inclined manometer pressure standard. A complete description of the calculations made to determine volumetric flow through the transport tube during filter sampling is given in Appendix A.

3.1.3.7 Probe and Transport Tube Sampling Efficiency

Accurate measurement of the concentration and composition of airborne particles from filter samples requires that aerosol properties not be distorted within the sampling system. This requirement offers particular design challenges for any sampling system that is intended to extract particles from a moving airstream. To minimize the distortion of particle size and mass distributions, the air velocity into the probe inlet must be the same as the relative velocity difference

between aircraft and the air being sampled. This is the "isokinetic" sampling condition. A second consideration is the potential loss of particles at the inlet and in the transport tube between the inlet and the collecting filters. Particle losses to the walls of the tube may arise from sedimentation, static attraction, inertial effects, and diffusion. The dominant mechanism of particle loss depends on particle size, tube flow conditions, and tube size.

3.1.3.8 Particle Sampling Losses

A number of experimental and mathematical studies have been completed on particle sampling losses in tubes. Although they provide some insight into the effects in the sampling system used in this work, the conditions in the published studies are not directly comparable to those in the SNL system. The turbulence intensity published in these studies, as indicated by Reynolds number, is typically less than one-quarter of the level encountered in the aircraft tube sampling system under normal flight speeds. Particle transmission efficiency through the probe inlet and tube are calculated from selected parameters from several of these studies and are given in Appendix A. Two cases are considered: one for the case of isokinetic entry into the probe and a second for an entry velocity that is 70 percent of the isokinetic rate. An approximate 70-percent isokinetic sampling rate was measured for the Phase A and B tests that were carried out with quartz filter media. A 100-percent isokinetic sampling rate was measured during the Phase C tests, during which Teflon™-coated glass fiber filters were used. The correction for nonisokinetic conditions is taken from the work of Durham and Lundgren (Reference 3). Deposition losses in the probe and transport tube were estimated as a function of particle size from the work of Liu and Agarwal (Reference 4). Tube flow conditions in the referenced report were not the same as during the AMCCOM tests, but the model has other attractive features. One of these is the inclusion of terms that allow for enhanced penetration of very large particles, rather than assuming that losses increase monotonically with increasing particle size. Details of the calculations are included in Appendix A. The sampling and transport efficiency of particles smaller than 1 μm is unaffected by operating conditions. The increased efficiency for particles larger than 1 μm in the 70-percent isokinetic case results from large-particle oversampling. This oversampling is the result of probe inlet velocity conditions and the lower losses during particle transport down the tube under less turbulent conditions. If the increased sampling efficiencies that result from large-particle reentrainment is disregarded, 70-percent isokinetic sampling conditions result in an approximate 50-percent cut point

for the inlet probe and transport tube at about 5 μm in aerodynamic particle diameter. In other words, an estimated 50 percent of the 5 μm aerodynamic diameter particles that enter the tube are transported to the filter. The other half are deposited on the walls of the transport tube and are not resuspended. Many of the larger (> 10μm) particles that enter the tube are eventually transported down the tube by saltation processes whereby the particles are continually deposited and reentrained down the tube.

3.1.3.9 Aircraft Gas Sampling Bag

A pillow-shaped 125-μm (5-mil) thickness Teflon™ bag (BGI Inc., Waltham, MA) with an approximate capacity of 80-L was positioned upstream from the filters as schematically shown in Figure 3.14. The bag was connected directly into the transport tube through a ball valve and was used to collect a gas sample from the transport tube at the same time an aerosol sample was being collected by the filter system. Gas analyzer input could be selected either directly from the tube or from the bag by a pneumatically controlled three-way valve. This arrangement allowed gas measurements from the bag to be completed in flight immediately after sampling.

3.1.3.10 Real-Time Particle Concentration/Size Measurements

Three instruments were flown on the aircraft to measure aerosol concentrations in real-time. For the Phase A tests, a flash-lamp-type integrating nephelometer (MRI, Model 1550) was connected directly into the transport tube to allow a real-time measurement of aerosol concentration in flight, as schematically shown in Figure 3.14. A flash rate of 8 Hz with an electronics time constant of 10 Hz was used during all cloud penetrations to insure acceptable instrument response. The output of this instrument was continuously recorded with the data acquisition system. For the Phase B tests, a second forward-scattering nephelometer (MIE Instruments, Model RAM-1) was also used in tandem with the integrating nephelometer as a cloud marker. Only the RAM-1 instrument was used during the Phase C tests.

3.1.3.11 Particle Spectrometers

Two laser-type particle spectrometers were externally mounted on the aircraft in a below-wing configuration. Particles in the 0.15 to 3.0 μm diameter range were measured with an active cavity laser system, using both forward- and back-scattered light collection optics (Particle Measuring Systems, model ASASP-100-X). Particles in the 1- to 47-μm diameter range were measured with a similar instrument that uses an external laser beam and forward-scattering light collection optics to measure both particle size and number counts (Particle Measuring Systems, model FSSP-100-X). The FSSP probe is designed so that it incorporates true in situ measurement principles and requires no correction for particle transmission or sampling losses in transport to the particle sensing zone. On the other hand, the ASASP probe is not a true *in situ* instrument. However, since it measures particles less than 3-μm diameter and incorporates a dilution air sheath in the sample route to the measurement chamber, particle transport losses are insignificant. Both probes incorporate extremely fast electronics which enable particle count rates in the range of 10^6 Hz. Data streams from both probes were fed to a digital data acquisition system (Particle Measuring Systems, PDS 400) and then to a portable computer hard disc. Data from each probe were averaged separately over a 5-s interval and recorded continuously during cloud penetrations with the aircraft.

3.1.3.12 Aircraft Data Acquisition Systems

3.1.3.12.1 Phase A

During the Phase A test, two data acquisition systems were used to record in-flight data. One system incorporated a 16-bit (0.01-millivolt resolution) analog-to-digital converter (Hewlett Packard, 3497A) and a computer (Hewlett Packard, 9816) to record all continuous voltage data at a sampling frequency of 2 Hz. A second identical computer was used to record digital data from the wing-mounted aerosol spectrometer probes and a long-range navigation (LORAN) unit. The LORAN receiver indicated aircraft position to an accuracy of about 0.5 km every 5 s.

3.1.3.12.2 Phases B and C

During the Phase B and C tests, all data acquisition was performed using a 386-type 20-mHz personal computer, equipped with Lab Tech Notebook™ data acquisition software that incorporated real-time graphical display during flight. While the aircraft was in ambient air and sampling bag

gas measurements were being taken, the data acquisition rate was at 0.2 Hz. During cloud penetration the data sampling rate was increased to 4 Hz in order to more precisely measure the edges of the clouds. The typical aircraft speed during cloud sampling was 50 m/s. This speed, coupled with the 4-Hz sampling rate, corresponds to a spatial resolution of about 13 meters per data interval.

3.1.3.13 Typical Aircraft Sampling Sequence

3.1.3.13.1 Preflight preparations

On a typical test-day, the aircraft and crew departed its operations base at Provo, Utah, Municipal Airport at approximately 0600. After a 30-min flight, the aircraft landed at MAAF for presampling preparations, which included a thorough cleaning of probe and transport tube interior surfaces, filter holders, and gaskets with isopropanol-soaked cotton swabs. Clean preweighed filters were then installed in the holders and placed in position in the filter sampling manifold. Gas instrument warmup and checkout was also completed during this time interval. While the aircraft was on the ground, the gas instruments were continually operated from auxiliary ground power in order to achieve thermal and electronics stability.

3.1.3.13.2 Background Sampling Flight

After takeoff, the aircraft flew at an altitude of 305 m (1,000 ft) above ground level (AGL) in the vicinity of the test grid and began background sampling. Background aerosol sampling involved sampling of about 150 m^3 of background air by continuous operation of the filter sampling system for about 20 min. During this interval, initial zero and span calibrations were also completed on the NO_y, CO, and CO_2 instruments. Gas instrument calibration was followed by a sampling period directly from the transport tube to measure ambient gas concentrations. A 6-L grab sample of background air was also collected into a canister directly from the transport tube at this time. The 80-L bag was flushed with ambient air two times and filled a third time. The gas instruments were then switched to sample from the bag for a period of about 5 min or until instrument readings had stabilized on the bag gas concentrations, whichever occurred first. The aircraft was then flown back to MAAF, during which time a final zero and span calibration was completed with the gas

instruments. Following landing at MAAF, the filter holders were removed and taken inside B-48 (the SNL mobile laboratory) and carefully disassembled. The filters were removed and immediately placed in dry-ice storage. The filter holders were reloaded with clean filters and installed again on the aircraft. The aircraft crew then waited for a ready signal from the ground test director to begin the test sampling flight.

3.1.3.13.3 Test Sampling Flight

a. At the ready signal, the aircraft again departed for the test grid area. On arrival at the test grid, air-to-ground radio communication was established with the test officer. The aircraft then began flying an approximate 4- by 6-km (2.5- by 3.8-mi) racetrack pattern over the test site at its typical sampling speed of 50 m/s (90 knots). During this time initial zero and span checks were completed on the gas instruments. During Phase A and B tests, aircraft position was coordinated with the test officer's countdown, so that the detonation site was approximately 2 km (1.2 mi) directly off the left wing with the aircraft at 305 m (1,000 ft) AGL at detonation time. At detonation time, the aircraft continued flying away from the cloud for about 30 s and then turned 180 degrees to the left, which brought it onto a flight track headed directly at the cloud. Elapsed time from detonation to the first aircraft interception of the cloud was typically in the range of 45 to 60 s. This time lag allowed the buoyant cloud to rise up to the altitude of the aircraft and provided an adequate margin of safety for large debris fallout from the cloud prior to aircraft fly-through. During the Phase C tests, the aircraft was flown at a heading pointing directly at the detonation point and was kept at a minimum distance of 2 km (1.2 mi) at detonation time. This flight path was selected in order to allow a videotape record of the detonation to be made with a nose-mounted "forward-looking" video camera on the aircraft. Prior to the first pass through the cloud, the filter blowers were started with the transport tube flow in the bypass mode. On interception with the cloud, the transport tube flow was diverted through the filters for the duration of the cloud transect. The valve to the 80-L bag was opened at the same time so that the bag was filled with a fraction of the total transport tube flow. A diaphragm valve on an evacuated 6-L canister, installed on a sampling port projecting directly into the transport tube, was manually opened when the aircraft intercepted the cloud on the first sampling pass. The valve was left open, allowing the evacuated cylinder to fill to near atmospheric pressure while the aircraft was in the

cloud, after which it was closed. Typically, the aircraft was in the cloud during this first pass for about 3 to 5 s. As the aircraft exited the cloud, both filter and gas sampling bag valves were switched to the bypass position. The aircraft then was put into a short radius in preparation for another cloud penetration.

b. Second, third, and sometimes fourth penetrations were conducted in precisely the same manner as described for the first, except that no 6-L canister samples were collected. Following the third or fourth pass, the aircraft was flown in level flight in the standard racetrack pattern over the detonation site. At this time, the gas instruments were switched to sample from the bag and a canister sample was also taken from the bag, which now contained cloud gases from all three passes. Sampling was continued from the bag for 5 minutes to adequately measure the bag gas contents. The 80-L bag was then flushed two times with ambient air and completely evacuated in preparation for the next detonation.

c. Continuous recording was carried out with the nephelometer and the two wing-mounted aerosol spectrometers while the multiple cloud penetrations were flown. Range changes were made by instrument operators to optimize instrument sensitivity as the cloud became increasingly dispersed with time

d. In a multiple detonation series, the aircraft returned to the preestablished racetrack pattern over the site, while waiting for the next event. At this time, the 80-L bag was flushed two times with ambient air and completely evacuated in preparation for the next test. Following detonation, an identical sampling sequence was followed as described above for each detonation in the test.

3.1.3.13.4 Posttest Activities

a. For phases A and B, at the completion of sampling from the final detonation cloud, the aircraft was flown back to MAAF. During the return flight, a final zero and span check was completed with the continuous gas analyzers. On landing at MAAF, the filter holders were once again disconnected from the sampling manifold and taken to the equipment trailer. The filters were removed and immediately placed in dry-ice storage. Data files were backed up and sample collection forms completed. Following these activities, the aircraft and crew then departed for the

Provo airport, carrying the ice chest containing the exposed filters with them. Upon landing at Provo, the filters were immediately delivered to Alpine West Laboratories (AWL), where they were placed in cold storage prior to weighing, extraction, and analysis.

b. For phase C, the filters were weighed and put in the freezer at DPG.

3.1.3.13.5 Propellant Test Sampling Differences

Flight activities for the propellant burns were carried out in an identical manner as described for the detonations, with the exception that a shorter elapsed time between burn initiation and aircraft penetration of the cloud was chosen. Usually, the very buoyant propellant clouds were rapidly dispersed. Typically only two aircraft sampling fly-throughs were completed for each burn.

3.1.4 Soil and Fallout Sampling

The specific sampling points for soil and fallout from the detonations and burns are shown on the grid maps in paragraph 3.1.2 and the following paragraphs. The Technical Steering Committee (TSC) considered the assay of every sample and the compositing of samples. One of these considerations was the high expense of analyzing each individual sample from the test area, of more importance was the TSC's unanimous belief that composite sampling would provide the basis for accurately characterizing ejecta and fallout material, and that compositing would be sufficient in developing the methodology required to identify and quantify emittant products from propellant, explosive, and pyrotechnic (PEP) material.

3.2 Explosive and Propellant Material

3.2.1 TNT

TNT was used in the BB and all three field tests for both surface and suspended detonations. While its physical form varied, either flake or block (the product of washout demilitarization operations), for the field tests, the TNT used in the BB tests was virtually pure trinitrotoluene, as

shown by chemical analysis. No individual detonation exceeded 907 kg (2,000 lb). MIL-T-24BC (Reference 5) contains the military specification for TNT.

3.2.1.1 BangBox

BB testing preceded field testing by several months. Less than 23 kg (50 lb) of TNT were consumed during the entire test series. All was received as 227-grams (0.5-lb) demolition blocks, which had to be stripped of protective cardboard wrappings and metal parts before use. Each trial involved one or more single detonations, each having the block suspended approximately 1 m above the surface by a monofilament nylon cord strung from an aluminum rod bracket assembly. The BB trials were conducted as summarized in Table 2.1.

3.2.1.2 Field Test Phase A

3.2.1.2.1 Description

a. Block. The TNT blocks used during Phase A testing were made from reclaimed TNT which had been cast into 32-kg (70-lb) blocks. Most blocks were packaged in cloth/plastic bags inside a metal container. The bags adhered to the sides of the containers and could not be removed. A lesser amount of TNT blocks came in vapor-barrier bags. These blocks were left in their bags because they were friable and would have spilled on the ground if removed.

b. Flaked. Flaked TNT, also made from reclaimed TNT, was packaged in fiber containers, each holding 60 lb.

3.2.1.2.2 Application

a. Block. The metal boxes containing block TNT were stacked 1.0-m (40-in) deep x 0.7-m (26-in) wide x 1.1-m (44-in) high for detonation. Four 454-g (1-lb) blocks of TNT, used as initiators for the stacked TNT, were each double primed with electric blasting caps and placed on top corners of the stack. The block TNT in vapor-barrier bags was also stacked and initiated by double-primed 454-g (1-lb) TNT blocks.

b. Flaked. The flaked TNT was poured into mild-steel cylindrical buckets, approximately 907 kg (2000 lb) of TNT per bucket. Each bucket was approximately 1.2-m (48-in) high x 1.1-m (45-in) diameter and open at both ends, thus resulting in direct contact between the TNT and the soil. The cylinders were each recessed into the ground approximately 15 cm (6 in) and initiated by one 454-g (1-lb) TNT detonation block double-primed with electric blasting caps and placed on top of the flaked material.

c. All trials were conducted as summarized in Table 2.2.

3.2.1.3 Field Test Phase B

A combination of individual surface, sequential surface, and suspended detonations were conducted, again using reclaimed TNT.

3.2.1.3.1 Description

a. Block. The TNT blocks used during Phase B testing were 32-kg (70-lb) blocks cast from reclaimed TNT. All were wet, varied in strength from being fairly solid to being friable, and had an average 18-percent void space between blocks when placed in the cylinders. Their dark color indicated contamination by munitions components such as asphaltum and gums during the reclamation process. The vapor-barrier bags which could not be removed easily remained on the blocks in some instances.

b. Flaked. The flaked TNT, also the product of reclaimed TNT, was dry when received but, like the block TNT, appeared to have been contaminated during the reclamation process.

3.2.1.3.2 Application

a. Block. The blocks were loaded into cylinders similar to those used during Phase A testing, except that leak-proof bottoms had been added to prevent direct contact of TNT with the soil. Flaked TNT was used to fill voids between blocks. The cylinders were initiated by four 454-g (1-lb) TNT blocks placed inside the cylinder, approximately 20-cm (8-in) from the bottom. The detonating

blocks were wrapped with pentaerythritol tetranitrate (PETN) detonating cord which was run through holes drilled in the sides of the cylinders 15 m (50 ft) to a firing point, where it was initiated by a radio-actuated electric blasting cap. The cylinders were set directly on the ground for surface detonations; for suspended detonations, they were hung approximately 12 m (40 ft) above the ground from a wire cable stretched between two telephone poles.

b. Flaked. The flaked TNT was used to fill voids between blocks in the cylinders. No cylinders were loaded with flaked TNT exclusively.

c. All trials were conducted as summarized in Table 2.3.

3.2.1.4 Field Test Phase C

3.2.1.4.1 Description

Again, TNT used during Phase C was reclaimed explosive which had been reprocessed into flakes and blocks. However, this time the blocks were slightly smaller and weighed 28 kg (62 lb).

3.2.1.4.2 Application

Procedures used in setting up testing events were identical to those used during Phase B, with the exceptions that the cylinder diameter had been reduced to 1.0 m (38 in), and that the cylinders for the ORI was filled with flaked TNT. Plastic sheets were spread on the ground to prevent accidental TNT spills from contaminating the soil. All trials were conducted as summarized in Table 2.4.

3.2.2 Composition B

3.2.2.1 Description

Composition B, manufactured from TNT and RDX, is commonly referred to as "comp B". This explosive was used for six surface detonations during Field Test Phase C. The nominal composition of composition B is given in Table 3.1.

Table 3.1

Ingredient[a]	Weight (%)	Carbon Content (%)
RDX	59.5	16.2
TNT	39.5	37.0
Composition D-2 Wax	1.0	85.2

[a]Weights are approximate. RDX and TNT are ±2.0 and wax is ±0.03 percent.

Application

Received in flakedform, the composition B was loaded into steel cylinders for test detonations, each cylinder containing a maximum of 916 kg (2020 lb). Each cylinder was 96-cm (38-in) high x 122-cm (48-in) diameter, with a 20-cm (8-in) ring at the top to increase its loading capacity. All trials were conducted as summarized in Table 2.4.

3.2.3 Explosive D

3.2.3.1 Description

Explosive D was used for an ORI and six surface detonations in Field Test Phase C. Commonly referred to as "yellow D" because of its yellow color, explosive D is also known by its chemical name, ammonium picrate. It has a propensity to stain, and can cause toxic reactions, thus mandating personal protection for technicians working with it. Because of its low sensitivity, large initiators were used to ensure complete detonation and avoid spreading undetonated explosive throughout the test site. The nominal composition of explosive D is given in Table 3.2.

Table 3.2 Nominal Composition of Explosive D.

Ingredient	Weight (%)	Carbon Content (%)
Ammonium picrate	99.9	29.3
Sulfates	0.1	
Chloroform insoluble impurities	0.1	
Ash (maximum)	0.1	
Water-insoluble material (maximum)	0.1	

3.2.3.2 Application

Received in granular form, explosive D was loaded into steel cylinders for test detonations, each cylinder containing a maximum of 917 kg (2020 lb). Plastic explosive C4 was used to initiate each cylinder. Plastic sheets were placed on the ground to prevent any spillage from contaminating the soil. Explosive D trials are summarized in Table 2.4.

3.2.4 RDX

3.2.4.1 Description

RDX (hexamethylenetrinitroamine) is not present in ordnance items as a pure explosive. RDX used during Phase C was PBXN-6, a mixture of RDX and Viton A™ (hereafter referred to as RDX). The nominal composition of this explosive is given in table 3.3.

Table 3.3 Nominal Composition of PBXN-6.

Ingredient	Weight (%)	Carbon Content (%)
RDX	95.0	16.2
Viton A™	5.0	28.1

3.2.4.2 Application

Granular RDX was delivered in 60-lb (27-kg) pasteboard boxes. It was loaded into steel cylinders 1.2-meters (48-in) high x 1.0-meters (38-in) diameter. Four 0.6-kg (1.25-lb) blocks of C4 explosive were used to initiate each cylinder. RDX trials are summarized in Table 2.4 on page 2-10.

3.2.5 Single-Base Propellant

3.2.5.1 M1 Propellant - Field Test Phase C

3.2.5.1.1 Description

M1 propellant is a single-base propellant normally used with field artillery, howitzers, and guns. This propellant, consisting almost entirely of nitrocellulose, was received in bulk containers in the form of small multiperforated pellets, each approximately 1 cm long, with a diameter of about 0.4 cm. The nominal composition of the M1 propellant used in phase C is shown in Table 3.4.

Table 3.4 Nominal Composition of M1 Propellant.

Component	Weight Fraction %	Carbon Fraction %
Nitrocellulose (13.15 % N)	85.00	25.7
Dinitrotoluene	10.00	46.2
Dibutylphthalate	5.00	69.0
Diphenylamine (added)	1.00	85.2
Potassium sulfate (added)	1.00	0.0
Volatile solvents	1.26	52.1
Residual water (moisture)	0.60	0.0

3.2.5.1.2 Application

The propellant was spread in the three burn pans to a depth not exceeding 8 cm (3 in) and ignited at both ends of the pans. M1 propellant trials are summarized in Table 2.4 on page 2-11.

3.2.5.2 M6 Propellant - Field Test Phase C

3.2.5.2.1 Description

M6 propellant, as delivered to the test site in 27-kg (60-lb) fiber drums, was a single-base propellant manufactured as a multiperforated grain, 1.7 cm long and 0.8 cm in diameter, consisting almost entirely of nitrocellulose. The nominal composition of this propellant is given in Table 3.5. A carbon fraction of 0.293 was calculated from the mass composition and the molecular formulas of the propellant constituents.

Table 3.5 Nominal Composition of M6 Propellant.

Component	Weight Fraction %	Carbon Fraction %
Nitrocellulose	87.7	25.7
Dinitrotoluene	9.7	46.2
Dibutylphthalate	2.5	69.0
Diphenylamine (added)	0.86	85.2
Potassium sulfate (added)	0.74	0.0
Volatile solvents	1.8	52.1
Residual water	<0.32	0.0

3.2.5.2.2 Application

The propellant was spread in the three burn pans to a depth not exceeding 8 cm (3 in) and ignited at both ends. Propellant ignition was accomplished by black-powder trains, which were ignited by electric squibs. M6 propellant trials are summarized in Table 2.4 on pages 2-10 and 2-11.

3.2.6 Double Base Rocket Propellant

3.2.6.1 BangBox

A single burn trial of 454 grams (1 lb) of NOSIH-AA-2, with 26.6 grams (1 oz) of ethylcellulose added, was conducted in the BB. A description of the propellant is given in Table 3.6. A carbon fraction of 0.266 was calculated from the mass composition and the molecular formulas of the propellant constituents. An additional 5.9 percent by weight of ethylcellulose was added to the mixture, with a carbon fraction of 0.585, to simulate actual field practice in OB of this propellant residue.

Table 3.6 Composition of NOSIH-AA-2 Propellant.

Ingredient	Weight (%)	Carbon Fraction (%)
Nitrocellulose	51.0	27.0
Nitroglycerin	38.6	15.9
Triacetin	2.7	49.5
Di-normal-propyl-adipate	1.6	62.6
2-Nitrodiphenlyamine	2.0	67.3
Lead salicylate	1.5	34.9
Lead β resorcylate	0.5	32.8
Monobasic copper salicylate	2.0	49.8
Candelilla wax	0.1	85.2
Ethylcellulose (added)	5.9	58.5

3.2.7 Triple-Base Propellant - Field Test Phase A

3.2.7.1 Description

A triple-base gun propellant, M30, was tested during Phase A. A complete description of the propellant is given in Table 3.7. A carbon fraction of 0.178 was calculated from the mass composition and the molecular formulas of the propellant constituents.

Table 3.7 M30 Triple-Base Gun Propellant[a] Composition.

Component	Weight Fraction (%)	Carbon Fraction (%)
Nitrocellulose (12.6 % N)	28.0	26.5
Nitroglycerin	22.5	15.9
Nitroguanidine	47.7	11.5
Ethyl Centralite	1.5	76.1
Graphite	0.2	100.0
Total Volatiles	0.1	62.0
Total	100.0	17.8

[a]Radford Army Ammunition Plant Lot No. RAD-65385.

3.2.7.2 Application

The propellant material was placed in a steel burn pan that measured 1.2 m (4 ft) by 11.0 m (36 ft). Approximately 907 kg (2000 lb) was burned in each of two separate burns for the ORI tests. The full test involved the burning of about 3175 kg (7000 lb) of material in each of two separate burns. M30 propellant testing is summarized in Table 2.2 on page 2-5.

3.2.8 Composite Propellant - BangBox

3.2.8.1 Description

A composite rocket propellant, NOSIH-EC, was tested in the BB test. A complete description of the propellant is given in Table 3.8.

Table 3.8 NOSIH-EC Propellant Composition.

Component	Weight Fraction %	Carbon Fraction %
Hydroxyl-terminated polybutadiene (R45M)	8.015	88.8
2,2-Methylene bis(4-methyl)-6-t butyl phenol (AO 2246)	0.200	81.1
Dioctyl sebacate (DOS)	4.500	73.2
Phenyl di-isodecyl phosphite	0.200	71.2
5-Ethyl-1,3-diglycidyl-5-methyl hydantoin diepoxide (XU-238)	0.300	56.7
Aluminum oxide	1.000	0
Carbon black	0.100	100.0
Ferric acetylacetonate (FeAA)	0.005	51.0
Ammonium perchlorate	85.000	0
Diethylene triamine (DETA)	0.080	46.6
Isophorone di-isocyanate	0.600	64.4

3.2.9 Manufacturing Residue

3.2.9.1 Field Test Phase B

3.2.9.1.1 Description

A variety of propellant types was used during the Phase B test burns. The purpose of mingling propellant and inhibitor materials was to accurately represent procedures used at manufacturing facilities which thermally treat residue as it is generated. The mixtures are defined in Table 3.9. A complete description of the propellants is given in Tables 3.6, 3.8, and 3.10 to 3.13. Carbon fractions of 0.214, 0.213, and 0.212 were calculated from the mass composition and the molecular formulas of the propellants for the ORI burn and the two burns on trial 1, respectively.

Table 3.9 Manufacturing Residues Burned in Field Test Phase B.

Propellant Type	Weight per Trial[a] (lb)		
	ORI P1	Trial I P1	Trial I P2
NOSIH-EC	1528	1599	1584
NOSIH - AA2	1100	1100	1155
NOSIH-AA6 (chunk)	605	495	495
NOSIH-AA6 (sheet)	2574	2574	2574
"Propellant A"	799	784	760
"Ignition propellant"	10	10	10
Cellulose Acetate Inhibitor	36	36	36
TOTAL	6652	6598	6614

[a]Trial dates (all 1990): ORI - 19 Oct; Trial 1.

Table 3.10 NOSIH-AA6 Propellant Composition.

Component	Weight Fraction %	Carbon Fraction %
Nitrocellulose (12.2% N)	24.50	27.0
Nitrocellulose (12.6% N)	24.50	26.5
Nitroglycerin	38.80	15.9
Triacetin	3.25	49.5
Di-normal propyl adipate	2.00	62.6
2-Nitrodiphenylamine	2.00	67.3
LC-12-15 Copper salicylate 1.60 % Lead β-resorcylate 1.70 %	3.30	 49.8 32.8
Candelilla wax	0.10	85.2
Carbon black	0.05	100.0
Aluminum	1.50	0

Table 3.11 "Propellant A" Composition.

Component	Weight Fraction %	Carbon Fraction %
Nitrocellulose (12.6% N)	49.89	26.5
Nitroglycerine	33.59	15.9
Triacetin	7.62	49.5
2-Nitrodiphenylamine	1.45	67.3
Aluminum	3.79	0
Lead salicylate	1.83	34.9
Lead resorcylate	1.44	32.8
Lead 2-ethyl hexoate	0.39	38.9
Graphite (added glaze)	0.03	100.0

Table 3.12 "Ignition Propellant" Composition.

Component	Weight Fraction %	Carbon Fraction %
Nitrocellulose (12.6% N)	68.44	26.5
Nitroglycerine	16.48	15.9
2-nitrodiphenylamine	1.91	67.3
Aluminum	7.30	0
Lead resorcylate	2.78	32.8
Lead salicylate	2.78	34.9
Carbon black	0.31	100.0
Graphite (added glaze)	0.04	100.0

Table 3.13 Cellulose Acetate Inhibitor Composition.

Component	Weight Fraction (%)	Carbon Fraction (%)
Cellulose acetate	75.0	50.0
Diethyl phthalate	16.7	64.9
Triphenyl phosphate	8.3	66.3

3.2.9.1.2 Application

The burn pans, used in phase A, were cleaned by test personnel prior to setup. The composite propellant, placed in the center of the three-pan array, could not be removed from cardboard shipping containers for the 19 October burn. Double-base propellants were placed in the two outer pans. Propellant manufacturing residue trials are summarized in Table 2.3 on page 2-7.

3.2.9.2 Field Test Phase C

3.2.9.2.1 Description

Manufacturing Residue propellants were used in the Phase-C test burns. They were NOSIH-AA2 and N-5. The propellant was in the form of rolls 10 cm (4 in) wide x 38 cm (15 in) diameter x 0.2 cm (0.08 in) thick, which would have been subjected to extrusion if its manufacturing process had

been continued. The mixtures for Phase C are defined in Table 3.14. The nominal composition of these propellants is given in Tables 3.6 and 3.15.

Table 3.14 Manufacturing Residues Burned in Field Test Phase C.

Propellant Type	Weight per Trial (lb)			
	Trial 1 P1	Trial 1 P2	Trial 2 P1	Trial 2 P2
NOSIH - AA2	1092	1014	1014	1014
N-5	3876	3800	3876	3876
TOTAL	4968	4814	4890	4890

Table 3.15 Composition of N5 Propellant.

Ingredient	Weight %	Carbon Fraction %
Nitrocellulose (12.6 % N)	50.0	26.5
Nitroglycerin	34.9	15.9
Nitrodiphenylamine	1.9	67.3
Diethylphthalate	10.5	64.8
Lead ethylhexoate	1.8	38.9
Lead salicylate	0.8	34.9
Candelilla wax	0.2	85.2

3.2.9.2.2 Application

These propellant rolls were laid in the burn pans and ignited at both ends of the pans with a powder train. Propellant manufacturing residue trials are summarized in Table 2.4 on page 2-9 and 2-10.

3.3 Analyte List - Detection Levels

The analyte list and detection levels for the field test are shown in Table 3.16.

Table 3.16 Analyte List and Limits of Detection for Phases A, B, and C Tests.

Chemical Analyte	Analyte List			Limit of Detection in Acetonitrile ng/mL[a]	Limit of Detection in 400g of DPG Test Site Soils.[b]	
	Phase A	Phase B	Phase C		ppbW	ng/mL
2,4-Dinitrotoluene	TNT, M30	TNT, MR	TNT, Comp-B, RDX, Exp-D, M6, M1, MR	0.07	1	400
2,6-Dinitrotoluene				0.05	1	400
2,4,6-Trinitrotoluene				0.06	1	400
2-Nitronaphthalene				0.03	1	400
N-Nitrosodiphenylamine				0.12	10	4000
1,3,5-Trinitrobenzene		TNT		0.12	10	4000
2-Nitrodiphenylamine		MR		0.10	10	4000
1-Nitropyrene		TNT		1.30	10	4000
Naphthalene		TNT, MR		0.62	50	20000
Benz[a]anthracene				0.73	1	400
Benzo[a]pyrene				2.30	1	400
Pyrene		MR		0.83	1	400
Phenol[c]		TNT, MR		0.23	1000	400000
Dibenzofuran				0.31	1	400
Diphenylamine				0.21	1	400
4-Nitrophenol				0.30		
Biphenyl				1.15		
Phenanthrene				1.20		
1-Methylnaphthalene				0.62		
2-Methylnaphthalene				0.62		
Ethyl centralite[d]	M30					
Nitroglycerin		MR	MR	0.21	10	4000
Nitroguanidine[e]						
4-Nitrodiphenylamine		MR				
1,3,5-Trinitrophenol			Exp-D	0.35	20	8000
RDX, Cyclonite[f]			Comp-B, RDX	0.20	1	400
HMX, Octogen[g]						

[a]Detection limit for SFC/MS under chemical ionization/selected ion monitoring (signal/noise = 3).
[b]Based on an acetonitrile extraction of 400 g of soil and then evaporation of the extract to a 1 mL sample for assay. Based on signal to noise ratio of 3 with respect to the soil background.
[c]Analyzed with GC/MS on Phase A.
[d]Chemical name: N,N'-diethyl-N,N'-diphenylurea.
[e]Analysed as its methyl derivative.
[f]1,3,5-Trinitrohexahydro-1,3,5-triazine.
[g]1,3,5,7-Tetranitrooctahydro-1,3,5,7-tetrazocine.

3.3.1 Discussion of Detection and Quantification Limits.

The following paragraphs pertain to the 3 to 4 orders of magnitude differences between the "limits of detection" of the analytes in acetonitrile solution and the "limits of quantification" of these analytes when extracted from 400 grams of DPG soil samples. This large difference is normal when extracting and analyzing for analytes in soil samples for the following reasons:

a. Matrix effects and stability of composition, particularly during analytical conditions, must always be considered while assessing the level at which analytes may be reliably measured in a field sample if the analytes are associated with relatively large amounts of "foreign" material.

b. When the analytes are associated with relatively large amounts of foreign material, two matrix effects interact. The first is interference from a relatively large "chemical" background (as distinguished from electronic "noise") in the mass spectra resulting from the complex and somewhat variable mixture of natural soil components, such as humic substances. The second is the difficulty of recovering the analytes from the matrix. Soils, especially fine clay soils such as those at DPG, have a large specific surface with high adsorption isotherms. These conditions make the complete recovery of analytes increasingly difficult as the concentration level of the analyte falls. The background and recovery effects combine to reduce the detection and quantification reliability levels of quantification analysis.

3.4 Sampling/Analysis

3.4.1 Volatile Organics

Both direct and indirect whole air grab samples were collected in passivated 6-L evacuated SS canisters during aircraft penetrations of the plume. Direct samples were collected in canisters that were connected to a 6-mm (1/4-in) SS probe that projected directly into the transport tube as schematically shown in Figure 3.14 on page 3-24. On aircraft contact with the plume, the canister valve was manually opened and the canister filled to ambient pressure. During the Phase B and C tests, indirect whole air grab samples were also collected from the Teflon™ bag into which multiple plume samples were composited. Following completion of the plume sampling and a 10-s

purge to clear the line of ambient gas, a gas sample was drawn from the bag through a length of Teflon™ tubing into the evacuated canister. The 6-L canisters were immediately shipped to the Oregon Graduate Institute of Science & Technology for gas transfer and chromatographic analysis for CO, CO_2 and C_1 through C_{10} hydrocarbons.

3.4.1.1 Measurement of CO_2, CO, and CH_4 was done by a GC-FID-M (FID - Flame Ionization Detector) method using a Carle Instrument Model 211-M. The CO_2 and CO are methanated over a hot nickel catalyst at 400°. The conversion of the CO_2 and CO is 100% to CH_4. However, the absolute calibration is done against National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) standards for each compound. The method is very sensitive, and precision is excellent since the method is used for long-term global monitoring of the ambient atmosphere where high precision is necessary. The precision of analysis is; CH_4 @ 1700 ppbv $\pm$0.2%, CO @ 100 ppbv $\pm$3%, and CO_2 @ 345 ppmv $\pm$0.3%.

3.4.1.2 The C_2 - C_{10} volatiles were measured by a different GC (using EPA's TO-14 compendium method) with no conversion to methane, but rather direct detection of each of the eluting compounds by flame ionization. A complete list of volatiles is available for every analysis (Appendix E); however, for the sake of brevity, "target" toxic species such as benzene and toluene were selected to show overall trends in volatile emissions from the various test conducted.

3.4.2 Semivolatile Organic Sampling and Analysis

3.4.2.1 Filter Description

Semivolatile organics were collected on the three 20-cm by 25-cm filters positioned at the termination of the aircraft transport tube. A complete description of the transport tube, valve, and flow measurement system is given in section 3.1.3. Quartz-fiber filters (Pallflex Corp, type QAOT) were used during the Phase A and B tests. These filters were prefired at 500 °C for at least 1 hour to remove organic material prior to preweighing and sample collection. In order to provide a weight-constant filter medium with which to measure particulate matter loading on the filter, Teflon™-coated glass fiber filters (Pallflex, Type T60A20) were used for sample collection during the phase C tests. Solvent extraction and SFC-MS analysis of blank Teflon™-coated glass fiber filters

showed no appreciable background organic material, so filters were used as received from the supplier and were not solvent-extracted prior to sample collection.

3.4.2.2 Sampling Methods

Almost all explosive tests conducted during field testing included three 907-kg (2000-lb) detonations. The cloud from each detonation was sampled for semivolatile organics during three aircraft passages through the cloud, with an approximate 5-second duration for each pass. The total sampling time in the cloud from all three detonations was about 45 s. To achieve maximum filter loading, the filters were not changed until all three detonation-produced clouds had been sampled. A typical sampling volume for a three-detonation test sequence was usually in the range of 8 to 10 m^3 of air for the Teflon™-coated glass fiber filters used in phase C. Sample volumes for the quartz-fiber filters used in the Phase A and B tests were in the range of 6 to 8 m^3. The lower sampling volumes for the quartz filters results from the increased airflow resistance through the quartz-fiber filters used during these tests.

3.4.2.3 Postsampling Filter Handling

During the phase A and B tests, the sample filters were removed from the filter holders when the aircraft landed, stored in either aluminum foil pouches or Teflon™ sheets to minimize filter contact with other contaminated surfaces, and placed in dry ice. During the Phase C tests, the filters were removed from the holders and weighed at DPG prior to being placed in dry ice storage. (See section 3.4.4 for additional information on filter weighing procedures.) All filter samples were preserved with dry ice during transport from the field location to AWL.

3.4.3 Real-Time Gases

3.4.3.1 Gas Analyzer Descriptions

Continuous gas analyzers installed on the aircraft and their measurement principle and detection limits are listed in Table 3.17. Gas filter correlation instruments were used for the measurement of CO_2 (Thermo Electron Corporation, model 41H) and CO (Thermo Electron Corporation, model 48). NO_x was measured with a chemiluminescent instrument. For phases A and B, a Columbia Scientific Instruments, model 1600 NO_x analyzer, was used and for Phase C, a Thermo Electron Corporation, model 42 was used. Ozone was measured during the phase B and C tests, using a UV absorption instrument (Thermo Electron Corporation, model 49). The CO and NO_x instruments are both certified as EPA equivalent methods, under 40 CFR 53. In-line cellulose filters were used in the air inlets of the CO and CO_2 instruments. An in-line Teflon™ filter was installed in the inlet of the NO_x instrument. The input plumbing pathway to these instruments is schematically shown in Figure 3.14 on page 3-24. The input flow to the gas instruments was manually selectable by an air-driven ball valve, so that air samples could be drawn directly from the transport tube or from the 80-L bag. Valve position was continuously recorded by the data acquisition system.

Table 3.17 OB/OD Real-Time Continuous Monitors Installed on the Aircraft.

Species	Instrument	Measurement Principle	Detection Level[a]
Carbon Dioxide	TECO Model 41H	Gas Filter Correlation	1.2 ppmv
Carbon Monoxide	TECO Model 48		0.1 ppmv
Ozone	TECO Model 49	UV[b] Absorption	5 ppbv
Oxides of Nitrogen	CSI Model 1600	Chemiuluminescence	6 ppbv

[a]Detection level defined as two times the standard deviation of the instrument noise.
[b]Ultraviolet

3.4.3.2 Gas Analyzer Calibration Procedures

Zero and span gas readings of each instrument were taken prior to and following each test measurement. Zero gas for the CO_2 instrument was produced by passing ambient air through a soda lime scrubber. A zero CO gas stream was produced by passing ambient air through a heated catalytic oxidation unit which converted all ambient CO to CO_2. A zero NO_x stream was produced by pumping ambient air through a scrubbing column containing a mixture of silica gel, activated charcoal, and Purafil™. Working-level span gases were also carried on the aircraft so that pretest and posttest zero and span gas checks could be conducted in flight. The CO and CO_2 span gases

were referenced to NIST standard gases in the possession of the Oregon Graduate Institute of Science & Technology. The NO span gas was measured with the NO_x instrument immediately following a multipoint calibration against a certified NO bottle standard. The NO level in the span cylinder measured by the calibrated instrument then became the assigned span value for the duration of the test series.

3.4.3.3 Gas Data Calculations

Multipoint calibrations with certified gas standards were completed on the CO_2, CO, and NO_x instruments prior to the onset of the test period in order to document instrument linearity over their working ranges. Daily instrument response factors were calculated from the pretest and posttest zero and span checks by the following formula,

3.1 Gas Data Calculation.

$$M = \frac{S}{\left(\frac{V_{si} + V_{sf}}{2}\right) - \left(\frac{V_{zi} + V_{zf}}{2}\right)}$$

where:

M = instrument response factor (ppm volt^{-1})
S = span gas value (ppm)
V_{si} = initial span reading (volt)
V_{sf} = final span reading (volt)
V_{zi} = initial zero reading (volt)
V_{zf} = final zero reading (volt)

Daily instrument response factors were calculated and used in favor of a single-response factor over the duration of the experiment. Past experiences have shown that, although the linearity of the instrument remains constant, daily electronics drift with varying temperature inside the aircraft can yield less accurate measurements when a single response factor is used. The use of a daily response factor that is derived from a daily two-point calibration (zero and span) takes daily instrument drift into account and yields a more accurate measurement of the particular gas. Gas concentrations in the bag were determined by calculating at least a 2-minute average instrument voltage reading while

the instrument was sampling from the 80-L bag. The starting point of the average was after the instrument had stabilized on the bag reading. The average voltage was then multiplied by the instrument response-factor. The same calculation was performed on the ambient air sample collected in the bag during the background flight. The ambient air gas concentration level was then subtracted from the cloud sample level to derive a background corrected cloud concentration level for each particular gas. Complete details of these calculations are given for a representative test case in Appendix C.

3.4.4 Airborne Particulate Matter

3.4.4.1 Gravimetric Analysis

Efforts were made to quantify the amount of particulate matter collected on the filters used for semivolatile organic analysis in each of the test series. Only crude estimates of particulate matter weight gain were available from the filter samples collected during the Phase A and B tests; because of the inherent weight instability of quartz filter media. Quartz fibers are susceptible to ambient moisture pickup and loss and thus are not well suited for gravimetric analysis. Teflon™-coated glass fiber filters were selected during the Phase C study in an effort to provide a more precise estimate of particulate loading because they are far less susceptible to environmental changes in humidity and temperature.

3.4.4.2 Weight Change

Filters were weighed prior to and after sample collection and the resultant weight change used as an estimate of particulate matter loading on the filters. A rigorous filter-weighing quality control program was initiated during Phase C to provide estimates of weight uncertainty during the initial and final weighing procedures. All filters were weighed on a precision microbalance (Mettler, model AE-20) with an approximate weighing precision of 100 μg. Overall weight uncertainty for the combined difference between an initial and final filter weight was about 1.5 mg.

3.4.4.3 Particulate Carbon Analysis

During the Phase A and B tests, a measure of particulate carbon content of the combustion or detonation clouds was determined by combustion analysis of a section of the quartz filter at Sunset Laboratories. This particulate carbon analysis incorporates a two-step volatilization and combustion process in which particulate carbon is burned, evolved as CO_2, catalytically reduced to methane, and detected with a flame-ionization detector. Differentiation between organic carbon, elemental carbon (soot), and inorganic or carbonate carbon is possible by using a multistep analysis procedure in which the combustion temperature and the carrier gas mix is varied (Johnson et al. 1981, Reference 6).

3.4.5 Aircraft-Based Video

Video recordings of all phase C test events were made with a forward-looking video camera mounted on the nose of the instrumented aircraft. A high speed, variable focal length lens (f1.0 to 2.2, 16 to 160 mm) was used to record the detonation while the aircraft was on a heading toward the detonation point and during subsequent sampling passes through the cloud. An on-screen elapsed timer was also used to mark the detonation and each passage of the aircraft through the plume. Originals of all VHS format videotapes made during the Phase C tests are archived at SNL. Selected video recordings were also made during the Phase A and B testing; however, many of these were made with a hand-held camera and are of less desirable quality than those made during the Phase C testing.

3.4.6 Meteorology

3.4.6.1 Synoptic weather for the test site was briefed each test day at 0700 hours to the test team prior to traveling to the test site by the Atmospheric Science Laboratory detachment at DPG. The briefing covered the wind speed and direction, cloud cover, and temperature gradient from the surface to the aircraft sampling height. The time window for the acceptable conditions for OB/OD testing was provided. The OB/OD test officer maintained radio contact with the weather detachment from the test control point throughout the field testing to avoid any unacceptable test conditions.

3.4.6.2 Standard meteorological surface observations of wind speed and direction, temperature, humidity, barometric pressures, and cloud cover were taken every 15 minutes at the test site. Tethersondes were also taken into the field to measure wind speed and direction, and temperature from the surface to 2000 meters above the ground.

SECTION 4 DATA COLLECTION, ANALYSIS, AND RESULTS

4.1 General Methods

This section covers the development of innovative methodology for the efficient and effective characterization of emissions from OB/OD, thermal treatment operations (carbon balance and supercritical fluid chromatography-mass spectrometry (SFC-MS)), existing methodology (gas chromatography-mass spectrometry (GC-MS)) and conversion factors for soil and air pollutant concentrations.

4.1.1 Carbon-Balance Method

4.1.1.1 *The emission factor (EF) is defined as the mass release of a particular species per unit mass of original explosive or propellant consumed.* The carbon-balance method of calculating EFs, is based on two premises: (1) the mass of carbon available in the explosive or propellant can be accounted for in the masses of the various carbon-containing product species, and (2) the proportional distribution among carbon-containing products within individual microregions of the cloud remains relatively constant, even though the actual values for individual concentrations may be different within different macroregions of the cloud.

4.1.1.2 Based on these two premises, the total volume of the cloud becomes irrelevant in making EF calculations, and the EF of any individual product, i, can be estimated by the equation:

Equation 4.1 Calculation of Emission Factor.

$$EF_i = (f_c)\,\frac{[D_{ij}]}{[C_j]}$$

where, f_c = mass fraction of carbon in the fuel;

$[D_{ij}]$ = average concentration of product, i, in any specific volume element, j, of the cloud; and

$[C_j]$ = concentration of all forms of carbon in the sample, from volume element, j.

For example, the maximum EF value calculated for 2,4-dinitrotoluene from Phase B *surface* detonation samples was 8.4 x 10^{-6} weight units of 2,4-dinitrotoluene (e.g., kg) per weight unit of TNT detonated (kg) . (Values used were f_c = 0.37, $[D_{ij}]$ = 797 x 10^{-6}mg/m^3 of 2,4-dinitrotoluene, $[C_j]$ = 34.95mg/m^3 of carbon. The product of an EF for a given species and the total amount of material consumed gives the total atmospheric release of the species.

The carbon-balance method has great potential for calculating OB/OD combustion product EFs in large-scale outdoor tests because *total volumes of clouds and total concentrations of products over that whole "volume" need not be known;* only "grab samples" need to be taken within the cloud by aircraft sampling. Since CO_2 is by far the major product of combustion, only the net (background corrected) CO_2 and the target analytes of interest need to be measured above background in order to successfully use the carbon-balance method.

4.1.2 Analytical Methods for Semivolatile Organics

Filters, soils, and the contents of fallout collection pans were analyzed either by supercritical fluid chromatography-mass spectrometry (SFC-MS) or gas chromatography-mass spectrometry (GC-MS) to expedite the work and allow comparison between the two methods. Phase C tests that incorporated the thermally labile RDX and explosive D (picric acid) explosives required the use of SFC-MS.

4.1.2.1 Gas Chromatography-Mass Spectrometry

Microbore capillary gas chromatography interfaced with mass spectrometry at its present mature stage of development is currently the most sensitive and broadly applicable general method for the analysis of volatile and semivolatile organic compounds, and it is presently the accepted standard. It suffers, however, from two major deficiencies: (1) inadequate volatility of some compounds of interest, even after modification by derivitization, and (2) analyte thermal decomposition under the required conditions of operation.

4.1.2.2 Supercritical Fluid Chromatography-Mass Spectrometry

Supercritical fluid chromatography-mass spectrometry is a rapidly emerging alternative to GC-MS. SFC-MS largely overcomes the two major disadvantages of GC-MS mentioned earlier by taking advantage of the additional parameters of solvation of the analytes in the supercritical carrier fluid modulated by variations in the pressure (fluid density), and by the addition of chemical modifiers. Furthermore, SFC closely approaches GC in resolving power. SFC suffers a disadvantage in that the much larger volumes of gas produced by expansion of the carrier fluid at the MS interface are more difficult to handle, but that problem is being rapidly overcome with improved technology.

4.1.3 Soil and Fallout Samples

4.1.3.1 Conversion Factors for Soil and Particulate Samples

Soil samples include the pretest (background), ejecta, and fallout samples from the explosive detonations. The particulate samples include the sputter, fallout, and burn pan residue samples from the propellant burns. Analytical results are expressed as mass of analyte per mass of soil or particulate collected. Some useful conversions are as follows:

μg/g or mg/kg = ppm (one part per million by mass or weight)
ng/g or μg/kg = ppb (one part per billion by mass or weight)
pg/g or ng/kg = ppt (one part per trillion by mass or weight).

4.1.3.2 Statistical Treatment of the Data.

All field-test phases provided several estimates of soil concentration for each analyte and for each sample source (background, ejecta, and 50- and 100-meter fallout soil). All data were examined and descriptive statistics calculated. The variance for each of the analyte/sample sources were more nearly equal with a logarithmic transformation; thus, geometric means were used to express averages. Using the transformed data, the analysis of variance (ANOVA) was performed for each analyte to determine if concentration means from the four sample sources were different. Duncan's multiple-range test was used to determine which concentration means were different. When the

analyte concentration values were below the detection limit, they were used as missing values in the statistical analyses. The calculation of the geometric means from only the values above the detection limits provides a positively biased mean, which, for health effect risks considerations are conservative.

4.1.3.3 Ejecta.

Ejecta soil is the soil displaced at the point of a *surface* detonation and redeposited in the crater, in the berm around the crater, and within a few meters of the crater. The volume of the displaced soil was estimated, using an equation developed in the Tooele Army Depot OB/OD Study. The equation is given in Equation 4.2.

Equation 4.2 Volume of Crater

$$V = \frac{\pi}{24} (3 D^2 L + 4 L^3)$$

where V = volume of crater
D = crater width
L = crater depth

4.1.3.4 Observations Applicable to all Detonations

The careful observer will note the anomaly of several of the semivolatile organic analytes occurring at concentration levels higher than background in soil fallout pans (which always contain only a few grams of very fine, dry soil particulates or dust) at radial distances in the 150 to 200 m range. The contamination is apparently greater at distances more remote from the detonation rather than the reverse which would seem more logical (of course in absolute terms the amounts are very small by any standard). Moreover, analytes such as TNT and the DNTs occur in levels above background levels in fallout pans from RDX detonations where they are not explainable at all in terms of direct contamination from the primary explosive itself. A possible explanation of these anomalies may lie in the nature of the surface of the dry desert soil at DPG which consists primarily of a very light, fluffy powder when it is dry, i.e. very fine soil particulate. A natural consequence of its fineness is that the particulate has a high specific surface (surface area per unit mass) which increases inversely

with particle size; consequently its adsorptive capacity for foreign matter likewise increases. This fine powdery particulate is easily disturbed and hence transported readily by winds and blast waves, yet its very fineness precludes rapid settling out, so that the very material most easily suspended and slowest to settle, by virtue of its higher specific surface, may carry relatively higher proportions of adsorbed foreign matter. Even the casual observer will note, that whenever a surface detonation occurred, that a component of the blast wave is propagated parallel to the ground surface stirring up a cloud of dust projecting a few meters up into the atmosphere and extending radially out from the blast center several hundred meters. This cloud is the major source of the fallout pan samples at distances beyond the periphery of significant subsurface soil ejection. Furthermore this material has been subject to cross-contamination from previous operations elsewhere in the vicinity at DPG. The factors indicate that fallout pan samples located on the surface, containing these fine particles are primarily samples of the existing surface contamination at DPG rather than representative samples of the contamination from the detonation. Soil fallout samples are probably a composite of (1) soil particles that are in direct contact with the fireball of detonation products, and (2) soil particles from the desert soil that are transported by the blast wave.

4.1.4 Emission Factors

Emission factors are also expressed as a ratio of the mass (weight) of a particular pollutant released to the mass (weight) of explosive or propellant consumed. Since the EF is a ratio, it is a dimensionless value; i.e., the EF for an analyte multiplied by pounds of explosive yields the total pounds of analyte released.

4.2 Explosives

The explosives chosen for study in these OB/OD tests were selected on the basis of the materials in the current demilitarization inventory. Bulk TNT was included in all phases as a baseline for comparison of reproducibility of results from phase to phase. It was originally selected for study because it is the most oxygen deficient of the explosives and thus most dependent on environmental oxygen for combustion; i.e., it represents a worst case for the potential of incomplete combustion and thus the greatest potential for air and soil contamination with detonation products.

4.2.1 TNT Tests - Phases A, B, and C

4.2.1.1 Airborne Release

4.2.1.1.1 Gases

a. Gaseous species measured during the large-scale *surface* and suspended TNT detonations conducted during Phases A, B, and C included carbon dioxide (CO_2), carbon monoxide (CO), and oxides of nitrogen (NO_x). During the Phase B and C tests, cloud ozone (O_3) concentrations were also measured. Summary EF data for *surface* TNT detonations are given in Table 4.2.1 and those for the suspended TNT tests in Table 4.2.2. For the *surface* TNT tests, the data in Table 4.2.1 are a compilation of 18 total; separate measurements, taken during three test phases. The data in Table 4.2.2 represents a statistical summary of 10 measurements accomplished in Phase B and C. Details of the methods used to calculate the gas EFs are given in detail in Appendix C. The minimum, maximum and average EF are given in the tables for each species measured. These EF's are dimensionless, so the reader can calculate values in the units of choice. For example, Table 4.2.1 shows that an average of 0.0036 kg of NO_2 were produced for each kg of TNT detonated in Phase A. To calculate the total release of a particular species, multiply the EF by the original weight of explosive or propellant.

Table 4.2.1 Gas Emission Factors for Surface TNT Detonations.

Gas Species	Emission Factors (g/g)		
	Phase A	Phase B	Phase C
CO_2 - min	1.19	1.27	1.25
CO_2 - max	1.28	1.33	1.30
CO_2 - avg	1.26	1.29	1.28
CO - min	0.037[a]	0.016	0.036
CO - max	0.10	0.054	0.066
CO - avg	0.061	0.042	0.049
NO - min	0.00020	0.00098	0.00087
NO - max	0.0010	0.0016	0.0017
NO - avg	0.00070	0.0014	0.0014
NO_2 - min	0.00091	0.00079	0.0011
NO_2 - max	0.0070	0.0016	0.0017
NO_2 - avg	0.0036	0.0011	0.0014

[a]Phase A CO data are taken from 6-L canister data.

Table 4.2.2 Gas Emission Factors for Suspended TNT Detonations[a].

Gas Species	Emission Factor (g/g)	
	Phase B	Phase C
CO_2 - min	1.33	1.34
CO_2 - max	1.36	1.34
CO_2 - avg	1.35	1.35
CO - min	0.0029	0.0052
CO - max	0.016	0.0078
CO - avg	0.0073	0.0069
NO - min	0.0016	0.0021
NO - max	0.0039	0.0024
NO - avg	0.0025	0.0023
NO_2 - min	0.0012	0.0011
NO_2 - max	0.0031	0.0013
NO_2 - avg	0.0021	0.0012

[a]No suspended TNT detonations were done during the Phase A tests.

b. Carbon dioxide EF for the *surface* TNT detonations ranged from 1.19 to 1.33 for all *surface* tests conducted with an overall average of 1.28. This compares to a theoretical CO_2 EF of 1.36, assuming that all the carbon in the TNT is converted to CO_2. A ratio of the actual to theoretical CO_2 EF gives an estimate of the overall efficiency of the detonation. For all *surface* tests, the average detonation efficiency is 0.94, indicating that all but 6 percent of the carbon in the TNT is converted to CO_2. Most of the remaining carbon is in the CO category, as discussed further below. Notably, the TNT molecule carries enough oxygen within it to oxidize only about 37 percent of the TNT carbon to CO_2. A secondary combustion mechanism is responsible for the high carbon conversion efficiencies observed in the tests. This occurs by way of entrainment of oxygen in ambient air into the detonation fireball, where further combustion of TNT carbon occurs.

c. The average CO_2 EF from all suspended TNT detonations was 1.35. The corresponding ratio of actual to theoretical CO_2 yield is 0.99, which reveals an even higher conversion efficiency of TNT carbon to CO_2 than observed for the *surface* TNT tests. A likely explanation for this observed effect is increased air entrainment into the detonation fireball in the suspended tests as compared to the *surface* tests. In the *surface* tests, the fireball has extensive contact with the adjacent soil, which depresses fireball temperatures, entrains soil, and restricts the incorporation of ambient oxygen into the fireball.

d. For the *surface* TNT tests, CO EFs varied between 0.016 and 0.10, with an overall average of 0.049. Inter-test comparisons of average CO EFs from each test phase are quite good and range from a low of 0.042 (Phase B) to a high of 0.061 (Phase C) with a relative standard deviation (RSD) between the three tests of 16 percent. For the *surface* TNT tests, about 2 to 3 percent of the TNT carbon is converted to CO, with about 94 percent converted to CO_2. The balance of carbon is in the other categories such as VOC and particles, as discussed below.

e. Carbon monoxide EF for the suspended TNT Tests are lower than those observed for the *surface* TNT tests. The overall average CO EF from the Phase B and C suspended tests was 0.007. These observations are consistent with the higher detonation efficiencies noted above for the suspended TNT tests. About 0.3 percent of the TNT carbon is converted to CO, with 99 percent converted to CO_2 for the suspended-detonation configuration.

f. Nitric oxide (NO) EFs for the *surface* TNT detonations reveal that averages for each of the three test phases varied by a factor of approximately two. Nitric oxide ranged from a low of 0.2 x 10^{-3} in the Phase A test to a high of 1.7 x 10^{-3} in the Phase C test. The overall NO EF average was 1.2 x 10^{-3}, or about 0.1 percent. Nitrogen dioxide (NO_2) EF results were in the same range as those encountered for NO, with an overall average of 1.9 x 10^{-3}. A conservative estimate of an NO_2 EF was determined to be (0.0038), or about 0.4 percent, by assuming that all NO released in the detonation is eventually converted to NO_2 by normal atmospheric processes. All calculations on gas EFs assume 100-percent recovery from the 80-L Teflon® sampling bag in the aircraft.

g. A slightly higher EF for NO was observed in the suspended TNT trials as compared to the *surface* trials. The average EF for NO_2 remained the same for the *surface* and suspended detonations, although the *surface* detonation EFs were associated with a larger variability. The larger variability is expected because the NO and NO_2 formed from the fixation of N_2 and O_2 is dependent upon the temperature of the fireball and the availability of O_2. The quantity of soil entrained varied from detonation to detonation and this would also result in variation in fireball temperature from detonation to detonation. In contrast, very little soil was entrained in the suspended tests and the NO and NO_2 EF were quite constant. For the suspended TNT tests, a conservative estimate of total NO_2 release, assuming that all NO is converted to NO_2, is about 0.6 percent.

h. Although measurements of ozone (O_3) were made of both background and plume air collected in the bag, the results were inconclusive and suggest that O_3 is rapidly lost to the bag surfaces. Average ozone (O_3) recovery from the bag is about 41 percent, based on collection and measurement of ambient (40 ppb) O_3 levels. It is likely that O_3 readily reacts with bag surfaces and cloud constituents such as NO and particles; however, the relative importance of these two reaction sinks cannot be ascertained from this data. Here, it is reasonable to assume that the detonation results in a net loss of ozone, since much of the NO produced will ultimately be converted to NO_2 by a reaction pathway that consumes O_3.

4.2.1.1.2 Particulate Matter

a. Results from the filter gravimetric analyses for all phases of TNT testing are given in Table 4.2.3. Data are reported as average particle mass concentrations per unit volume of air sampled in the cloud for both *surface* and suspended detonations. The reported data normally represent an average of three cloud passes per detonation for multiple detonations. Particle mass concentration in the cloud was measured by the aircraft in multiple passes through the cloud starting at about detonation time plus 1 minute (T_0+1) to T_0+4 minutes. Results for *surface* TNT detonations are highly variable and range from an average of 45 mg/m^3 in Phase A to 258 mg/m^3 in Phase C. It is likely that the marked differences in cloud particle concentrations between the Phase A, B, and C tests are largely influenced by the degree of soil moisture and compaction at the detonation site. Ground crews noted very different soil conditions during the various testing phases. Those sites with loosely packed soil are much more likely to loft soil during the detonation. The suspended TNT detonations clearly loft less soil debris than the *surface* detonations, as evidenced by average cloud particulate loadings of 11 and 37 mg/m^3 for the Phase B and C tests, respectively.

Table 4.2.3 Summary of Total Particulate Mass Concentrations for Surface and Suspended TNT Detonations.

Test	Particulate Mass Concentration (mg/m^3)			
	Minimum	Maximum	Average	No. of Filter Samples
Phase A - surface	24	65	45	2
Phase B - surface	35	85	62	3
Phase C - surface	248	268	258	2
Phase B - Suspended	8	16	11	3
Phase C - Suspended	37	37	37	1

4.2.1.1.3 Volatile Organic Compounds

a. A statistical summary of VOC EFs measured during all *surface* TNT detonations in all testing phases is given in Table 4.2.4. A similar summary for all suspended TNT tests is given in Table 4.2.5. Only representative species including methane, total nonmethane hydrocarbons (TNMHC--the sum of the C_2 to C_{10} compounds detected), and benzene were selected to show the general

trends in VOC emissions from TNT tests. A representative example of all VOC species detected with a calculation of VOC species EFs is given in Appendix E.

Table 4.2.4 Volatile Organic Compound Emission Factors for Surface TNT Detonations[a].

Species	Emission Factor (g/g)		
	Phase A	Phase B	Phase C
CH_4 - min	930×10^{-6}	360×10^{-6}	610×10^{-6}
CH_4 - max	1600×10^{-6}	5200×10^{-6}	2200×10^{-6}
CH_4 - avg	1500×10^{-6}	1200×10^{-6}	1500×10^{-6}
Number of observations	5	19	6
TNMHC - min	750×10^{-6}	500×10^{-6}	BD[b]
TNMHC - max	1600×10^{-6}	11000×10^{-6}	5000×10^{-6}
TNMHC - avg	1400×10^{-6}	1900×10^{-6}	2100×10^{-6}
Number of observations	5	19	11
Benzene - min	58×10^{-6}	32×10^{-6}	0.27×10^{-6}
Benzene - max	120×10^{-6}	400×10^{-6}	130×10^{-6}
Benzene - avg	94×10^{-6}	93×10^{-6}	100×10^{-6}
Number of observations	5	19	11

[a]Emission factors are expressed in terms of 10^{-6} for ease of comparison, e.g., 930×10^{-6} is equivalent to 0.00093.
[b]Below detection limit.

b. Average methane EFs for *surface* TNT tests are about 0.0015 in all three phases. Similar results were observed for the TNMHC category, with an average EF of slightly less than 0.002. For these tests, the TNMHC category was primarily composed of light hydrocarbons, such as ethane, propane, acetylene, etc., with little or no contribution from toxic VOC species, such as benzene and toluene. The methane and TNMHC categories reveal information concerning the degree of detonation efficiency in much the same manner as the carbon dioxide EF. High conversion efficiency of the carbon in the parent explosive compound to CO_2 is accompanied by low production rates of methane and TNMHC. Benzene EFs for the *surface* TNT tests are about a factor of 10 lower than EFs for methane and TNMHC. The average benzene EF from all tests is very near 0.0001 in all three phases.

Table 4.2.5 Volatile Organic Compound Emission Factors for Suspended TNT Detonations[a].

Species	Emission Factor (g/g)	
	Phase B	Phase C
CH_4 - min	BD[b]	610×10^{-6}
CH_4 - max	220×10^{-6}	2200×10^{-6}
CH_4 - avg	61×10^{-6}	1500×10^{-6}
Number of observations	13	6
TNMHC - min	BD	BD
TNMHC - max	4800×10^{-6}	5800×10^{-6}
TNMHC - avg	210×10^{-6}	5000×10^{-6}
Number of observations	16	6
Benzene - min	BD	8.8×10^{-6}
Benzene - max	11×10^{-6}	130×10^{-6}
Benzene - avg	3.2×10^{-6}	62×10^{-6}
Number of observations	13	6

[a]Emission factors are expressed in terms of 10^{-6} for ease of comparison, e.g., 220×10^{-6} is equivalent to 0.000220.
[b]Below detection limit.

c. Similar data for the suspended TNT tests reveals generally lower average EFs for all detected VOC compounds. Methane EFs are quite variable, with a near 50-fold difference between the Phase B and C tests. Much larger differences also exist for the TNMHC category between Phase B and C suspended tests. Benzene EFs for the suspended TNT tests, at about 0.000003, are lower than those measured for the *surface* tests by about a factor of 30. Benzene is included here as representative of the potentially toxic VOC categories for bulk explosive detonations.

d. In general, the VOC EFs for suspended TNT tests are lower than for the *surface* TNT tests. This is consistent with the so called "detonation efficiency" determined for these two test configurations as discussed earlier. Interaction of the *surface* detonated TNT fireballs with soil materials very likely serves to reduce the duration of elevated temperatures within the fireball, as well as entrainment of ambient air into the fireball. The net result for the *surface* detonations is reduced conversion of carbon in the explosive to carbon dioxide with higher fractions of carbon monoxide and light hydrocarbon formation by incomplete combustion mechanisms.

4.2.1.1.4 Semivolatile Organics

a. EFs for the semivolatile organic target compounds are given in Table 4.2.6 for the *surface* TNT test and Table 4.2.7 for the suspended TNT test. As a conservative estimate, only the maximum value encountered in each test type is given in the table for each test series. In general, for both surface and suspended detonations, the majority of the compounds on the target analyte list were not detected on the filter samples.

Table 4.2.6 Maximum Semivolatile Organic Emission Factors Measured for Surface TNT Detonations[a].

Species[b]	Emission Factor (g/g)		
	Phase A	Phase B	Phase C
2,4-Dinitrotoluene	150×10^{-9}	8400×10^{-9}	BD[c]
2,6-Dinitrotoluene	19×10^{-9}	7100×10^{-9}	BD
2,4,6-Trinitrotoluene	220×10^{-9}	150×10^{-9}	60×10^{-9}
2-Nitronaphthalene	80×10^{-9}	270×10^{-9}	BD
N-Nitrosodiphenylamine	BD	4.4×10^{-9}	BD
1,3,5-Trinitrobenzene	BD	BD	BD
2-Nitrodiphenylamine	BD	N/A[d]	BD
1-Nitropyrene	BD	39×10^{-9}	BD
Naphthalene	BD	3700×10^{-9}	2600×10^{-9}
Benz[a]anthracene	2.2×10^{-9}	160×10^{-9}	100×10^{-9}
Benzo[a]pyrene	BD	240×10^{-9}	BD
Pyrene	BD	N/A	220×10^{-9}
Phenol	BD	5200×10^{-9}	BD
Dibenzofuran	BD	85×10^{-9}	180×10^{-9}
Diphenylamine	N/A	7.7×10^{-9}	170×10^{-9}
4-Nitrophenol	BD	N/A	N/A
Biphenyl	BD	N/A	N/A
Phenanthrene	BD	N/A	N/A
1-Methylnaphthalene	BD	N/A	N/A
2-Methylnaphthalene	BD	N/A	N/A

[a]Emission factors are expressed in terms of 10^{-9} for ease of comparison, e.g., 150×10^{-9} is equivalent to 0.000000150.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels.
[c]Below detection limit.
[d]Not included on analyte list for analysis.

Table 4.2.7 Maximum Semivolatile Organic Emission Factors Measured for Suspended TNT Detonations[a].

Species[b]	Emission Factor (g/g)	
	Phase B	Phase C
2,4-Dinitrotoluene	200×10^{-9}	BD[c]
2,6-Dinitrotoluene	300×10^{-9}	BD
2,4,6-Trinitrotoluene	46×10^{-9}	140×10^{-9}
2-Nitronaphthalene	15×10^{-9}	BD
N-Nitrosodiphenylamine	29×10^{-9}	BD
1,3,5-Trinitrobenzene	BD	BD
2-Nitrodiphenylamine	N/A[d]	BD
1-Nitropyrene	59×10^{-9}	BD
Naphthalene	12×10^{-9}	1800×10^{-9}
Benz[a]anthracene	66×10^{-9}	320×10^{-9}
Benzo[a]pyrene	310×10^{-9}	BD
Pyrene	N/A	19×10^{-9}
Phenol	12000×10^{-9}	BD
Dibenzofuran	60×10^{-9}	190×10^{-9}
Diphenylamine	25×10^{-9}	BD

[a]Emission factors are expressed in terms of 10^{-9} for ease of comparison, e.g., 200×10^{-9} is equivalent to 0.000000200.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection limits.
[c]Below detection limit.
[d]Not included on analyte list for analysis.

b. In most cases semivolatile compounds detected during these tests include the parent compound, 2,4,6-TNT, as well as the 2,4- and 2,6-dinitrotoluene compounds. The compounds occurring in the highest concentrations are typically phenol and naphthalene, with EFs about 0.000001. Most of the other detected compounds are observed at levels 10-fold to 1000-fold lower than those for phenol and naphthalene.

c. An examination of semivolatile results for the suspended tests reveals that the emission levels do not change appreciably from those measured in the *surface* tests. This is an important observation and stands in contrast to the lower EFs for such species as CO and VOC seen in the

suspended TNT tests. Above-ground elevation of the bulk explosive prior to detonation does not appear to have a significant effect on the production of semivolatile organic compounds.

4.2.1.2 Soil

4.2.1.2.1 Ejecta.

Ejecta soil is the soil displaced at the point of a *surface* detonation and redeposited in the crater, in the berm around the crater, and within a few meters of the crater. The volume of the displaced soil was estimated using Equation 4.2, paragraph 4.1.3.3. The calculated crater volume for TNT tests are shown in Table 4.2.8. The volume of the displaced soil varied from 12 to 42 m^3. The calculated weight of the soil, based on a density of 2.5 g/cc, varied from 29 to 105 metric tons, with a mean of 56 metric tons. This loose soil was sampled, and the semivolatile organics remaining after the detonation were identified and quantified. Background soil samples of the sites were taken prior to the detonations to provide a baseline concentration level of semivolatile organics in the local soil.

Table 4.2.8 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil.

Location	Rim Opening (m)	Depth (m)	Volume (m^3)	Weight of Soil (kg)	Average Weight (kg)
TNT Surface Detonations-Phase B					
1	5.6	2.1	30.71	76777	
2	4.9	1.7	18.60	46503	
3	5.3	1.3	15.49	38726	
4	5.0	1.8	20.73	51813	
5	6.5	2.2	42.08	105192	
6	ND[a]	1.9	ND	ND	
7	ND	1.4	ND	ND	
TNT Surface Detonations-Phase C					
C1	4.3	1.4	11.60	29005	
C2	4.6	1.6	15.44	38600	
C3	6.7	1.8	34.78	86961	
C4	4.5	1.7	16.09	40228	
C5	ND	ND	ND	ND	
C6	4.3	1.7	14.92	37290	
C0	5.3	2.0	26.25	65627	56066

[a]ND - no data.

a. Phase A. Soil sampling was accomplished to develop and refine field soil collection methods and the chemical extraction/assay procedures. The data are summarized in Table 4.2.9.

Table 4.2.9 Summary of Phase A Pretest and Ejecta Soil Samples for Semivolatile Organics.

Source of Sample	Compounds Found[a]	Concentration Range (ng/kg)[b]
Pretest 12-ft core	None	BD[c]
Pretest 15-cm core	2,4-Dinitrotoluene	0.58 to 1.2
	2,6-Dinitrotoluene	BD to 2.7
	2-Nitronaphthalene	2.3 to 2.9
Ejecta	2,4-Dinitrotoluene	68 to 170
	2,6-Dinitrotoluene	23 to 35
	2,4,6-Trinitrotoluene	300 to 4400
	2-Nitronaphthalene	1.1 to 4.9
	1,3,5-Trinitrobenzene	BD to 160
	Naphthalene	BD to 1200
Posttest 15-cm core	2,4-Dinitrotoluene	30
	2,6-Dinitrotoluene	BD
	2,4,6-Trinitrotoluene	1500
	2-Nitronaphthalene	1.1
	1,3,5-Trinitrobenzene	11
	Naphthalene	BD
Pan-composite	2,4-Dinitrotoluene	160
	2,6-Dinitrotoluene	140
	2,4,6-Trinitrotoluene	190
	2-Nitronaphthalene	2.7
	1,3,5-Trinitrobenzene	240
	Naphthalene	2300

[a]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[b]Represents ng of analyte per kg of soil.
[c]Below detection limit.

b. Phases B and C.

(1) Background samples were taken at all detonation sites. Although sampling procedures differed somewhat between phases B and C, (depth of cores, number of cores, and the compositing of samples), all samples were from an area at DPG considered uncontaminated from previous explosive detonations. The ejecta sampling at each site on Phases B and C were similar, although

compositing of samples differed between the two phases. The summary data are shown in Table 4.2.10. The analytes which showed increased concentrations (above concentration levels in the pretest soil) in the ejecta soil after detonation were 2,4,6-trinitrotoluene, 1,3,5-trinitrobenzene, benz[a]anthracene, pyrene, and phenol.

Table 4.2.10 Summary of Semivolatile Organic Concentrations from Phases B and C Pretest and Ejecta Soil Samples, Based on the Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Concentration Range (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
Pretest	10	7	2,4-Dinitrotoluene	BD[e] to 1.6	0.87
	10	5	2,6-Dinitrotoluene	BD to 9.3	5.0
	10	9	2,4,6-Trinitrotoluene	BD to 24	1.0
	10	8	2-Nitronaphthalene	BD to 1.6	0.33
	10	2	N-Nitrosodiphenylamine	BD to 0.19	0.020
	10	10	Naphthalene	0.016 to 4.8	0.89
	10	9	Benz[a]anthracene	BD to 0.39	0.21
	10	10	Pyrene	0:026 to 2.2	0.10
	10	10	Dibenzofuran	0.007 to 1.6	0.21
	10	2	Diphenylamine	BD to 0.55	0.40
Ejecta	13	9	2,4-Dinitrotoluene	BD to 8.0	1.3
	13	10	2,6-Dinitrotoluene	BD to 2.3	0.70
	13	13	2,4,6-Trinitrotoluene	1.7 to 360	23
	13	8	2-Nitronaphthalene	BD to 1.8	0.27
	13	6	N-Nitrosodiphenylamine	BD to 1.1	0.18
	13	8	1,3,5-Trinitrobenzene	BD to 39	0.97
	13	1	1-Nitropyrene	BD to 1.2	1.2
	13	13	Naphthalene	0.028 to 210	7.0
	13	10	Benz[a]anthracene	BD to 11	1.3
	13	12	Pyrene	BD to 53	2.4
	13	1	Phenol	BD to 69	69
	13	10	Dibenzofuran	BD to 18	0.59
	13	2	Diphenylamine	BD to 0.79	0.67

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed only from the values above the detection limit.
[e]Below detection limit.

4.2.1.2.2 Fallout

Fallout for these OB/OD tests is defined as the particulate material deposited beyond the ejecta area. On the Phase A trials, samples were collected to verify and refine the methodologies of sample placement, sample type, sample handling, and laboratory extraction and assay. The Phase B and C tests were designed to characterize the resulting soil fallout pattern and the amount of species deposited on the soil. The background and ejecta data were included along with the fallout data prior to performing the ANOVA; this permitted the comparison of background, ejecta, 50-meter fallout, and 100-meter fallout soil data.

a. Surface TNT Detonations, Phase A.

Fallout was sampled with both a 1-m^2 pan and a 15-cm depth core sampler at each sampling point. The data were valuable for identifying analytes present in the soil before and after detonation and for refining sampling technology; however, the close proximity of the detonations permitted overlap of fallout and thus rendered the data useless for characterizing a single detonation. A summary of the semivolatile organics detected, and the concentration for the two types of samples are shown in Table 4.2.11.

Table 4.2.11 Summary of Semivolatile Analyte Concentrations Detected in Soil Samples in Phase A TNT Detonations.

Analyte	Concentration (ng/kg)[a]	
	Soil Core	Fallout Pan
2,4-Dinitrotoluene	32	170
2,6-Dinitrotoluene	BD[b]	140
2,4,6-Trinitrotoluene	1600	190
2-Nitronaphthalene	1.2	2.6
1,3,5-Trinitrobenzene	12	240
Naphthalene	BD	2400

[a]Represents ng of analyte per kg of soil.
[b]Below detection limit.

(1) The results indicate the following:

(a) Chemical extraction and analysis of semivolatile analyte compounds is possible,

(b) The pan samples are more representative of the fallout soil than the 15-cm cores, which are almost entirely samples of undisturbed soil. The pan samples represent a deposition area of 1 m^2, whereas the 5-cm diameter core represents an area of 0.002 m^2,

(c) The pans must be located at least 50 meters from detonation points to avoid damage by the blast wave.

b. Surface TNT Detonations, Phases B and C.

Fallout sampling for a *surface* detonation was done with 1-m^2 pans on all trials. On the Phase B ORI and all Phase C trials, pans were placed on the 50-, 100-, 150-, and 200-meter circles. On other *surface* detonations, sampling was only on the 50-, and 100-meter circles.

(1) The analyte concentration data from the 50- and 100-meter sampling circles for the *surface* detonations are summarized in Table 4.2.12a. The analyte concentration data for the 150- and 200-meter sampling circles are summarized in Table 4.2.12b. The weight of sample available for assay after combining the fallout pan samples (six 1-m^2 samples) varied from 3.6 to 35 grams at 150 meters and 1 to 4.9 grams at 200 meters from the detonation. The analytes 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 1,3,5-trinitrobenzene, benz[a]anthracene, and pyrene were detected above background levels on the 50-meter circle. The analytes 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronaphthalene, 1,3,5-trinitrobenzene, naphthalene, benz[a]anthracene, pyrene, and dibenzofuran were detected above background levels on the 100-meter circle. The analytes identified on the 150-meter and 200-meter circles were the same analytes identified by soil samples from the ejecta, and fallout at 50 and 100 meters.

Table 4.2.12a Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Concentration Range (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
50-m circle	7	4	2,4-Dinitrotoluene	BD[e] to 32	4.0
	7	5	2,6-Dinitrotoluene	BD to 7.8	0.77
	7	7	2,4,6-Trinitrotoluene	6.8 to 45	13
	7	4	2-Nitronaphthalene	BD to 2.6	0.43
	7	3	1,3,5-Trinitrobenzene	BD to 0.89	0.28
	7	1	N-Nitrosodiphenylamine	BD to 0.069	0.069
	7	7	Naphthalene	0.50 to 74	6.0
	7	5	Benz[a]anthracene	BD to 6.4	1.3
	7	6	Pyrene	BD to 36	1.7
	7	5	Dibenzofuran	BD to 2.3	0.73
100-m circle	7	4	2,4-Dinitrotoluene	BD to 35	9.2
	7	4	2,6-Dinitrotoluene	BD to 21	3.0
	7	7	2,4,6-Trinitrotoluene	11 to 310	75
	7	2	2-Nitronaphthalene	BD to 47	8.7
	7	3	1,3,5-Trinitrobenzene	BD to 19	5.2
	7	7	Naphthalene	0.30 to 220	21
	7	6	Benz[a]anthracene	BD to 51	5.6
	7	2	Benzo[a]pyrene	BD to 8.5	6.4
	7	6	Pyrene	BD to 21	4.7
	7	4	Dibenzofuran	BD to 29	5.2
	7	1	Diphenylamine	BD to 5.4	5.4

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

Table 4.2.12b Summary of Semivolatile Organic Concentrations from Phases B and C Fallout So Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Concentration Range (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
150-m circle	3	1	2,6-Dinitrotoluene	BD[e] to 2.1	2.1
	3	2	2,4,6-Trinitrotoluene	BD to 35	26
	3	2	Naphthalene	BD to 19	11
	3	1	Benz[a]anthracene	BD to 1.9	1.9
	3	2	Benzo[a]pyrene	BD to 9.1	7.8
	3	1	Pyrene	BD to 10	10
	3	2	Diphenylamine	BD to 97	33
200-m circle	3	2	2,4,6-Trinitrotoluene	BD to 680	110
	3	1	Naphthalene	BD to 510	510
	3	1	Benz[a]anthracene	BD to 87	87
	3	1	Pyrene	BD to 88	88
	3	3	Diphenylamine	5.7 to 97	24

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

(2) The Duncan's multiple-range test comparing the ejecta sample results with the fallout sample results for the semivolatile organics shows the following:

(a) The ejecta analyte concentration means were not different from the 50-meter concentration means.

(b) The 100-meter concentration means for 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronaphthalene, and dibenzofuran were larger than the ejecta concentration means.

(3) This increase in concentration of the semivolatile analytes on the fallout soil at greater distance from the detonation may be a function of particle size. The increased surface area per volume of particle that results with the smaller particles provides more surface area for absorption of the analyte. The results of these tests show that analytes in the 200-, 150-, and 100-meter fallout

samples were more concentrated than in the 50-meter fallout samples. The results did not show the 50-meter analyte concentrations to be greater than the ejecta concentration means. A probable explanation of this is that soil chunks are propelled as far as 50-meters and the sample is a composite of a wide range of particle sizes, including the larger chunks whose interior volume is not exposed to detonation products. This is in contrast to the fallout samples at greater distances, which consist of smaller particles.

(4) Relationship of Mass of Analyte to Fallout Area. The mass of analyte collected was compared to the total sampling area of the fallout pans making up the sample. The data are summarized in Tables 4.2.13a and 4.2.13b. These data are useful in estimating the amount of an analyte that is deposited on the terrain as a function of distance from the source.

Table 4.2.13a Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Area Sampled.

Source of Sample	Number of Observations		Analyte[b]	Concentration Range ($\mu g/m^2$)[c]	Geometric Mean[d] ($\mu g/m^2$)
	Total	AD[a]			
50-m circle	7	4	2,4-Dinitrotoluene	BD[e] to 3.8	0.47
	7	5	2,6-Dinitrotoluene	BD to 0.48	0.080
	7	7	2,4,6-Trinitrotoluene	0.48 to 5.3	1.2
	7	4	2-Nitronaphthalene	BD to 0.25	0.045
	7	1	N-Nitrosodiphenylamine	BD to 0.008	0.008
	7	3	1,3,5-Trinitrobenzene	BD to 0.063	0.026
	7	7	Naphthalene	0.047 to 8.7	0.59
	7	5	Benz[a]anthracene	BD to 0.75	0.14
	7	6	Pyrene	BD to 4.2	0.18
	7	5	Dibenzofuran	BD to 0.24	0.081
100-m circle	7	4	2,4-Dinitrotoluene	BD to 0.29	0.15
	7	4	2,6-Dinitrotoluene	BD to 0.18	0.047
	7	7	2,4,6-Trinitrotoluene	0.045 to 2.7	0.88
	7	2	2-Nitronaphthalene	BD to 0.38	0.14
	7	3	1,3,5-Trinitrobenzene	BD to 0.16	0.052
	7	7	Naphthalene	0.090 to 2.1	0.24
	7	6	Benz[a]anthracene	BD to 0.48	0.064
	7	2	Benzo[a]pyrene	BD to 0.072	0.69
	7	6	Pyrene	BD to 0.60	0.054
	7	4	Dibenzofuran	BD to 0.30	0.086
	7	1	Diphenylamine	BD to 0.021	0.021

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per m^2 of terrain.
[d]Geometric means were computed from the values above detection limit.
[e]Below detection limit.

Table 4.2.13b Summary of Semivolatile Organic Concentrations from Phases B and C Fallout Soil Samples, Based on Area Sampled.

Source of Sample	Number of Observations		Analyte[b]	Concentration Range ($\mu g/m^2$)[c]	Geometric Mean[d] ($\mu g/m^2$)
	Total	AD[a]			
150-m circle	3	1	2,6-Dinitrotoluene	BD[e] to 0.012	0.012
	3	2	2,4,6-Trinitrotoluene	BD to 0.20	0.060
	3	2	Naphthalene	BD to 0.11	0.025
	3	1	Benz[a]anthracene	BD to 0.011	0.011
	3	2	Benzo[a]pyrene	BD to 0.038	0.018
	3	1	Pyrene	BD to 0.058	0.058
	3	2	Diphenylamine	BD to 0.029	0.017
200-m circle	3	2	2,4,6-Trinitrotoluene	BD to 0.11	0.041
	3	1	Naphthalene	BD to 0.420	0.420
	3	1	Benz[a]anthracene	BD to 0.071	0.071
	3	1	Pyrene	BD to 0.072	0.072
	3	3	Diphenylamine	0.0047 to 0.016	0.0083

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per m^2 of terrain.
[d]Geometric means were computed from the values above detection limit.
[e]Below detection limit.

c. Suspended TNT Detonations, Phase B.

The Phase B suspended detonation sampling was accomplished by taking a 15-cm diameter core to a depth of 2.5 cm on the 1-, 2-, 4-, 8-, and 16-meter sampling circles. The soil was sampled prior to the suspended detonation to establish background concentration levels for the semivolatiles. These samples were taken horizontally out to 16 meters from a point on the ground directly under the suspended TNT. The same fallout sampling points and procedures were used for the post detonation samples. An ANOVA comparing the means from each analyte for the background, 1-, 2-, 4-, 8-, and 16-meter samples detected no significant differences in the level of analyte. The data from the post detonation, 1-, 2-, 4-, 8-, and 16-meter samples, were combined for the summary in Table 4.2.14.

Table 4.2.14 Summary of Semivolatile Organic Concentrations from Phase B TNT Suspended Detonation Soil Samples.

Source of Sample	Number of Observations		Analyte[b]	Concentration Range (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
Pretest	7	7	2,4-Dinitrotoluene	0.16 to 9.5	0.62
	7	7	2,6-Dinitrotoluene	0.012 to 1.3	0.08
	7	7	2,4,6-Trinitrotoluene	1.9 to 1200	33
	7	2	2-Nitronaphthalene	BD[e] to 0.10	0.04
	7	2	N-Nitrosodiphenylamine	BD to 0.30	0.27
	7	6	1,3,5-Trinitrobenzene	BD to 78	0.41
	7	7	Naphthalene	1.5 to 27	8.8
	7	7	Benz[a]anthracene	0.016 to 1.9	0.29
	7	7	Pyrene	.0.090 to 2.1	1.1
	7	7	Dibenzofuran	.034 to 0.51	0.22
	7	4	Diphenylamine	BD to 0.10	0.023
Posttest	20	20	2,4-Dinitrotoluene	0.02 to 13	0.93
	20	18	2,6-Dinitrotoluene	BD to 3.1	0.65
	20	20	2,4,6-Trinitrotoluene	3.3 to 1300	25
	20	13	2-Nitronaphthalene	BD to 1.1	0.12
	20	7	N-Nitrosodiphenylamine	BD to 2.8	0.41
	20	15	1,3,5-Trinitrobenzene	BD to 17	0.63
	20	20	Naphthalene	1.4 to 86	13
	20	16	Benz[a]anthracene	BD to 4.0	0.43
	20	19	Pyrene	BD to 7.7	1.7
	20	2	Phenol	BD to 1.8	55
	20	19	Dibenzofuran	BD to 31	0.55
	20	12	Diphenylamine	BD to 0.14	0.057

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed only from the values above detection limit.
[e]Below detection limit.

4.2.1.2.3 Estimates of Total Deposition.

The methodologies developed and refined for collection of samples and analyses of data during the OB/OD testing are useful in arriving at estimates of soil deposition of emissions from munitions to be disposed of in the demilitarization inventory. The results from the detonation of approximately 1 metric ton of bulk TNT and the resulting deposition of 2,4-dinitrotoluene are used here as an example. Table 4.2.15 lists the maximum values for 2,4-dinitrotoluene concentration from the OB/OD TNT detonations that would be of use in an assessment of environmental impact.

Table 4.2.15 Summary of Fallout and 2,4-Dinitrotoluene Concentration by Weight and Area

Concentration	Back-ground	Ejecta	50-m Circle	100-m Circle	150-m Circle	200-m Circle
Fallout (grams of soil/m^2 of terrain)	NA[a]	NA	80	8.9	2.4	0.42
Geometric mean (μg of analyte/kg of soil)	0.87	1.3	4	9.2	BD[b]	BD
Maximum (μg/kg)	1.6	8.0	32	35	BD	BD
Geometric mean (μg of analyte/m^2 of terrain)	NA	NA	0.47	0.15	BD	BD
Maximum (μg/m^2)	NA	NA	3.8	0.29	BD	BD

[a]Not applicable.
[b]Below detection limit.

a. For example, the data above can be used to determine the maximum mass of residual 2,4-dinitrotoluene that would be expected from a 1-metric-ton detonation of TNT. Using the maximum crater soil weight given in Table 4.2.8 (105 metric tons) and the maximum concentration for 2,4-dinitrotoluene at the 100-meter circle given in Table 4.2.15 (35μg/kg), the calculated total 2,4-dinitrotoluene soil deposition from a 1-metric-ton TNT detonation is 3.7 grams. This is a conservative estimate, because all the ejecta soil is considered as contaminated at this level, whereas if the ejecta concentration value is used, it would be concluded that no 2,4-dinitrotoluene resulted from the detonation. The mean ejecta 2,4-dinitrotoluene concentration (1.3 μg/kg) does not significantly differ from the mean background concentration level at that test site (0.87 μg/kg).

b. A second example may be used to estimate the 2,4-dinitrotoluene fallout from a 1-metric-ton TNT detonation. This can be approximated by using the deposition concentration (μg of analyte per m^2 of terrain) multiplied by an assigned deposition area at each sampled distance. This is shown in Table 4.2.16 with the total amount of 2,4-dinitrotoluene fallout estimated at 76 mg. A similar calculation using the measured analyte concentration expressed in μg of analyte per kg of soil, multiplied by the mass of fallout soil in the deposition area, yields a total amount of 2,4-dinitrotoluene of 55 mg. This means that about 2.0 percent of the 3.7 gram total 2,4-dinitrotoluene soil deposition was recovered as fallout within 225 meters of the detonation site. In other words, about 98 percent of the total 2,4-dinitrotoluene residues are in the immediate vicinity of the crater in the soil ejecta.

Table 4.2.16 Concentration and Deposition Area Used to Determine Fallout Amount for 2,4-Dinitrotoluene.

Distance Interval (m)	Deposition Area (m^2)	Concentration ($\mu g/m^2$)	Fallout Amount (mg)
0 to 75	17,671	3.8	67
75 to 125	31,416	0.29	9
125 to 175	47,124	BD[a]	0
175 to 225	62,832	BD	0
		Total =	76

[a]Below detection limit.

c. The results reveal some important implications for future characterization of OB/OD demilitarization of explosive munitions. First, crater mass and fallout mass at various distances should be well documented. Along with these weight measurements, a concentration of analytes in the fallout soil is required. It is suggested that this can be accomplished with chemical analysis of soil at 100 meters; this distance is suggested because it provided suffic sample size for extraction and it was also free of clods. The analyte concentration at 100 meters would be used to characterize the ejecta soil and fallout soil at all sampling points based on the mass of soil collected. If implemented, these changes would result in less chemical analyses, thus reducing the cost of testing.

4.2.2 Composition B Test - Phase C

4.2.2.1 Air Emissions

4.2.2.1.1 Gases

a. Gas EFs measured during the six 907-kg composition B detonations are statistically summarized in Table 4.2.17. Carbon dioxide EFs range from 0.86 to 0.87. An average value of 0.87 compares with a theoretical CO_2 EF of 0.92, assuming 100-percent conversion of explosive carbon to CO_2. This corresponds to a detonation efficiency of about 0.95. Although the oxygen balance of composition B at -53 percent is higher than that of TNT, the detonation efficiency for a *surface* detonation is about the same. From this observation it appears that the oxygen balance of the explosive molecule does not appear to play a significant role in the observed carbon conversion efficiency in the detonation process. The entrainment of ambient air into the fireball provides additional oxygen to provide the high carbon-conversion efficiencies observed.

Table 4.2.17 Gas Emission Factors for Composition-B Surface Detonations.

Species	Emission Factor (g/g)
CO_2 - min	0.86
CO_2 - max	0.87
CO_2 - avg	0.87
CO - min	0.026
CO - max	0.037
CO - avg	0.031
NO - min	BD
NO - max	1.8×10^{-3}
NO - avg	0.8×10^{-3}
NO_2 - min	0.009×10^{-3}
NO_2 - max	2.3×10^{-3}
NO_2 - avg	1.0×10^{-3}

b. Carbon monoxide EFs are correspondingly low, ranging from 0.026 to 0.037, with an average of 0.031. Emission factors measured for NO and NO_2 are in the vicinity of 1×10^{-3}. In both cases, the measured levels are comparable to those measured for TNT.

4.2.2.1.2 Particulates

Particulate mass concentrations measured during multiple aircraft passes through the detonation clouds from the composition B tests are summarized in Table 4.2.18. Cloud particle concentrations from the two three-detonation trials were about 200 mg/m^3. The carbon content of the particulate samples was not measured in this test series; however, on the basis of earlier phase B TNT tests, virtually all the collected particulates are suspended soil.

Table 4.2.18 Average Particulate Matter Concentrations Measured During Multiple Aircraft Sampling Passes of Composition-B Detonation Clouds.

Test Event	**Particulate Matter Concentration (mg/m^3)**
Composition-B - first 3-detonation series	218
Composition-B - second 3-detonation series	19[illegible]

4.2.2.1.3 Volatile Organic Compounds

VOC EFs for the composition B *surface* detonations as sampled with 6-L canisters and followed by gas chromatographic analysis are summarized in Table 4.2.19. The results are very similar to those observed from the TNT tests, with relatively low methane and TNMHC releases. The toxic VOC category as represented by benzene is similarly low, with an average EF of about 0.000062.

Table 4.2.19 Volatile Organic Compound Emission Factors Measured for the Composition-B Detonation Tests.

Species	Emission Factor (g/g)
CH_4 - min	0.4×10^{-3}
CH_4 - max	0.8×10^{-3}
CH_4 - avg	0.6×10^{-3}
TNMHC - min	0.5×10^{-3}
TNMHC - max	2.3×10^{-3}
TNMHC - avg	1.2×10^{-3}
Benzene - min	29×10^{-6}
Benzene - max	86×10^{-6}
Benzene - avg	62×10^{-6}

4.2.2.1.4 Semivolatile Organics (Exotics)

Emission factors for the semivolatile organic target compounds are given in Table 4.2.20 for the Phase C surface detonation of composition B, which is a mixture of TNT and RDX. The values shown in the table are the maximum values obtained from two separate trials each consisting of three detonations in series. Analyses for the semivolatile target analytes were done by SFC-MS which allows the determination of thermally labile compounds such as the parent explosive RDX, which would otherwise decompose during separation by conventional gas chromatography. The EFs for the target analytes are all observed at less than the part per million (10^{-6}) level. The highest EFs observed were for 2,4-dinitrotoluene and naphthalene at levels of about 4×10^{-7}. Next highest EFs were 2,4,6-trinitrotoluene, and pyrene at a level of about 2×10^{-7}. In this test series the parent compound RDX was not seen although it accounts for about 40 percent of the mass of the composition B explosive. The remainder of the target analytes were either not detected or observed at lower levels. To place these EFs into perspective, consider that about 1 gram of TNT parent compound (accounts for about 60 percent of the composition B mass), would be released into the detonation cloud following the detonation of a metric ton of composition B, assuming that the TNT EF is 1×10^{-6}. If a stable detonation cloud volume of 10^6 cubic meters is assumed, the elevated

cloud concentration of TNT would be 1 μg per cubic meter. A further dilution of about 4 or 5 orders of magnitude would typically result following downwind movement of the cloud prior to its ground contact. Downwind ground-level concentrations of TNT would then be in the tens or hundreds of pg (10^{-12} g) per cubic meter of air.

Table 4.2.20 Maximum Semivolatile Organic Emission Factors Measured for Surface Composition B Detonations[a].

Species[b]	Emission Factor (g/g)
2,4-Dinitrotoluene	450 x 10^{-9}
2,6-Dinitrotoluene	24 x 10^{-9}
2,4,6-Trinitrotoluene	250 x 10^{-9}
2-Nitronaphthalene	86 x10^{-9}
N-Nitrosodiphenylamine	36 x 10^{-9}
1,3,5-Trinitrobenzene	59 x 10^{-9}
2-Nitrodiphenylamine	72 x 10^{-9}
1-Nitropyrene	56 x 10^{-9}
RDX	BD[c]
Naphthalene	420 x 10^{-9}
Benz[a]anthracene	7.4 x 10^{-9}
Benzo[a]pyrene	14 x 10^{-9}
Pyrene	210 x 10^{-9}
Phenol	---[d]
Dibenzofuran	BD
Diphenylamine	66 x 10^{-9}

[a]Emission factors are expressed in terms of 10^{-9} for ease of comparison, e.g., 450 x 10^{-9} is equivalent to 0.000000450.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels.
[c]Below detection limit.
[d]---Phenol was lost in the extraction of the semivolatiles.

4.2.2.2 Soil

4.2.2.2.1 Ejecta

a. Ejecta soil is the soil displaced at the point of a *surface* detonation and redeposited in the crater, in the berm around the crater, and within a few meters of the crater. The volume of the

displaced soil was estimated, using Equation 4.2, paragraph 4.1.3.3. The calculated results are given in Table 4.2.21. The volume of the displaced soil varied from 22 to 28 m^3. The calculated weight of this soil, based on a density of 2.5 g/cc, varied from 55 to 70 metric tons, with a mean of 64 metric tons. This loose soil was sampled, and the semivolatile organics remaining after the detonation were identified and quantified.

Table 4.2.21 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil for Composition B.

Location	Rim Opening (m)	Depth (m)	Volume (m^3)	Weight of Soil (kg)	Average Weight (kg)
Composition B					
B0	5.0	2.0	23.82	59559	
B1	ND[a]	ND	ND	ND	
B2	5.0	1.9	22.24	55611	
B3	5.5	2.0	27.95	69868	
B4	5.0	2.0	23.82	59559	
B5	ND	ND	ND	ND	
B6	5.5	2.0	27.95	69868	
D0	5.5	2.0	27.95	69868	64056

[a]ND - no data.

b. Background samples were taken at all detonation sites. All detonation sites were located in an area at DPG considered uncontaminated from previous explosive detonations. The pretest (background) and ejecta summary data are given in Table 4.2.22. The analyte which showed increased concentration (above concentration levels detected in the pretest soil) in the ejecta soil after detonation was 2,4,6-trinitrotoluene.

Table 4.2.22 Composition B, Summary of Semivolatile Organic Concentrations from Phase C Pretest and Ejecta Soil Samples, Based on the Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
Pretest	3	3	2,4-Dinitrotoluene	1.3 to 6.4	3.7
	3	3	2,6-Dinitrotoluene	0.13 to 0.24	0.19
	3	3	2,4,6-Trinitrotoluene	0.58 to 2.3	1.2
	3	3	2-Nitronaphthalene	0.075 to 0.24	0.16
		2	N-Nitrosodiphenylamine	BD[e] to 1.3	0.68
	3	2	1,3,5-Trinitrobenzene	BD to 0.87	0.25
	3	2	2-Nitrodiphenylamine	BD to 0.21	0.14
	3	1	Naphthalene	BD to 0.16	0.16
	3	2	Benz[a]anthracene	BD to 1.2	0.93
	3	3	Pyrene	0.14 to 1.2	0.40
	3	3	Diphenylamine	0.11 to 0.36	0.22
Ejecta	3	3	2,4-Dinitrotoluene	10 to 17	14
	3	3	2,6-Dinitrotoluene	0.57 to 1.0	0.79
	3	3	2,4,6-Trinitrotoluene	12 to 14	13
	3	3	2-Nitronaphthalene	0.078 to 0.39	0.16
	3	1	N-Nitrosodiphenylamine	BD to 0.39	0.39
	3	3	1,3,5-Trinitrobenzene	0.14 to 0.39	0.22
	3	2	2-Nitrodiphenylamine	BD to 0.60	0.24
	3	1	1-Nitropyrene	BD to 0.14	0.14
	3	3	Naphthalene	3.4 to 13	6.9
	3	2	Benz[a]anthracene	BD to 1.9	1.5
	3	1	Benzo[a]pyrene	BD to 0.55	0.55
	3	3	Pyrene	1.4 to 4.5	2.7
	3	2	Dibenzofuran	BD to 1.6	1.4
	3	2	Diphenylamine	BD to 1.6	1.4

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed only from the values above the detection limit.
[e]Below detection limit.

4.2.2.2.2 Fallout

a. Fallout for the OB/OD thermal treatment testing is defined as the particulate material deposited beyond the ejecta area. The Phase C testing was conducted partly to characterize the resulting soil fallout pattern and amount of species deposited on the soil. The background and ejecta data were included along with the fallout data, prior to performing the ANOVA.

b. Phase C . Fallout for a *surface* detonation was sampled with 1-m^2 pans placed on the 50-, 100-, 150-, and 200-meter circles.

(1) The analyte concentration data from the 50- and 100-meter sampling circles for the *surface* detonations are summarized in Table 4.2.23a. The analyte concentration data for the 150- and 200-meter sampling circles are presented in Table 4.2.23b. The analytes detected above background levels on the 50-meter circle were 2,4-dinitrotoluene, and 2,4,6-trinitrotoluene. The analytes above background levels on the 100-meter circle were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronaphthalene, pyrene, and diphenylamine. The analytes detected above background levels on the 150-meter circle were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronaphthalene, 2-nitrodiphenylamine, pyrene, and diphenylamine. The analytes detected above background levels on the 200-meter circle were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, naphthalene, benz[a]anthracene, pyrene, and diphenylamine. Dibenzofuran was not found in the background sample but was found in some of the ejecta and fallout pan samples.

Table 4.2.23a Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
50-m circle	3	3	2,4-Dinitrotoluene	12 to 150	52
	3	1	2,6-Dinitrotoluene	BD[e] to 0.67	0.67
	3	3	2,4,6-Trinitrotoluene	11 to 220	39
	3	2	2-Nitronaphthalene	BD to 0.47	0.25
	3	3	1,3,5-Trinitrobenzene	0.26 to 1.6	0.50
	3	1	1-Nitropyrene	BD to 1.1	1.1
	3	3	Naphthalene	0.58 to 1.5	0.47
	3	2	Pyrene	BD to 1.4	0.76
	3	3	Dibenzofuran	0.36 to 3.1	1.0
100-m circle	3	3	2,4-Dinitrotoluene	640 to 1800	1230
	3	3	2,6-Dinitrotoluene	2.5 to 27	7.5
	3	3	2,4,6-Trinitrotoluene	47 to 92	69
	3	3	2-Nitronaphthalene	1.9 to 7.5	3.1
	3	3	1,3,5-Trinitrobenzene	0.062 to 9.8	0.96
	3	1	2-Nitrodiphenylamine	BD to 1.1	1.1
	3	1	1-Nitropyrene	BD to 1.0	1.0
	3	1	Naphthalene	BD to 8.7	8.7
	3	2	Benz[a]anthracene	BD to 8.6	6.5
	3	3	Pyrene	2.3 to 9.8	6.0
	3	1	Dibenzofuran	BD to 6.2	6.2
	3	3	Diphenylamine	1.3 to 6.6	3.4

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

Table 4.2.23b Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
150-m circle	3	3	2,4-Dinitrotoluene	360 to 5600	1200
	3	3	2,6-Dinitrotoluene	5.1 to 49	18
	3	3	2,4,6-Trinitrotoluene	13 to 330	81
	3	3	2-Nitronaphthalene	0.77 to 21	4.1
	3	2	1,3,5-Trinitrobenzene	BD[e] to 4.9	2.3
	3	3	2-Nitrodiphenylamine	1.3 to 17	5.9
	3	1	1-Nitropyrene	BD to 15	15
	3	2	Naphthalene	BD to 37	8.4
	3	3	Benz[a]anthracene	0.59 to 33	5.9
	3	3	Pyrene	1.4 to 64	9.8
	3	1	Dibenzofuran	BD to 35	35
	3	3	Diphenylamine	1.0 to 33	6.9
200-m circle	3	3	2,4-Dinitrotoluene	2100 to 8900	4400
	3	3	2,6-Dinitrotoluene	79 to 330	130
	3	3	2,4,6-Trinitrotoluene	130 to 970	450
	3	3	2-Nitronaphthalene	26 to 33	29
	3	3	1,3,5-Trinitrobenzene	9.0 to 21	15
	3	3	2-Nitrodiphenylamine	8.8 to 84	29
	3	1	1-Nitropyrene	BD to 37	37
	3	3	Naphthalene	8.9 to 140	34
	3	2	Benz[a]anthracene	26 to 76	51
	3	1	Benzo[a]pyrene	BD to 32	32
	3	1	Pyrene	30 to 170	73
	3	3	Dibenzofuran	4.6 to 57	20
	3	2	Diphenylamine	BD to 130	76

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

(2) The Duncan's multiple-range test comparing the ejecta sample results with the fallout sample results for the semivolatile organics shows the following:

(a) The ejecta analyte concentration means were not different from the 50-meter concentration means.

(b) The 100-meter concentration means for 2,4-dinitrotoluene, 2,6-dinitrotoluene, and 2-nitronaphthalene were larger than the ejecta concentration means for these same compounds.

(c) The 150-meter concentration means for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitronaphthalene, and 2-nitrodiphenylamine were larger than the ejecta concentration means for these same compounds.

(d) The 200 meter concentration means for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronaphthalene, 1,3,5-trinitrobenzene, 2 nitrodiphenylamine, benz[a]anthracene, pyrene, and diphenylamine were larger than the ejecta concentration means for these same compounds.

(3) This increase in concentration of the semivolatile analytes on the fallout soil at greater distance from the detonation may be a function of particle size. The increased surface area per volume of particle that results with the smaller particles provides more surface area for absorption of the analyte. The results of the OB/OD test show that analytes in the 200-, 150-, and 100-meter fallout samples were more concentrated than in the 50-meter fallout samples. The results did not show the 50-meter analyte concentrations to be greater than the ejecta concentration means. A probable explanation of this is that soil chunks are still being propelled as far as 50 meter and the sample is a composite of a wide range of particle sizes including the larger chunks whose interior volume is not exposed to detonation products. This is in contrast to the fallout samples at greater distances which consist of smaller particles.

(4) Relationship of Mass of Analyte to Fallout Area. The mass of analyte collected was compared to the total sampling area of the fallout pans making up the sample. The data is

summarized in Tables 4.2.24a and 4.2.24b. These data are useful in estimating the amount of an analyte that is deposited on the terrain as a function of distance from the source.

Table 4.2.24a Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled.

Source of Sample	Number of Observations		Analyte[b]	Range Response (ng/m^2)[c]	Geometric Mean[d] (ng/m^2)
	Total	AD[a]			
50-m circle	3	3	2,4-Dinitrotoluene	630 to 9200	3100
	3	1	2,6-Dinitrotoluene	BD[e] to 47	47
	3	3	2,4,6-Trinitrotoluene	680 to 15000	2300
	3	3	2-Nitronaphthalene	BD to 25	14
	3	3	1,3,5-Trinitrobenzene	14 to 110	30
	3	1	1-Nitropyrene	BD to 66	66
	3	3	Naphthalene	4.0 to 90	28
	3	2	Pyrene	BD to 95	49
	3	3	Dibenzofuran	25 to 170	62
100-m circle	3	3	2,4-Dinitrotoluene	6800 to 9700	8500
	3	3	2,6-Dinitrotoluene	27 to 160	52
	3	3	2,4,6-Trinitrotoluene	250 to 820	480
	3	3	2-Nitronaphthalene	10 to 43	21
	3	3	1,3,5-Trinitrobenzene	0.33 to 57	6.7
	3	1	2-Nitrodiphenylamine	BD to 6.0	6.0
	3	1	1-Nitropyrene	BD to 6.0	6.0
	3	1	Naphthalene	BD to [illegible]	47
	3	2	Benz[a]anthracene	BD to 50	37
	3	3	Pyrene	25 to 57	41
	3	1	Dibenzofuran	BD to 33	33
	3	3	Diphenylamine	14 to 38	24

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents ng of analyte per m^2 of terrain.
[d]Geometric means were computed from the values above detection limit.
[e]Below detection limit.

Table 4.2.24b Composition B, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled.

Source of Sample	Number of Observations		Analyte[b]	Range Response (ng/m^2)[c]	Geometric Mean[d] (ng/m^2)
	Total	AD[a]			
150-m circle	3	3	2,4-Dinitrotoluene	1800 to 6800	3200
	3	3	2,6-Dinitrotoluene	22 to 98	49
	3	3	2,4,6-Trinitrotoluene	150 to 270	210
	3	3	2-Nitronaphthalene	9.2 to 15	11
	3	2	1,3,5-Trinitrobenzene	BD[e] to 20	15
	3	3	2-Nitrodiphenylamine	7.7 to 25	16
	3	1	1-Nitropyrene	BD to 6.7	6.7
	3	2	Naphthalene	BD to 82	55
	3	3	Benz[a]anthracene	11 to 23	16
	3	3	Pyrene	23 to 28	26
	3	1	Dibenzofuran	BD to 16	16
	3	3	Diphenylamine	15 to 22	19
200-m circle	3	3	2,4-Dinitrotoluene	1500 to 5300	2500
	3	3	2,6-Dinitrotoluene	57 to 92	71
	3	3	2,4,6-Trinitrotoluene	145 to 630	250
	3	3	2-Nitronaphthalene	5.7 to 32	16
	3	3	1,3,5-Trinitrobenzene	3.7 to 22	8.6
	3	3	2-Nitrodiphenylamine	7.8 to 37	16
	3	1	1-Nitropyrene	BD to 42	42
	3	3	Naphthalene	10 to 28	19
	3	3	Benz[a]anthracene	11 to 85	28
	3	3	Pyrene	27 to 90	41
	3	3	Dibenzofuran	5.2 to 28	11
	3	2	Diphenylamine	BD to 150	76

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents ng of analyte per m^2 of terrain.
[d]Geometric means were computed from the values above detection limit.
[e]Below detection limit.

4.2.3 Explosive D Test - Phase C

4.2.3.1 Air Emissions

4.2.3.1.1 Gases

a. Gas EFs for the six *surface* explosive D detonations are summarized in Table 4.2.25. The CO_2 EF average ranges from 0.97 to 1.00, with an average of 0.99. The theoretical EF is 1.07, assuming complete conversion of explosive carbon to CO_2. The ratio of observed carbon conversion to theoretical, or the detonation efficiency, is 0.93 and very nearly the same as all other *surface*-detonated explosives evaluated in this test series.Although the oxygen balance of explosive D at -52 percent is greater than TNT and about the same as composition B, the detonation efficiency for a *surface* detonation is about the same.

Table 4.2.25 Gas Emission Factors for Explosive-D Surface Detonations.

Species	Emission Factor (g/g)
CO_2 - min	0.97
CO_2 - max	1.00
CO_2 - avg	0.99
CO - min	0.046
CO - max	0.064
CO - avg	0.053
NO - min	0.4×10^{-3}
NO - max	1.5×10^{-3}
NO - avg	0.9×10^{-3}
NO_2 - min	0.4×10^{-3}
NO_2 - max	1.6×10^{-3}
NO_2 - avg	1.1×10^{-3}

b. Carbon-monoxide EFs for explosive D range from a low of 0.046 to a high of 0.064, with an average of 0.053. Nitric oxide and NO_2 EFs are in the vicinity of 0.001 and comparable to those

observed for the other explosives. The ratio of NO to NO_2 EFs for this explosive is also very nearly one.

4.2.3.1.2 Particulates

a. The particulate mass concentration in the explosive D detonation clouds as measured during multiple aircraft passes is summarized in Table 4.2.26. Cloud particle concentrations from the two trials of three-detonations each show more variability than encountered for the other explosive types, with a high concentration of about 300 and a low of 180 mg/m^3. Differences in soil compaction at the various detonation sites may account for the variability noted.

Table 4.2.26 Average Particulate Matter Concentrations Measured During Multiple Aircraft Sampling Passes of Explosive-D Detonation Clouds.

Test Event	Particulate Matter Concentration (mg/m^3)
Explosive-D - First 3-detonation series	184
Explosive-D - Second 3-detonation series	315

4.2.3.1.3 Volatile Organic Compounds

Volatile organic compound EFs from the explosive D tests are given in Table 4.2.27. Average methane EFs are higher than those for composition B, by nearly a factor of ten. Emission factors for the TNMHC and benzene categories are also higher, but only by a factor of about two.

Table 4.2.27 Volatile Organic Compound Emission Factors Measured for the Explosive-D Detonation Tests.

Species	Emission Factor (g/g)
CH_4 - min	0.7×10^{-3}
CH_4 - max	7.7×10^{-3}
CH_4 - avg	2.4×10^{-3}
TNMHC - min	1.2×10^{-3}
TNMHC - max	2.7×10^{-3}
TNMHC - avg	2.0×10^{-3}
Benzene - min	69×10^{-6}
Benzene - max	160×10^{-6}
Benzene - avg	110×10^{-6}

4.2.3.1.4 Semivolatile Organics (Exotics)

a. Emission factors for the semivolatile organic target compounds are given in Table 4.2.28 for the Phase C surface detonation of explosive D. The values shown in the table are the maximum values obtained from two separate tests each consisting of three detonations in series. Analysis for the semivolatile target analytes was done by SFC-MS which allows the determination of thermally unstable compounds which would otherwise decompose during separation by conventional gas chromatography. The emission factors for the target analytes are all observed at less than the part per million (10^{-6}) level. The highest emission factors observed were for 2,4-dinitrotoluene and naphthalene at levels of about 5×10^{-7}. Next highest were pyrene and dibenzofuran at a level slightly in excess of 1×10^{-7}. In this test series the parent compound picric acid is seen at a relatively low level of 5×10^{-8}. The remainder of the target elements were either not detected or observed at lower levels. To place these emission factors into perspective, consider that about 0.1 gram of picric acid would be released into the detonation cloud following the detonation of a metric ton of explosive D, if one conservatively assumes that the picric acid emission factor is 1×10^{-7}. If a stable cloud volume of 10^6 cubic meters is assumed, the elevated cloud concentration of picric acid would be about 0.1 μg per cubic meter. A further dilution of about 4 or 5 orders of magnitude would typically result following downwind movement of the cloud prior to its ground contact.

Downwind ground-level concentrations of TNT would then be in the tens or hundreds of pg (10^{-12} grams) per cubic meter of air, a vanishingly low level.

Table 4.2.28 Maximum Semivolatile Organic Emission Factors Measured for Surface Explosive D Detonations[a].

Species[b]	Emission Factor (g/g)
2,4-Dinitrotoluene	590×10^{-9}
2,6-Dinitrotoluene	80×10^{-9}
2,4,6-Trinitrotoluene	44×10^{-9}
2-Nitronaphthalene	43×10^{-9}
N-Nitrosodiphenylamine	58×10^{-9}
1,3,5-Trinitrobenzene	18×10^{-9}
2-Nitrodiphenylamine	58×10^{-9}
1-Nitropyrene	11×10^{-9}
Picric acid	50×10^{-9}
Naphthalene	630×10^{-9}
Benz[a]anthracene	19×10^{-9}
Benzo[a]pyrene	38×10^{-9}
Pyrene	180×10^{-9}
Phenol	---[d]
Dibenzofuran	110×10^{-9}
Diphenylamine	19×10^{-9}

[a]Emission factors are expressed in terms of 10^{-9} for ease of comparison, e.g., 590×10^{-9} is equivalent to 0.000000590.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels.
[c]Below detection limit.
[d]---Phenol was lost in the extraction of the semivolatiles.

4.2.3.2 Soil

4.2.3.2.1 Ejecta

a. Ejecta soil is the soil displaced at the point of a *surface* detonation and redeposited in the crater, in the berm around the crater, and within a few meters of the crater. The volume of the displaced soil was estimated using Equation 4.2, paragraph 4.1.3.3. The calculated results are given in Table 4.2.29. The volume of the displaced soil varied from 37 to 53 m^3. The calculated weight of this soil, based on a density of 2.5 g/cc, varied from 93 to 132 metric tons, with a mean of 114 metric tons. This loose soil was sampled, and the semivolatile organics remaining after the detonation were identified and quantified.

Table 4.2.29 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced Soil for Explosive D.

Location	Rim Opening (m)	Depth (m)	Volume (m^3)	Weight of Soil (kg)	Average Weight (kg)
Explosive D					
A1	7.5	2.0	48.37	120919	
A2	7.4	2.2	52.88	132211	
A3	6.7	2.1	41.87	104671	
A4	6.9	2.3	49.37	123431	
A5	6.5	2.0	37.37	93430	
A6	7.0	2.0	42.67	106683	113557

b. Background samples were taken at all detonation sites. All detonation sites were located in an area considered uncontaminated from previous explosive detonations. The pretest (background) and ejecta summary data are given in Table 4.2.30. The analyte which showed increased concentrations (above concentration levels in the pretest soil) in the ejecta soil after detonation was pyrene. The parent compound picric acid was found in the pretest soil sample; however it was below detection in the ejecta sample. N-nitrosodiphenylamine was found in 1 of 3 samples in the ejecta soil.

Table 4.2.30 Explosive D: Summary of Semivolatile Organic Concentrations from Phase C Pretest and Ejecta Soil Samples, Based on the Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
Pretest	2	2	2,4-Dinitrotoluene	0.84 to 1.2	1.0
	2	2	2,6-Dinitrotoluene	0.074 to 0.15	0.11
	2	2	2,4,6-Trinitrotoluene	0.12 to 0.45	0.23
	2	2	2-Nitronaphthalene	0.026 to 0.24	0.080
	2	1	1,3,5-Trinitrobenzene	BD to 0.53	0.53
	2	1	2-Nitrodiphenylamine	BD to 0.29	0.29
	2	1	1-Nitropyrene	BD to 0.069	0.069
	2	1	Picric acid	BD to 0.37	0.37
	2	2	Naphthalene	1.0 to 2.6	1.6
	2	1	Benz[a]anthracene	BD to 0.98	0.98
	2	2	Pyrene	0.048 to 0.29	0.12
	2	2	Dibenzofuran	0.16 to 1.8	0.54
	2	2	Diphenylamine	0.24 to 0.32	0.28
Ejecta	3	3	2,4-Dinitrotoluene	0.48 to 1.3	0.92
	3	3	2,6-Dinitrotoluene	0.010 to 0.14	0.054
	3	3	2,4,6-Trinitrotoluene	0.52 to 7.4	1.3
	3	3	2-Nitronaphthalene	0.014 to 0.11	0.049
	3	1	N-Nitrosodiphenylamine	BD to 0.090	0.090
	3	3	1,3,5-Trinitrobenzene	0.022 to 0.14	0.043
	3	3	2-Nitrodiphenylamine	0.082 to 0.24	0.12
	3	3	1-Nitropyrene	0.0020 to 0.12	0.025
	3	3	Naphthalene	1.4 to 11	3.3
	3	2	Benz[a]anthracene	BD to 5.4	2.2
	3	1	Benzo[a]pyrene	BD to 0.67	0.67
	3	3	Pyrene	1.5 to 5.2	3.2
	3	3	Dibenzofuran	0.24 to 1.0	0.56
	3	3	Diphenylamine	0.058 to 0.26	0.15

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed only from the values above the detection limit.
[e]Below detection limit.

4.2.3.2.2 Fallout

a. Fallout for the OB/OD thermal treatment testing is defined as the particulate material deposited beyond the ejecta area. The Phase C testing was to characterize the resulting soil fallout pattern and the amount of species deposited on the soil. The background and ejecta data were included along with the fallout data prior to performing the ANOVA.

b. Phase C . Fallout from a *surface* detonation was sampled with 1-m^2 pans placed on the 50-, 100-, 150-, and 200-meter circles.

(1) The analyte concentration data from the 50- and 100-meter sampling circles for the *surface* detonations are summarized in Table 4.2.31a. The analyte concentration data for the 150- and 200-meter sampling circles are presented in Table 4.2.31b. The analytes detected above background levels on the 50-meter circle were 2,4,6-trinitrotoluene, and pyrene. The analytes found above background levels on the 100-meter circle were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 1,3,5-trinitrobenzene, picric acid, and pyrene. The analytes detected above background levels on the 150-meter circle were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, picric acid, pyrene, and diphenylamine. The analytes detected above background levels on the 200-meter circle were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, 1-nitropyrene, picric acid, naphthalene, benz[a]anthracene, pyrene, dibenzofuran and diphenylamine.

Table 4.2.31a Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (µg/kg)[c]	Geometric Mean[d] (µg/kg)
	Total	AD[a]			
50-m circle	3	3	2,4-Dinitrotoluene	0.48 to 0.56	0.51
	3	3	2,6-Dinitrotoluene	0.059 to 0.25	0.15
	3	3	2,4,6-Trinitrotoluene	0.73 to 38	5.3
	3	1	2-Nitronaphthalene	BD[e] to 0.085	0.085
	3	3	1,3,5-Trinitrobenzene	0.041 to 0.15	0.082
	3	1	2-Nitrodiphenylamine	BD to 0.61	0.61
	3	1	1-Nitropyrene	BD to 0.081	0.081
	3	2	Picric acid	BD to 1.9	1.2
	3	3	Naphthalene	0.97 to 6.5	2.2
	3	2	Benz[a]anthracene	BD to 0.97	0.89
	3	1	Pyrene	BD to 5.9	5.9
	3	1	Diphenylamine	BD to 1.7	1.7
100-m circle	3	3	2,4-Dinitrotoluene	10 to 15	12
	3	3	2,6-Dinitrotoluene	0.60 to 1.8	1.0
	3	3	2,4,6-Trinitrotoluene	4.5 to 34	12
	3	3	2-Nitronaphthalene	0.37 to 2.9	1.1
	3	2	N-Nitrosodiphenylamine	BD to 0.96	0.83
	3	3	1,3,5-Trinitrobenzene	0.69 to 2.2	1.3
	3	2	2-Nitrodiphenylamine	BD to 1.3	0.97
	3	2	1-Nitropyrene	BD to 0.18	0.14
	3	1	Picric acid	BD to 7.1	7.1
	3	3	Naphthalene	2.7 to 9.5	6.1
	3	2	Benz[a]anthracene	BD to 0.41	0.29
	3	3	Pyrene	7.6 to 12	10
	3	1	Dibenzofuran	BD to 2.4	2.4
	3	1	Diphenylamine	BD to 1.1	1.1

[a]Above detection limit.
[b]See Table 3.16 for list containing the semivolatile organics and the detection levels in soil.
[c]µg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

Table 4.2.31b Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
150-m circle	3	3	2,4-Dinitrotoluene	34 to 410	82
	3	3	2,6-Dinitrotoluene	4.5 to 24	10
	3	3	2,4,6-Trinitrotoluene	11 to 73	20
	3	3	2-Nitronaphthalene	2.5 to 14	7.0
	3	3	N-Nitrosodiphenylamine	2.8 to 20	9.1
	3	3	1,3,5-Trinitrobenzene	3.5 to 17	7.1
	3	3	2-Nitrodiphenylamine	3.1 to 35	11
	3	3	1-Nitropyrene	3.2 to 16	7.8
	3	1	Picric acid	BD[e] to 18	18
	3	2	Naphthalene	BD to 29	11
	3	2	Benz[a]anthracene	BD to 5.1	3.2
	3	1	Benzo[a]pyrene	BD to 1.7	1.7
	3	2	Pyrene	BD to 65	24
	3	3	Dibenzofuran	9.2 to 130	24
	3	3	Diphenylamine	9.7 to 23	15
200-m circle	3	3	2,4-Dinitrotoluene	65 to 1300	210
	3	3	2,6-Dinitrotoluene	11 to 140	37
	3	3	2,4,6-Trinitrotoluene	15 to 460	120
	3	3	2-Nitronaphthalene	12 to 150	41
	3	3	1,3,5-Trinitrobenzene	8.1 to 100	31
	3	3	2-Nitrodiphenylamine	7.5 to 180	39
	3	3	1-Nitropyrene	4.6 to 38	18
	3	2	Picric acid	BD to 36	36
	3	3	Naphthalene	36 to 720	120
	3	1	Benz[a]anthracene	BD to 20	20
	3	1	Benzo[a]pyrene	BD to 53	53
	3	3	Pyrene	5.8 to 260	11
	3	3	Dibenzofuran	13 to 540	19
	3	2	Diphenylamine	BD to 140	10

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

(2) The Duncan's multiple-range test comparing the ejecta sample results with the fallout sample results for the semivolatile organics shows the following:

(a) The only semivolatile analyte found at 50-meter in higher concentration than in the ejecta soil was diphenylamine. Picric acid was not recovered in the ejecta soil, although it was found in the background soil from the detonation sites.

(b) The measured 100-meter concentration means for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitronaphthalene, 1,3,5-trinitrobenzene, and diphenylamine were larger than the ejecta concentration means.

(c) The 150-meter concentration means for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitronaphthalene, N-nitrosodiphenylamine, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, 1-nitropyrene, and diphenylamine were larger than the ejecta concentration means for these same compounds.

(d) The measured 200-meter concentration means for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronaphthalene, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, 1-nitropyrene, naphthalene, dibenzofuran, and diphenylamine were larger than the ejecta concentration means for these same compounds.

(3) This increase in concentration of the semivolatile analytes on the fallout soil at greater distance from the detonation may be a function of particle size (the increased surface area per volume of particle that results with the smaller particles provides more surface area for absorption of the analyte.) The results of OB/OD test show that analytes in the 200-, 150, and 100-meter fallout samples were more concentrated than in the 50-meter fallout samples. The results did not show the 50-meter analyte concentrations to be greater than the ejecta concentration means except for diphenylamine. A probable explanation of the increased concentration of analytes with distance is that soil chunks are still being propelled as far as 50 meter and the sample is a composite of a wide range of particle sizes including the larger chunks whose interior volume is not exposed to detonation products. This is in contrast to the fallout samples at greater distances, which consist of smaller particles.

(4) Relationship of Mass of Analyte to Fallout Area. The mass of analyte collected was compared to the total sampling area of the fallout pans making up the sample. The summary of this data is shown in Tables 4.2.32a and 4.2.32b. This data are useful in estimating the amount of an analyte that is deposited on the terrain as a function of distance from the source.

Table 4.2.32a Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled.

Source of Sample	Number of Observations		Analyte[b]	Range Response (ng/m^2)[c]	Geometric Mean[d] (ng/m^2)
	Total	AD[a]			
50-m circle	3	3	2,4-Dinitrotoluene	23 to 46	35
	3	3	2,6-Dinitrotoluene	4.9 to 20	10
	3	3	2,4,6-Trinitrotoluene	30 to 3600	360
	3	1	2-Nitronaphthalene	BD[e] to 3.5	3.5
	3	3	1,3,5-Trinitrobenzene	3.4 to 8.8	5.6
	3	1	2-Nitrodiphenylamine	BD to 25	25
	3	1	1-Nitropyrene	BD to 6.7	6.7
	3	2	Picric acid	BD to 180	76
	3	3	Naphthalene	81 to 270	150
	3	2	Benz[a]anthracene	BD to 91	78
	3	1	Pyrene	BD to 550	550
	3	1	Diphenylamine	BD to 160	160
100-m circle	3	3	2,4-Dinitrotoluene	67 to 110	84
	3	3	2,6-Dinitrotoluene	4.3 to 14	7.5
	3	3	2,4,6-Trinitrotoluene	37 to 220	87
	3	3	2-Nitronaphthalene	2.7 to 18	7.7
	3	2	N-Nitrosodiphenylamine	BD to 7.8	6.4
	3	3	1,3,5-Trinitrobenzene	5.0 to 14	9.6
	3	2	2-Nitrodiphenylamine	BD to 11	7.4
	3	2	1-Nitropyrene	BD to 1.3	1.1
	3	1	Picric acid	BD to 45	45
	3	3	Naphthalene	20 to 72	44
	3	2	Benz[a]anthracene	BD to 3.3	2.1
	3	3	Pyrene	48 to 100	72
	3	1	Dibenzofuran	BD to 16	16
	3	1	Diphenylamine	BD to 6.7	6.7

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents ng of analyte per m^2 of terrain.
[d]Geometric means were computed from the values above detection limit.
[e]Below detection limit.

Table 4.2.32b Explosive D, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Area Sampled.

Source of Sample	Number of Observations		Analyte[b]	Range Response (ng/m^2)[c]	Geometric Mean[d] (ng/m^2)
	Total	AD[a]			
150-m circle	3	3	2,4-Dinitrotoluene	58 to 100	80
	3	3	2,6-Dinitrotoluene	6 to 17	10
	3	3	2,4,6-Trinitrotoluene	2.7 to 130	20
	3	3	2-Nitronaphthalene	3.5 to 16	6.8
	3	3	N-Nitrosodiphenylamine	4.8 to 43	8.9
	3	3	1,3,5-Trinitrobenzene	1.5 to 28	6.9
	3	3	2-Nitrodiphenylamine	6.8 to 22	10.9
	3	3	1-Nitropyrene	2.3 to 27	7.6
	3	1	Picric acid	BD[e] to 32	32
	3	2	Naphthalene	BD to 50	22
	3	2	Benz[a]anthracene	BD to 11	2.4
	3	1	Benzo[a]pyrene	BD to 3.0	3.0
	3	2	Pyrene	BD to 16	16
	3	3	Dibenzofuran	16 to 32	23
	3	3	Diphenylamine	4.2 to 50	15
200-m circle	3	3	2,4-Dinitrotoluene	20 to 85	48
	3	3	2,6-Dinitrotoluene	6.2 to 11	8.6
	3	3	2,4,6-Trinitrotoluene	15 to 85	28
	3	3	2-Nitronaphthalene	6.7 to 13	9.4
	3	3	1,3,5-Trinitrobenzene	6.5 to 8.2	7.1
	3	3	2-Nitrodiphenylamine	7.5 to 12	9.0
	3	3	1-Nitropyrene	2.5 to 6.3	4.2
	3	2	Picric acid	BD to 37	9.2
	3	3	Naphthalene	12.2 to 47	28
	3	1	Benz[a]anthracene	BD to 3.7	3.7
	3	1	Benzo[a]pyrene	BD to 9.8	9.8
	3	3	Pyrene	5.8 to 25	13
	3	3	Dibenzofuran	8.8 to 35	16
	3	3	Diphenylamine	BD to 27	13

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents ng of analyte per m^2 of terrain.
[d]Geometric means were computed from the values above detection limit.
[e]Below detection limit.

4.2.4 RDX Test - Phase C

4.2.4.1 Air Emissicns

4.2.4.1.1 Gases

a. The gas EFs for the six *surface* RDX detonations are statistically summarized in Table 4.2.33. The CO_2 EF average was 0.57 for these approximate 907 kg RDX *surface* detonations. Assuming that all carbon in the explosive is converted to CO_2, the resulting theoretical EF is 0.59. The detonation efficiency, (the ratio of the measured CO_2 EF to the theoretical value) for this explosive is about 0.97. The detonation efficiency for RDX is higher (indicating a greater percentage of carbon converted to CO_2) than the detonation efficiency measured for *surface* detonated TNT, composition B, and explosive D. The fact that the RDX molecule has a higher oxygen content (-21.6 % oxygen balance) compared to TNT (-73.9 % oxygen balance),composition B (-53.0% oxygen balance), explosive D (-52.0 % oxygen balance) could be a contributing factor to the increased detonation efficiency.. From this observation, it appears that the oxygen content of the explosive molecule may have an impact on the observed detonation efficiency. The relatively high and invariant carbon to CO_2 conversion efficiencies observed for these *surface* detonations also indicate the presence of a so-called "secondary combustion" mechanism, whereby ambient oxygen is entrained into the detonation fireball providing oxidant for further combustion of such incomplete detonation products as CO to CO_2.

Table 4.2.33 Gas Emission Factors for RDX Surface Detonations.

Species	Emission Factor (g/g)
CO_2 - min	0.55
CO_2 - max	0.58
CO_2 - avg	0.57
CO - min	0.026
CO - max	0.039
CO - avg	0.031
NO - min	0.5×10^{-3}
NO - max	1.6×10^{-3}
NO - avg	0.9×10^{-3}
NO_2 - min	0.4×10^{-3}
NO_2 - max	0.9×10^{-3}
NO_2 - avg	0.6×10^{-3}

b. The CO EFs for RDX ranged from 0.026 to 0.039, with an average of 0.031. Nitric oxide and NO_2 EFs for RDX are in the 10^{-3} range, with a ratio of about one. These values for both CO and NO_x species are comparable to those measured for surface detonated TNT.

4.2.4.1.2 Particulate Emissions

Particulate mass concentration as measured in multiple passes through the clouds from surface detonated RDX is summarized in Table 4.2.34. Cloud particle concentrations for the two three-shot tests are in the vicinity of 200 mg/m^3 and are similar to those measured in the *surface* TNT, composition B, and explosive D tests. The collected particulate samples for organic and elemental carbon content were not analyzed since the Teflon®-coated glass fiber filters employed during the Phase C testing phase are not well suited for this analysis procedure.

Table 4.2.34 Average Particulate Concentrations Measured During Multiple Aircraft Sampling Passes of RDX Detonation Clouds.

Test Event	Particulate Matter Concentration (mg/m^3)
RDX - first 3-detonation series	242
RDX - second 3-detonation series	179

4.2.4.1.3 VOC Emissions

Volatile organic compound EFs for the RDX *surface* detonations as measured with the 6-L grab canisters and gas chromatographic analysis are summarized in Table 4.2.35. Methane emissions are low and in the range observed for the other propellants and explosives tested. Total non-methane hydrocarbon concentrations are similarly low, with an average EF of 0.0013. The toxic sub-category of TNMHC as represented by benzene is also low with an average benzene EF of 0.000069. Although detonation efficiencies less than unity are observed for this explosive, these data reveal that only a very small amount of the original carbon ends up in the VOC category of emissions.

Table 4.2.35 Volatile Organic Compound Emission Factors Measured for the RDX Detonation Tests.

Species	Emission Factor (g/g) RDX
CH_4 - min	BD[a]
CH_4 - max	0.4×10^{-3}
CH_4 - avg	0.2×10^{-3}
TNMHC - min	0.7×10^{-3}
TNMHC - max	2.9×10^{-3}
TNMHC - avg	1.3×10^{-3}
Benzene - min	2.3×10^{-6}
Benzene - max	140×10^{-6}
Benzene - avg	69×10^{-6}

[a]Below detection limit.

4.2.4.1.4 Semivolatile Organics (Exotics)

a. Emission factors for the semivolatile organic target compounds are given in Table 4.2.36 for the Phase C RDX surface detonations. The values shown in the table are the maximum values obtained from two separate trials each consisting of three detonations in series. Analyses for the semivolatile target analytes were done by SFC-MS which allows the determination of thermally labile compounds such as the parent explosive RDX which would otherwise decompose during separation by conventional gas chromatography. The EFs for the target analytes are all observed at the part per million (10^{-6}) level or less. The highest EFs observed were for the RDX and dibenzofuran at about 2×10^{-6}. Next highest were 2,4-dinitrotoluene, naphthalene, pyrene, and diphenylamine at about 2×10^{-7}. It is not clear from these data whether the measured 2,4-dinitrotoluene and diphenylamine are derived from rearrangement of some small fraction of the RDX molecule during the detonation or whether they arise from previous contamination of the soils in the area of the surface RDX shots. One detonation of the three RDX detonations was primed with 1.8 kg of TNT (Table 2.4b) which could have been a contributor to some of these unexpected compounds; however, this alone does not explain these compounds being found when TNT was not used as a primer. It is more reasonable to attribute these compounds to the contaminated soil at the detonation site. The remainder of the target analytes were either not detected or observed at lower levels. To place these EFs into perspective consider that 1 gram of RDX parent compound would be released into the detonation cloud following the detonation of a metric ton of RDX, assuming that RDX EF is 1×10^{-6}. If a stable detonation cloud volume of 10^6 cubic meters is assumed, the elevated cloud concentration of RDX would be 1 μg per cubic meter. A further dilution of about 4 or 5 orders of magnitude would typically result following downwind movement of the cloud prior to its ground contact. Downwind ground-level concentrations of RDX would then be in the tens or hundreds of pg (10^{-12} g) per cubic meter of air.

Table 4.2.36 Maximum Semivolatile Organic Emission Factors Measured for Surface RDX Detonations[a].

Species[b]	Emission Factor (g/g)
2,4-Dinitrotoluene	210×10^{-9}
2,6-Dinitrotoluene	41×10^{-9}
2,4,6-Trinitrotoluene	98×10^{-9}
2-Nitronaphthalene	49×10^{-9}
N-Nitrosodiphenylamine	BD[c]
1,3,5-Trinitrobenzene	44×10^{-9}
2-Nitrodiphenylamine	34×10^{-9}
1-Nitropyrene	50×10^{-9}
RDX	2100×10^{-9}
Naphthalene	200×10^{-9}
Benz[a]anthracene	93×10^{-9}
Benzo[a]pyrene	140×10^{-9}
Pyrene	220×10^{-9}
Phenol	---[d]
Dibenzofuran	2000×10^{-9}
Diphenylamine	310×10^{-9}

[a]Emission factors are expressed in terms of 10^{-9} for ease of comparison, e.g., 210×10^{-9} is equivalent to 0.000000210.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels.
[c]Below detection limit.
[d]---Phenol was lost in the extraction of the semivolatiles.

4.2.4.2 Soil

4.2.4.2.1 Ejecta

a. Ejecta soil is the soil displaced at the point of a *surface* detonation and redeposited in the crater, in the berm around the crater, and within a few meters of the crater. The volume of the displaced soil was estimated using Equation 4.2 paragraph, 4.1.3.3. The calculated results are given in Table 4.2.37. The volume of the displaced soil varied from 21 to 37 m^3. The calculated weight of this soil, based on a density of 2.5 g/cc, varied from 52 to 94 metric tons with a mean of 67 metric tons. This loose soil was sampled, and the semivolatile organics remaining after the detonation were identified and quantified.

Table 4.2.37 OB/OD Detonation Crater Dimension, Volume, and Weight of Displaced So for RDX.

Location	Rim Opening (m)	Depth (m)	Volume (m^3)	Weight of Soil (kg)	Average Weight (kg)
RDX Explosive					
D1	6.5	1.5	26.65	66636	
D2	6.5	1.2	20.81	52037	
D3	6.0	1.5	22.97	57432	
D4	6.5	1.5	26.65	66636	
D5	6.5	2.0	37.37	93430	
D6	6.5	1.5	26.65	66636	67135

b. Background samples were taken at all detonation sites. All detonation sites were located in an area considered uncontaminated from previous explosive detonations. The pretest (background) and ejecta summary data are presented in Table 4.2.38. The analytes which showed increased concentrations (above concentration levels in the pretest soil) in the ejecta soil after detonation were naphthalene, pyrene, and dibenzofuran. N-nitrosodiphenylamine was found in all of the ejecta samples but not found in the soil background samples.

Table 4.2.38 RDX, Summary of Semivolatile Organic Concentrations from Phase C Pretest and Ejecta Soil Samples, Based on the Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
Pretest	3	3	2,4-Dinitrotoluene	0.56 to 0.73	0.62
	3	3	2,6-Dinitrotoluene	0.056 to 0.32	0.15
	3	3	2,4,6-Trinitrotoluene	0.16 to 0.64	0.39
	3	3	2-Nitronaphthalene	0.18 to 0.51	0.31
	3	3	1,3,5-Trinitrobenzene	0.14 to 0.30	0.20
	3	3	2-Nitrodiphenylamine	0.12 to 0.30	0.19
	3	3	1-Nitropyrene	0.20 to 0.80	0.42
	3	3	RDX	1.1 to 3.8	2.3
	3	3	Naphthalene	0.11 to 0.46	0.25
	3	3	Benz[a]anthracene	0.17 to 0.18	0.18
	3	3	Benzo[a]pyrene	0.14 to 0.16	0.15
	3	3	Pyrene	0.0027 to 0.062	0.018
	3	2	Dibenzofuran	BD[e] to 0.080	0.062
	3	3	Diphenylamine	0.24 to 0.25	0.25
Ejecta	3	3	2,4-Dinitrotoluene	0.34 to 2.0	0.86
	3	3	2,6-Dinitrotoluene	0.080 to 0.90	0.27
	3	3	2,4,6-Trinitrotoluene	0.28 to 0.67	0.37
	3	3	2-Nitronaphthalene	0.13 to 0.90	0.33
	3	3	N-Nitrosodiphenylamine	0.60 to 1.7	1.2
	3	3	1,3,5-Trinitrobenzene	0.13 to 0.77	0.27
	3	3	2-Nitrodiphenylamine	0.14 to 0.19	0.17
	3	2	1-Nitropyrene	BD to 0.23	0.10
	3	3	RDX	4.9 to 15	9.6
	3	3	Naphthalene	3.1 to 5.3	4.4
	3	3	Benz[a]anthracene	1.8 to 2.4	2.1
	3	2	Benzo[a]pyrene	BD to 0.41	0.33
	3	3	Pyrene	0.53 to 5.3	2.1
	3	3	Dibenzofuran	0.69 to 0.95	0.83
	3	2	Diphenylamine	BD to 0.48	0.46

[a]Above detection limit.
[b]See Table 3.16 for list containing the semivolatile organics and the detection levels in soil.
[c]μg of analyte per kg of soil.
[d]Geometric means were computed only from the values above the detection limit.
[e]Below detection limit.

4.2.4.2.2 Fallout

a. Fallout for the OB/OD thermal treatment testing is defined as the particulate material deposited beyond the ejecta area. The Phase C testing was to characterize the resulting soil fallout pattern and the amount of species deposited on the soil. The background and ejecta data were included along with the fallout data, prior to performing the ANOVA.

b. In Phase C, fallout sampling for a *surface* detonation was done with 1-m^2 pans placed on the 50-, 100-, 150-, and 200-meter circles.

(1) The analyte concentration data from the 50- and 100-meter sampling circles for the *surface* detonations are summarized in Table 4.2.39a. The analyte concentration data for the 150- and 200-meter sampling circles are given in Table 4.2.39b. The analytes detected above background concentration levels at the 50-meter distance from detonation were RDX, benz[a]anthracene, pyrene, and diphenylamine. At the 100-meter distance RDX, dibenzofuran, and diphenylamine were detected above background concentration levels. The analytes detected above background levels at the 150-meter distance were 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 2-nitrodiphenylamine, 1-nitropyrene, RDX, naphthalene, benz[a]anthracene, benzo[a]pyrene, pyrene, dibenzofuran, and diphenylamine. The analytes detected above background levels at the 200-meter distance were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, 1-nitropyrene, RDX, naphthalene, benz[a]anthracene, benzo[a]pyrene, pyrene, dibenzofuran, and diphenylamine. N-nitrosodiphenylamine was not found in the background soil samples; however, it was found in the ejecta and fallout pan samples.

Table 4.2.39a RDX, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
50-m circle	3	3	2,4-Dinitrotoluene	0.30 to 2.0	0.81
	3	3	2,6-Dinitrotoluene	0.081 to 0.84	0.26
	3	3	2,4,6-Trinitrotoluene	0.95 to 5.0	1.9
	3	3	2-Nitronaphthalene	0.36 to 1.6	0.68
	3	2	N-Nitrosodiphenylamine	BD[e] to 3.8	2.0
	3	3	1,3,5-Trinitrobenzene	0.093 to 0.92	0.23
	3	3	2-Nitrodiphenylamine	0.56 to 0.70	0.63
	3	3	1-Nitropyrene	0.045 to 1.0	0.17
	3	3	RDX	11 to 45	25
	3	3	Naphthalene	1.1 to 1.4	1.2
	3	3	Benz[a]anthracene	1.8 to 12	6.0
	3	2	Benzo[a]pyrene	BD to 2.9	2.4
	3	3	Pyrene	2.7 to 5.3	3.9
	3	1	Dibenzofuran	BD to 0.35	0.35
	3	1	Diphenylamine	BD to 0.67	0.67
100-m circle	3	3	2,4-Dinitrotoluene	0.16 to 0.79	0.39
	3	3	2,6-Dinitrotoluene	0.015 to 0.68	0.16
	3	3	2,4,6-Trinitrotoluene	0.48 to 4.8	2.1
	3	3	2-Nitronaphthalene	0.33 to 1.1	0.63
	3	2	N-Nitrosodiphenylamine	BD to 4.2	0.38
	3	3	1,3,5-Trinitrobenzene	0.0075 to 0.28	0.081
	3	3	2-Nitrodiphenylamine	0.051 to 1.2	0.75
	3	2	1-Nitropyrene	BD to 1.5	0.70
	3	3	RDX	8.6 to 130	32
	3	3	Naphthalene	0.82 to 1.8	1.1
	3	2	Benz[a]anthracene	BD to 8.8	1.3
	3	3	Benzo[a]pyrene	0.022 to 0.98	0.22
	3	3	Pyrene	0.0038 to 5.7	0.38
	3	1	Dibenzofuran	BD to 3.1	3.1

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

Table 4.2.39b RDX, Summary of Semivolatile Organic Concentrations from Phase C Fallout Soil Samples, Based on Weight of Sample.

Source of Sample	Number of Observations		Analyte[b]	Range Response (μg/kg)[c]	Geometric Mean[d] (μg/kg)
	Total	AD[a]			
150-m circle	3	3	2,4-Dinitrotoluene	2.2 to 110	21
	3	3	2,6-Dinitrotoluene	0.82 to 130	5.5
	3	3	2,4,6-Trinitrotoluene	12 to 150	62
	3	2	2-Nitronaphthalene	BD[e] to 120	21
	3	3	N-Nitrosodiphenylamine	6.6 to 210	30
	3	3	1,3,5-Trinitrobenzene	0.79 to 200	5.5
	3	2	2-Nitrodiphenylamine	BD to 78	20
	3	2	1-Nitropyrene	BD to 120	26
	3	2	RDX	BD to 1400	1000
	3	3	Naphthalene	15 to 210	47
	3	2	Benz[a]anthracene	BD to 220	19
	3	3	Benzo[a]pyrene	2.5 to 160	11
	3	3	Pyrene	9.0 to 250	30
	3	2	Dibenzofuran	BD to 93	32
	3	1	Diphenylamine	BD to 86	86
200-m circle	3	3	2,4-Dinitrotoluene	16 to 260	73
	3	2	2,6-Dinitrotoluene	BD to 66	16
	3	3	2,4,6-Trinitrotoluene	6.5 to 150	27
	3	3	2-Nitronaphthalene	6.5 to 150	27
	3	3	N-Nitrosodiphenylamine	15 to 170	40
	3	3	1,3,5-Trinitrobenzene	5.9 to 95	16
	3	3	2-Nitrodiphenylamine	4.9 to 35	17
	3	3	1-Nitropyrene	7.8 to 71	18
	3	3	RDX	290 to 1100	680
	3	3	Naphthalene	9.5 to 740	66
	3	3	Benz[a]anthracene	30 to 60	40
	3	1	Benzo[a]pyrene	BD to 79	79
	3	3	Pyrene	35 to 230	69
	3	2	Dibenzofuran	BD to 46	40
	3	3	Diphenylamine	18 to 46	28

[a]Above detection limit.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels in soil.
[c]Represents μg of analyte per kg of soil.
[d]Geometric means were computed from the values above the detection limit.
[e]Below detection limit.

(2) The Duncan's multiple-range test comparing the ejecta sample results with the fallout sample results for the semivolatile organics shows the following:

(a) The 50-meter concentration means were not different than the ejecta concentration means.

(b) The 100-meter analyte concentration means were not different from the ejecta centration means.

(c) The analytes detected above ejecta concentration levels at the 150-meter distance were 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 2-nitrodiphenylamine, 1-nitropyrene, RDX, naphthalene, dibenzofuran, and diphenylamine.

(d) The analytes detected above ejecta concentration levels at the 200-meter distance were 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2,4,6-trinitrotoluene, 2-nitronapthalene, 1,3,5-trinitrobenzene, 2-nitrodiphenylamine, 1-nitropyrene, RDX, naphthalene, benz[a]pyrene, dibenzofuran, and diphenylamine.

(3) This increase in concentration of the semivolatile analytes on the fallout soil at greater distance from the detonation may be a function of particle size (the increased surface area per volume of particle that results with the smaller particles provides more surface area for absorption of the analyte.) The results of OB/OD test show that analytes in the 200-, 150, and 100-meter fallout samples were more concentrated than in the 50-meter fallout samples. The results did not show the 50-meter analyte concentrations to be greater than the ejecta concentration means. A probable explanation of the increased concentration of analytes with distance is that soil chunks are still being propelled as far as 50 meter and the sample is a composite of a wide range of particle sizes including the larger chunks whose interior volume is not exposed to detonation products. This is in contrast to the fallout samples at greater distances, which consist of smaller particles.

(4) The mass of analyte collected was compared to the total sampling area of the fallout pan comprising the sample. Those data are summarized in Tables 4.2.40a and 4.2.40b. These data are useful in estimating the amount of an analyte that is deposited on the terrain as a function of distance from the source.

Table 4.3.6 Gas and VOC Emission Factors for the M-6 Single Base Propellant.

Species	Emission Factor (g/g)
CO_2 - min	1.06
CO_2 - max	1.06
CO_2 - avg	1.06
Number of observations	6
CO - min	BD[a]
CO - max	470×10^{-6}
CO - avg	95×10^{-6}
Number of observations	9
NO - min	2300×10^{-6}
NO - max	2600×10^{-6}
NO - avg	2400×10^{-6}
Number of observations	6
NO_2 - min	470×10^{-6}
NO_2 - max	580×10^{-6}
NO_2 - avg	520×10^{-6}
Number of observations	6
CH_4 - min	1.3×10^{-6}
CH_4 - max	390×10^{-6}
CH_4 - avg	46×10^{-6}
Number of observations	9
TNMHC - min	BD
TNMHC - max	69×10^{-6}
TNMHC - avg	13×10^{-6}
Number of observations	9
Benzene - min	BD
Benzene - max	7.3×10^{-6}
Benzene - avg	1.7×10^{-6}
Number of observations	9

[a]Below detection limit.

(2) Carbon monoxide EFs for M-6 are very low and in the range 10^{-4} to below detection level. This is not surprising considering the very high CO_2 EFs encountered. Nitric oxide EFs for M-6 are in the range of 0.002 and are similar to those encountered for the *surface* TNT tests. Nitrogen dioxide levels are about a factor of 10 lower, although as noted in an earlier section on total NO_x emission from TNT tests, it can be conservatively estimated that all NO produced in the burn will eventually be converted to NO_2. With this assumption and correcting for the mass difference between the NO and the NO_2 molecule, the average NO_2 EF for M-6 would be 0.0042.

b. Particulate Matter

(1) Mass concentrations within the cloud during the Phase C August 29 and 30 M-6 tests reveal cloud concentrations in the range of 2.7 to 2.8 mg/m^3 as averaged over three passes in a time interval of about 4 minutes following propellant ignition. Assuming that all particulate in the cloud is derived from the propellant and none is entrained soil, these measured cloud concentrations translate to a range of total particulate EFs between 9.0×10^{-3} to 1.2×10^{-2}, or very near 1 percent of the propellant. Data from the wing-mounted aerosol probes reveals that the sizes of particles encountered in the cloud are all within the range that can be efficiently sampled by the aircraft inlet probe and transport tube. As a result the collected particulate mass can be reasonably interpreted as a "total" particulate mass.

c. Volatile Organic Compounds

(1) Emission factors for representative VOC's for the M-6 are given in Table 4.3.6. Considering the high carbon conversion efficiencies noted for M-6 propellant, it is no surprise that EFs for methane, TNMHC and benzene appear at low levels. The average EFs for methane, TNMHC, and benzene are 0.000046, 0.000013, and 0.0000017, respectively. Like the TNT results , the TNMHC category is principally composed of non-toxic light weight gases, such as ethane, propane, acetylene, etc.

d. Semivolatile Organics

(1) Emission factors for the semivolatile organic category from the M-6 tests are given in Table 4.3.7. As a conservative estimate, only the maximum value determined in two discrete measurements for each propellant is given in the table. As was noted for the TNT tests, most of the target analytes were below the detection level of the analytical instrument. Species observed above the detection level for the M-6 propellant include 2,4-DNT, 2,6-DNT, N-nitrosodiphenylamine, phenol, naphthalene, and diphenylamine. Of all target analytes, naphthalene was detected at the highest concentration. This level corresponds to an EF of about 75×10^{-9}.

Table 4.3.7 Semivolatile Organic Emission Factors for M-6 Single Base Propellants.

Species	Emission Factor (g/g)
2,4 Dinitrotoluene	1.0×10^{-9}
2,6 Dinitrotoluene	0.077×10^{-9}
2,4,6 Trinitrotoluene	BD[a]
2-Nitronaphthalene	BD
N-Nitrosodiphenylamine	0.14×10^{-9}
1,3,5-Trinitrobenzene	BD
1-Nitropyrene	BD
Naphthalene	75×10^{-9}
Benz[a]anthracene	BD
Benzo[a]pyrene	BD
Pyrene	BD
Phenol	1.5×10^{-9}
Dibenzofuran	BD
Diphenylamine	0.026×10^{-9}

[a]Below detection limit, which is less than 10×10^{-9} for most target analytes.

4.3.1.2.2 Soil Deposition

a. Sputter

Ten sputter pan samples were placed 1 meter from the burn pans to collect propellant granules ejected from the burn pans during the burn. All M-6 propellant residue landing in the powdery soil or collected in the 1-m^2 pans visually appeared to be charred residue. This observation was substantiated by the low level of the analytes recovered. The mass of ash collected in the sputter

pans averaged 24.2 g/m². The concentration of each analyte expressed as ng/g and ng/m² of terrain surface are given in Table 4.3.8.

Table 4.3.8 Summary of Semivolatile Analyte Concentrations from M-6 Burn, Sputter Pan Sampling.

Analyte	Number of Observations		Concentration Range	
	Total	AD[a]	(ng/g)[b]	(ng/m²)[c]
2,4-Dinitrotoluene	3	3	8.1 to 12	44 to 66
2,4,6-Trinitrotoluene	3	1	BD[d] to 0.004	BD to 0.022
2-Nitronaphthalene	3	2	BD to 0.010	BD to 0.056
1,3,5-Trinitrobenzene	3	1	BD to 0.009	BD to 0.048
1-Nitropyrene	3	1	BD to 0.009	BD to 0.049
Naphthalene	3	3	0.34 to 1.00	1.9 to 5.4
Benz[a]anthracene	3	1	BD to 0.51	BD to 2.7
Benzo[a]pyrene	3	2	BD to 0.34	BD to 1.9
Pyrene	3	1	BD to 0.30	BD to 1.6
Phenol	3	1	BD to 0.14	BD to 0.78
Dibenzofuran	3	2	BD to 1.4	BD to 7.7
Diphenylamine	3	3	0.16 to 4.0	0.88 to 22

[a]Above detection limit.
[b]Represents ng of analyte per gram of fallout.
[c]Represents ng of analyte per m² of terrain.
[d]Below detection limit.

b. Fallout

Fallout pan samplers were placed in concentric circles 6 and 12 meters from the center of the burn pan array. The mass of ash collected in the pans at 6 meters was 8.6 g/m². The mass of ash collected in the pans at 12 meters was 2.8 g/m². No sampling was done beyond 12 meters on the M-6 burns; however, sampling beyond this distance on other propellant burns resulted in insufficient fallout for quantification of any of the analytes of interest. The analyte concentration data from the 6- and 12-meter fallout pans are summarized in Table 4.3.9. Using the maximum measured 2,4-dinitrotoluene concentration of 1300 ng/m² as representative of the terrain deposition out to 18 meter, results in a total deposition of 1.32 mg of 2,4-DNT spread over 1000 m² or 0.25 acre.

Table 4.3.9 Summary of Semivolatile Analyte Concentrations from M-6 Burn, Fallout Pan Sampling.

Analyte	Sample Distance (m)	Number of Observations		Concentration Range	
		Total	AD[a]	(ng/g)[b]	(ng/m²)[c]
2,4-Dinitrotoluene	6	3	3	45 to 410	140 to 1300
	12	3	3	37 to 230	110 to 480
2,4,6-Trinitrotoluene	6	3	1	BD[d] to 0.786	BD to 2.5
	12	3	3	0.088 to 1.0	0.28 to 3.1
2-Nitronaphthalene	6	3	2	BD to 0.11	BD to 0.34
	12	3	3	0.007 to 0.18	0.21 to 0.55
N-Nitrosodiphenylamine	6	3	1	BD to 20	BD to 63
	12	3	1	BD to 4.0	BD to 13
2-Nitrodiphenylamine	6	3	1	BD to 1.1	BD to 3.5
	12	3	1	BD to 0.16	BD to 0.49
Naphthalene	6	3	2	BD to 0.84	BD to 2.6
	12	3	2	BD to 9.6	BD to 30
Benz[a]anthracene	6	3	3	0.12 to 2.2	0.38 to 6.8
	12	3	1	BD to 0.062	BD to 0.13
Benzo[a]pyrene	6	3	3	0.18 to 1.1	0.57 to 3.5
	12	3	0	BD	BD
Pyrene	6	3	2	BD to 0.36	BD to 1.1
	12	3	0	BD	BD
Phenol	6	3	1	BD to 0.15	BD to 0.46
	12	3	0	BD	BD
Dibenzofuran	6	3	3	2.0 to 53	6.1 to 170
	12	3	2	BD to 2.8	BD to 8.9
Diphenylamine	6	3	3	0.44 to 26	1.4 to 83
	12	3	3	0.28 to 5.6	0.58 to 18

[a]Above detection limit.
[b]represents ng of analyte per gram of fallout.
[c]Represents ng of analyte per m^2 of terrain.
[d]Below detection limit.

c. Burn Pan Residue

Burn pan residue for each 3200 kg of M-6 propellant burned varied from 2.3 to 3.2 kg, the average residue was 2.6 kg or about 0.1 percent of the original propellant mass. Burn pan residue samples for semivolatile analyses were taken on each burn trial, with a composite sample for each of the four M-6 burn trials analyzed. The semivolatile analytes detected and their concentrations are given in Table 4.3.10. The residue consisted primarily of elemental and inorganic carbon. Approximately 200 μg of semivolatile organic compounds were recovered from each gram of residue. The mass fraction of 2,4-DNT in the M-6 propellant was 0.10. After burning, the mass fraction of 2,4-DNT in the residue was 0.00013. Based on these results, the semivolatile organic fraction in the propellant residue is very low, corresponding to about 0.000000103 of the original propellant weight prior to burning. The marked reduction of 2,4-DNT in the propellant residue is consistent with the observation that the bulk of the residue is char or elemental carbon.

Table 4.3.10 Summary of Semivolatile Analyte Concentrations From M-6 Burn, Burn Pan Residue.

Analyte	Number of Observations		Concentration Range (ng/g)[b]
	Total	AD[a]	
2,4-Dinitrotoluene	6	6	10000 to 130000
2,4,6-Trinitrotoluene	6	6	3.7 to 280
2-Nitronaphthalene	6	6	8.2 to 160
2-Nitrodiphenylamine	6	6	14 to 320
Naphthalene	6	2	BD[c] to 860
Benz[a]anthracene	6	5	BD to 680
Pyrene	6	4	BD to 280
Dibenzofuran	6	6	150 to 72000
Diphenylamine	6	6	62 to 2000

[a]Above detection limit.
[b]Represents ng of analyte per gram of pan residue.
[c]Below detection limit.

4.3.1.2.3 Total Release of 2,4-Dinitrotoluene

Based on the analysis results for M-6, estimates of total release of a typical target analyte such as 2,4-DNT can be estimated as follows. The original weight fraction of 2,4-DNT in the M-6 parent compound is about 0.10 (see Table 3.5). Based on fallout pan analysis, total release to the soil surrounding the burn pan is about 1.3 mg. Based on residue analysis, an estimate of the total amount of 2,4-DNT in the burn residue is about 400 mg. Based on the measured emission air factor, the total release of 2,4-DNT to the air is also about 3 mg. The total release of DNT to all receptors is therefore in the order of 400 mg. The amount of 2,4-DNT in the original weight of M-6 prior to ignition is about 300 kg. Using these estimates, the mass fraction of 2,4 DNT not consumed in the burn is about 0.0000013. In other words, all but about 1.3 ppm of the original 2,4-DNT is consumed in the combustion process and oxidized to CO_2.

4.3.2 Triple Base Test - Phase A

4.3.2.1 Air Emissions

4.3.2.1.1 Gases

a. Gas EFs for the Triple Base Propellant burn carried out during the Phase A test series are statistically summarized in Table 4.3.11. Minimum and maximum EFs are given for important gaseous species. Sample size was limited to two samples for most species in this particular test event. The CO_2 EF was observed to be 0.66 in both samples collected. This compares with a theoretical CO_2 EF of 0.65 for this particular propellant, assuming that all propellant carbon is converted to CO_2. This observation is accompanied by very low ($\sim$0.00003) EFs for CO. This trend of high carbon conversion to CO_2 is consistent with observations made on the M-1 and M-6 single- base propellants. A single measurement of NO and NO_2 which was completed on this particular test reveals an EF in the 10^{-3} range and similar to those encountered with the M-1 and M-6 propellants. Assuming total conversion of emitted NO to NO_2, the total NO_2 EF is very near 1 percent for this propellant.

Table 4.3.11 Gas Emission Factors for Triple Base Propellants.

Species	Emission Factor (g/g)
CO_2 - min	0.66
CO_2 - max	0.66
CO_2 - avg	0.66
Number of observations	2
CO - min	20×10^{-6}
CO - max	30×10^{-6}
CO - avg	25×10^{-6}
Number of observations	2
NO - min	5.2×10^{-3}
NO - max	5.2×10^{-3}
NO - avg	5.2×10^{-3}
Number of observations	1
NO_2 - min	2.1×10^{-3}
NO_2 - max	2.1×10^{-3}
NO_2 - avg	2.1×10^{-3}
Number of observations	1

4.3.2.1.2 Particulate Matter

a. Precision weighing was not carried out on the filter samples from the Phase A tests. As a result, only rough estimates of particulate mass concentrations in the cloud are available. Particulate concentrations in the cloud were determined to be about 4 mg/m^3 for the two-burn sequence. This cloud concentration corresponds to a particulate matter EF of about 2 percent. Some existing evidence suggests that some of the particles in the cloud were soil particles entrained in the smoke column from the burning propellant; however, further testing is required to establish this fact.

4.3.2.1.3 Volatile Organic Compounds

a. Emission factors for principal VOC compounds are given in Table 4.3.12. All species given in the table were below detection, with the exception of the TNMHC category. Levels at this

category were very low (10^{-6}). These observations are consistent with the low VOC emissions observed for the M-1 and M-6 propellant tests.

Table 4.3.12 Volatile Organic Compound Emission Factors for Triple-Base Propellant.

Species	Emission Factor (g/g)
CH_4 - min	BD[a]
CH_4 - max	BD
CH_4 - avg	BD
Number of observations	2
TNMHC - min	0.34×10^{-6}
TNMHC - max	2.6×10^{-6}
TNMHC - avg	1.5×10^{-6}
Number of observations	2
Benzene - min	BD
Benzene - max	BD
Benzene - avg	BD
Number of observations	2

[a]Below detection limit.

4.3.2.1.4 Semivolatile Organic Compounds

a. All target analytes were at or below the analytical detection limit for the triple-base propellant. The detection limit for most of these semivolatile organics corresponds to a range of about 10^{-8} to 10^{-9}. These results yield further evidence of the clean burning nature of many of these propellant types.

4.3.2.2 Soil Deposition

4.3.2.2.1 Sputter

No samples were collected in close proximity to the burn pans. A visual inspection of the area after the burn showed a number of small indentations in the powdery soil. Each indentation contained a charred skeleton of the M-30 propellant granule. These indentations extended out approximately

3 meters from the burn pan. A sample of these char residues was collected and assayed by both GC-MS and SFC-MS. None of the semivolatile compounds on the analyte list were detected.

4.3.2.2.2 Fallout

A composite sample composed of fallout from the 6- and 12-meter sampling circles was assayed. The compounds detected and the concentrations were phenol, 190 μg/g; ethyl centralite, 96 μg/g; nitroglycerin, 43 μg/g; and nitroguanidine, 55 μg/g. Fallout pan samples were also placed on a circle 30 meters from the burn pans; however, the amount of fallout material collected at this range was too small for a valid chemical assay.

4.3.2.2.3 Burn Pan Residue

The analytes and the concentrations detected in the burn pan residue were phenol, 0.12 μg/g; 2-nitrodiphenylamine, 0.51 μg/g; ethyl centralite, 2.8 μg/g; nitroglycerin, 0.73 μg/g; and, nitroguanidine, 0.79 μg/g.

4.3.3 Manufacturing Residue Tests - Phases B and C

4.3.3.1 Manufacturing Residue Test - Phase B

4.3.3.1.1 The composition of the propellants in the manufacturing residue was known to contain ammonium perchlorate and some metals which would release undesirable emittant products during combustion. These emissions need to be quantified prior to RCRA Sub-part X permitting.

4.3.3.1.2 During the BB study a special task force from Battelle Columbus Division drew samples during the BB study to identify/quantify the PCDD's and PCDF's (Reference BB Volume-2, Appendix B; also BB Volume-1, paragraphs 5.7.6 and 5.7.7, page 5-22, and BB Volume-2, paragraphs 7.3.2.10 and 7.3.2.11, page 7-19)

4.3.3.1.3 Sampling for HCL during the BB study was not conclusive due to the inability of sampling to account for a chlorine balance from the composite propellant (Reference BB Volume-1, paragraph 5.7.5, page 5-22, and BB Volume-2, paragraph 7.3.2.9, pages 7-18 and 7-19).

4.3.3.1.4 During the BB study, metals were sampled successfully on Teflon™ filter media (Reference BB Volume-1, paragraph 5.7.4, page 5-17, table 5.5c, page 5-20; and BB Volume-2, paragraph 7.3.2.6, page 7-18).

4.3.3.1.5 During the design of the field tests, the TSC recommended that sampling/analysis for HCL, PCDD's,PCDF's and metals not be done. This discussion was based on the lack of funding and time, and other needs of the project which necessitated Teflon™ coated glass fiber filters or quartz fiber filters. Metals could not be successfully assayed from these filters. Additionally the methodology and technology objectives of this study did not require the development of these data.

4.3.3.1.6 Accordingly the following sections do not address these issues.

4.3.3.1.7 Air Emissions

a. Gases

(1) Gas emissions for the mixed-manufacturing propellant waste burn carried out during the Phase B test series are given in Table 4.3.13. The measured CO_2 EF is 0.77 and, consistent with the other propellants examined in these tests, is within 1 percent of what one would expect to see if all the carbon in the propellant is converted to CO_2. The CO EFs are correspondingly low, and in the range of 10^{-3} to 10^{-4}. The manufacturing residue, like the other propellants tested in this study, shows remarkably clean burning characteristics when burned in bulk quantities. Nitric oxide and nitrogen dioxide emissions for this propellant material were similar to those measured for the single- and triple-base materials discussed earlier, with levels in the range of 10^{-4} and 10^{-3}.

b. Particulate Matter

Table 4.3.13 Gas Emission Factors for Phase B Manufacturing Residue Burns.

Species	Emission Factor (g/g)
CO_2 - min	0.77
CO_2 - max	0.77
CO_2 - avg	0.77
Number of observations	9
CO - min	69×10^{-6}
CO - max	1700×10^{-6}
CO - avg	490×10^{-6}
Number of observations	9
NO - min	1.9×10^{-3}
NO - max	3.8×10^{-3}
NO - avg	2.8×10^{-3}
Number of observations	2
NO_2 - min	0.34×10^{-3}
NO_2 - max	0.67×10^{-3}
NO_2 - avg	0.51×10^{-3}
Number of observations	2

(1) The average particulate matter concentration as measured in several passes of the aircraft through the cloud from the Phase B manufacturing residue burn was 4.7 mg/m^3. This concentration level is similar to those measured in the other propellant burn clouds. Assuming that all particles in the cloud are combustion products from the burn and that no soil is entrained into the smoke column during the burning process, the particulate matter EF corresponding to this cloud particle concentration level is about 1.6 percent. Thus, for every kilogram of propellant consumed, 16 grams of particulate material will be released to the atmosphere.

c. Volatile Organic Compounds

(1) Emission factors for VOC measured for the manufacturing residue are given in Table 4.3.14. Results are very similar to those determined for the M-30 triple-base material, in that only very low EFs (10^{-4}) for the general class of TNMHC are detected; however, specific species such as CH_4 and benzene are not detected. These results are consistent with the observed general pattern of highly

efficient combustion of nearly all single-, double-, and triple-base propellants examined in this test program.

Table 4.3.14 Volatile Organic Compound Emission Factors, Phase B, Manufacturing Residue Burns.

Species	Emission Factor (g/g)
CH_4 - min	BD[a]
CH_4 - max	BD
CH_4 - avg	BD
Number of observations	6
TNMHC - min	2.2×10^{-6}
TNMHC - max	230×10^{-6}
TNMHC - avg	45×10^{-6}
Number of observations	6
Benzene - min	BD
Benzene - max	BD
Benzene - avg	BD
Number of observations	6

[a]Below detection limit.

d. Semivolatile Organic Compounds

(1) Emission factors for the semivolatile organic category for the Phase B manufacturing residue burn are given in Table 4.3.15. Emission factors for most of the analytes on the target list are either nondetectable with a corresponding EF in the range of 10^{-8} to 10^{-9}, or are detected at a slightly higher level. The two analytes seen at the highest levels are naphthalene and phenol, with EFs in the 10^{-6} range. The pattern of semivolatile compound emissions from this propellant class is consistent with the emissions measured for the other single-, and triple-base propellants examined in this test series.

4.3.3.1.8 Soil Deposition

a. Sputter

Table 4.3.15 Semivolatile Organic Emission Factors, Phase B, Manufacturing Residue Burns.

Species	Emission Factor (g/g)
2,4-Dinitrotoluene	BD[a]
2,6-Dinitrotoluene	BD
2,4,6-Trinitrotoluene	BD
2-Nitronaphthalene	3.7×10^{-9}
N-Nitrosodiphenylamine	19×10^{-9}
Naphthalene	1500×10^{-9}
Benz[a]anthracene	38×10^{-9}
Benzo[a]pyrene	23×10^{-9}
Pyrene	71×10^{-9}
Phenol	8000×10^{-9}
Dibenzofuran	260×10^{-9}
Diphenylamine	20×10^{-9}

[a]Below detection limit which is less than 10×10^{-9} for most of the target analytes.

Ten sputter pan samples were placed 1 meter from the burn pans to collect propellant granules ejected from the burn pans during the burns. All propellant residue landing in the powdery soil or collected in the 1-m^2 pans visually appeared to be charred residue. This observation was substantiated by the low level of the analytes recovered. The mass of ash collected in the sputter pans averaged 2.8 g/m^2. The concentration of each analyte expressed as ng/g and ng/m^2 of terrain surface is given in Table 4.3.16.

Table 4.3.16 Summary of Semivolatile Analyte Concentrations, Phase B, Manufacturing Residue Burn, Sputter Pan Sampling.

Analyte	Number of Observations		Concentration Range	
	Total	AD[a]	(ng/g)[b]	(ng/m²)[c]
Naphthalene	2	2	39 to 54	240 to 290
Pyrene	2	2	42 to 58	260 to 310
Phenol	2	2	0.65 to 0.77	4.0 to 4.1
Dibenzofuran	2	2	2.4 to 2.8	13 to 17
Nitroglycerin	2	2	22 to 23	120 to 130

[a]Above detection limit.
[b]Represents ng of analyte per gram of fallout.
[c]Represents ng of analyte per m^2 of terrain.

b. Fallout

Fallout pan samplers were placed in concentric circles 6 and 12 meters from the center of the burn pan array. The mass of ash collected in the pans at 6 meters was 0.85 g/m^2. The mass of ash collected in the pans at 12 meters was 1.3 g/m^2. No sampling was conducted beyond 12 meters on the manufacturing residue burns; however, sampling beyond this distance on previous burns resulted in insufficient fallout for quantification of any of the analytes of interest. The analyte concentration data from the 6- and 12-meter fallout pans are summarized in Table 4.3.17. Using the maximum measured 2,4-dinitrotoluene concentration of 1300 ng/m^2 as representative of the terrain deposition out to 18 meters, results in a total deposition of 1.32 mg of 2,4-DNT, spread over 1000 m^2 or 0.25 acre.

Table 4.3.17 Summary of Semivolatile Analyte Concentrations, Phase B, Manufacturing Residue Burn, Fallout Pan Sampling.

Analyte	Sample Distance (m)	Number of Observations		Concentration Range	
		Total	AD[a]	(ng/g)[b]	(ng/m²)[c]
2,6-Dinitrotoluene	6	2	2	100 to 700	170 to 1300
	12	2	1	BD[d] to 210	BD to 540
N-Nitrosodiphenylamine	6	2	0	BD	BD
	12	2	2	1.7 to 6.7	11 to 18
2-Nitrodiphenylamine	6	2	1	BD to 2.5	BD to 4.1
	12	2	2	13 to 17	34 to 110
Naphthalene	6	2	2	73 to 300	130 to 490
	12	2	2	160 to 390	1000 to 1000
Pyrene	6	2	2	67 to 510	120 to 840
	12	2	2	54 to 410	340 to 1100
Phenol	6	2	2	0.62 to 6.9	1.1 to 11
	12	2	2	8.1 to 16	41 to 50
Dibenzofuran	6	2	2	14 to 29	25 to 47
	12	2	2	5.4 to 16	33 to 41
Diphenylamine	6	2	1	BD to 2.7	BD to 4.5
	12	2	2	0.81 to 1.3	3.4 to 5.0
Nitroglycerin	6	2	2	76 to 100	140 to 170
	12	2	2	110 to 310	670 to 810

[a]Above detection limit.
[b]Represents ng of analyte per gram of fallout.
[c]Represents ng of analyte per m^2 of terrain.
[d]Below detection limit.

c. Burn Pan Residue

The amount of propellant burned was about 3000 kg on each burn. The burn pan residue amount varied from 3.4 kg to 7.4 kg or about 0.1 to 0.2 percent of the initial weight of propellant. The burn pan residue was analyzed by Chemtech, using EPA method 8270 (acid/base/neutral compounds), with the only compounds detected being phenol at 0.054 mg/kg of residue and the phthalates (phthalate compounds are not included on the semivolatile analyte list).

4.3.3.2 Manufacturing Residue Burn Test - Phase C

4.3.3.2.1 Air Emissions

a. Gases

Gas EFs for the mix of Navy NOSIH-AA-2 and N-5 manufacturing residues burned during Phase C test series are statistically summarized in Table 4.3.18. Minimum and maximum EFs are given for all significant gaseous species. Sample size was limited to four Teflon® bag samples for the NO and NO_2 species and about eight samples for CO_2, CO, and the VOC compounds. The minimum, maximum, and average CO_2 EF was observed to be 1.00 in all samples collected. This compares with a theoretical CO_2 EF of 1.00 for this particular propellant, assuming that all propellant carbon is converted to CO_2. The high CO_2 EFs are accompanied by very low ($\sim$0.0008) EFs for CO. This trend of high carbon conversion to CO_2 in these burns is consistent with observations made on the M-1 and M-6 single-base propellants as well. Nearly all of these propellants have a positive or near positive oxygen balance, so that little or no excess ambient air is required in the combustion zone to achieve complete conversion of carbon to CO_2. Nitrogen oxide emissions are at about the 0.1 percent level with nearly all of the gases in the NO category. These levels are consistent with those determined for the M-1 and M-6 propellant types discussed earlier. Assuming that all NO is ultimately converted to NO_2, the resulting NO_2 EF following NO oxidation is about 0.004 for this manufacturing residue.

Table 4.3.18 Gas Emission Factors for the Phase C Manufacturing Residue Burns.

Species	Emission Factor (g/g)
CO_2 - min	1.00
CO_2 - max	1.00
CO_2 - avg	1.00
Number of observations	8
CO - min	0.005×10^{-3}
CO - max	3.0×10^{-3}
CO - avg	0.7×10^{-3}
Number of observations	8
NO - min	1.8×10^{-3}
NO - max	4.1×10^{-3}
NO - avg	2.6×10^{-3}
Number of observations	4
NO_2 - min	22×10^{-6}
NO_2 - max	600×10^{-6}
NO_2 - avg	150×10^{-6}
Number of observations	4

[a]Below detection limit.

b. Particulate Matter

Particulate matter concentrations were measured twice during multiple aircraft passes through the plume. Each measurement represents an average of three cloud passages from two successive burns, starting at about 45 seconds and extending out to about 2.5 minutes after the completion of the burn. Gravimetric analysis of the particulate material collected on the filter and information on the air volume drawn through the filter provide a means of calculating the average cloud particulate matter concentration. Average cloud concentrations measured for August 14 and August 15 burns were 3.3 and 3.2 mg/m^3, respectively. Concentration levels are consistent with low levels observed for other propellant types examined in these test series. These cloud concentrations correspond to a particulate matter EF of about 1 percent. Some existing evidence suggests that some of the particles in the cloud were soil particles entrained in the smoke column from the burning propellant; however, further testing is required to verify this theory.

c. Volatile Organic Compound

Emission factors for principal VOC compounds are given in Table 4.3.19 for the manufacturing residue test. Major species shown in the table include CH_4, TNMHC, and benzene. However all were detected at very low EF levels. Methane and TNMHC are both detected at slightly less than the 0.1 percent level and benzene is detected at the 0.01 percent level. These observations are similarly consistent with the low VOC emissions observed for the M-1 and M-6 propellant tests.

Table 4.3.19 Volatile Organic Compound Emission Factors for the Phase C Manufacturing Residue Burns.

Species	Emission Factor (g/g)
CH_4 - min	3.8×10^{-6}
CH_4 - max	3400×10^{-6}
CH_4 - avg	750×10^{-6}
Number of observations	5
TNMHC - min	130×10^{-6}
TNMHC - max	1200×10^{-6}
TNMHC - avg	560×10^{-6}
Number of observations	7
Benzene - min	2.9×10^{-6}
Benzene - max	34×10^{-6}
Benzene - avg	16×10^{-6}
Number of observations	7

d. Semivolatile Organics (Exotics)

Emission factors for the semivolatile organic target compounds are given in Table 4.3.20 for the phase C manufacturing residue propellant burns. The values shown in the table are the maximum values obtained from two separate tests each consisting of two burns in series. Analysis allows the determination of thermally unstable compounds such as nitroglycerin which would otherwise decompose during injection and separation by conventional gas chromatography. The emission factors for the target analytes are all observed at the part per million (10^{-6}) level or less. The highest emission factors observed were for naphthalene, pyrene, and diphenylamine. Efficient combustion of the nitrodiphenylamine, present in the parent propellant at a level of 2 percent of the weight, is evidenced by an emission factor for diphenylamine of 3×10^{-7}. It is not likely that the

measured 2,4-dinitrotoluene, 2,6-dinitrotoluene, and 2,4,6-trinitrotoluene are derived from th chemical rearrangement of propellant constituents during the burn. It is noteworthy that nitroglycerin, one of the major propellant constituents, is not detected in the air samples collected. Similarly, the remainder of the target analytes were either not detected or observed at low (10^{-8} or 10^{-9}) levels.

Table 4.3.20 Maximum Semivolatile Organic Emission Factors Measured for the Phase C Manufacturing Residue Burns[a].

Species[b]	Emission Factor (g/g)
2,4 Dinitrotoluene	160×10^{-9}
2,6 Dinitrotoluene	140×10^{-9}
2,4,6 Trinitrotoluene	64×10^{-9}
2-Nitronaphthalene	83×10^{-9}
N-Nitrosodiphenylamine	27×10^{-9}
1,3,5-Trinitrobenzene	5.3×10^{-9}
2-Nitrodiphenylamine	13×10^{-9}
1-Nitropyrene	BD[c]
Nitroglycerin	BD
Naphthalene	540×10^{-9}
Benz[a]anthracene	140×10^{-9}
Benzo[a]pyrene	81×10^{-9}
Pyrene	320×10^{-9}
Phenol	---[d]
Dibenzofuran	120×10^{-9}
Diphenylamine	310×10^{-9}

[a]Emission factors are expressed in terms of 10^{-9} for ease of comparison, e.g., 160×10^{-9} is equivalent to 0.000000160.
[b]See Table 3.16 for a list containing the semivolatile organics and the detection levels.
[c]Below detection limit.
[d]---Phenol was lost in the extraction of the semivolatiles.

4.3.3.2.2 Soil Deposition

a. Sputter

Ten sputter pan samples were placed 1 meter from the burn pans to collect propellant granules ejected from the burn pans during the burn. All manufacturing residue landing in the powdery soil or collected in the 1-m^2 pans visually appeared to be charred residue. This observation was substantiated by the low level of the analytes recovered. The mass of ash collected in the sputter pans averaged 3.2 g/m^2 on trial 1 and 1.8 g/m^2 on trial 2. The concentration of each analyte expressed as ng/g and ng/m^2 of soil surface is given in Table 4.3.21.

Table 4.3.21 Manufacturing Residue Burn: Summary of Semivolatile Organic Concentrations, Sputter Pan Sampling, Phase C.

Analyte	Number of Observations		Concentration Range	
	Total	AD[a]	(ng/g)[b]	(ng/m^2)[c]
2,4-Dinitrotoluene	2	2	5.5 to 21	15 to 58
2,6-Dinitrotoluene	2	2	1.8 to 8.1	4.9 to 22
2,4,6-Trinitrotoluene	2	1	BD[d] to 7.1	BD to 19
2-Nitronaphthalene	2	1	BD to 3.2	BD to 8.6
Naphthalene	2	1	BD to 13	BD to 34
Benz[a]anthracene	2	1	BD to 35	BD to 94
Benzo[a]pyrene	2	1	BD to 3.1	BD to 8.4
Pyrene	2	1	BD to 6.2	BD to 17
Dibenzofuran	2	1	BD to 30	BD to 80

[a]Above detection limit.
[b]Represents ng of analyte per gram of fallout.
[c]Represents ng of analyte per m^2 of terrain.
[d]Below detection limit.

b. Fallout

Fallout pan samplers were placed in concentric circles 6 and 12 meters from the center of the burn pan array. The mass of ash collected in the pans at 6 meters was 3.1 and 3.6 g/m^2 on trial 1 and trial 2, respectively. The mass of ash collected in the pans at 12 meters was 9.8 and 1.4 g/m^2 for trial 1 and trial 2, respectively. No sampling was conducted beyond 12 meters on the phase C manufacturing residue burns; however, sampling beyond this distance on previous burns resulted in insufficient fallout for quantification of any of the analytes of interest. The analyte concentration data from the 6- and 12-meter fallout pans are given in Table 4.3.22. Using the maximum measured

2,4-dinitrotoluene concentration of 24 ng/m^2 as representative of the terrain deposition out to 18 meters, results in a total deposition of 0.024 mg of 2,4-DNT spread over the 1000 m^2 or 0.25 acre.

Table 4.3.22 Manufacturing Residue Burn: Summary of Semivolatile Analyte Concentrations, Fallout Pan Sampling, Phase C.

Analyte	Sample Distance (m)	Number of Observations		Concentration Range	
		Total	AD[a]	(ng/g)[b]	(ng/m^2)[c]
2,4-Dinitrotoluene	6	2	2	7.3 to 7.5	11.4 to 11.8
	12	2	2	3.7 to 23	3.9 to 24
2,6-Dinitrotoluene	6	2	2	4.3 to 5.0	6.8 to 7.9
	12	2	2	0.62 to 4.8	0.65 to 5.1
2,4,6-Trinitrotoluene	6	2	0	BD[d]	BD
	12	2	2	0.62 to 120	0.64 to 120
2-Nitronaphthalene	6	2	2	2.3 to 5.0	3.7 to 7.9
	12	2	2	0.42 to 8.4	0.44 to 8.8
1,3,5-trinitrobenzene	6	2	0	BD	BD
	12	2	1	BD to 5.4	BD to 5.7
Naphthalene	6	2	1	BD to 11	BD to 18
	12	2	1	BD to 23	BD to 24
Benz[a]anthracene	6	2	1	BD to 7.8	BD to 12
	12	2	1	BD to 29	BD to 30
Benzo[a]pyrene	6	2	1	BD to 1.7	BD to 2.7
	12	2	1	BD to 0.079	BD to 0.083
Pyrene	6	2	1	BD to 3.0	BD to 4.6
	12	2	1	BD to 15	BD to 16
Dibenzofuran	6	2	0	BD	BD
	12	2	1	BD to 48	BD to 50
Diphenylamine	6	2	0	BD	BD
	12	2	1	BD to 21	BD to 21

[a]Above detection limit.
[b]Represents ng of analyte per gram of fallout.
[c]Represents ng of analyte per m^2 of terrain.
[d]Below detection limit.

c. Burn Pan Residue

Burn pan residue for each 2200 kg of manufacturing residue burned varied from 0.37 kg to 1.1 kg over the four burns. The average residual was 0.61 kg, or about 0.03 percent of the initial weight

of propellant. Burn pan residue samples for semivolatile organic analyses were taken on each burn. A composite sample for each of the burn trials was analyzed. The semivolatile organic analytes detected and the concentrations are given in Table 4.3.23.

Table 4.3.23 Manufacturing Residue Burn: Summary of Semivolatile Analyte Concentrations, Burn Pan Residue, Phase C.

Analyte	Number of Observations		Concentration Range (ng/g)[b]
	Total	AD[a]	
2,4-Dinitrotoluene	2	2	1.8 to 6.0
2,6-Dinitrotoluene	2	2	3.5 to 5.0
2-Nitronaphthalene	2	2	0.13 to 3.6
Benzo[a]pyrene	2	2	11 to 11
Pyrene	2	2	3.2 to 5.2
Dibenzofuran	2	2	18 to 22
Diphenylamine	2	1	BD[c] to 1.9

[a]Above detection limit.
[b]Represents ng of analyte per gram of pan residue.
[c]Below detection limit.

4.4 Comparison of BangBox and Field TNT Detonations

EFs from the BangBox, open-air *surface*, and open-air suspended TNT detonations are summarized in Table 4.4.1. This table gives values for CO_2, CO, NO, NO_2, volatile organics, (methane, TNMHC, and benzene), and the selected list of semivolatiles.

Table 4.4.1 Average Emission Factors for the Volatile and Maximum Emission Factors for the Semivolatile Analytes from the BangBox and Open-Air Detonation with TNT.

Analyte	BangBox	Phase A	Phase B		Phase C	
		Surface	Surface	Suspended	Surface	Suspended
CO_2	1.32	1.26	1.29	1.35	1.28	1.35
CO	4.9×10^{-3}	61×10^{-3}	42×10^{-3}	7.3×10^{-3}	49×10^{-3}	6.9×10^{-3}
NO	11×10^{-3}	0.70×10^{-3}	1.4×10^{-3}	2.5×10^{-3}	1.4×10^{-3}	2.3×10^{-3}
NO_2	0.56×10^{-3}	3.6×10^{-3}	1.1×10^{-3}	$2.1 \times ^{-3}$	1.4×10^{-3}	1.2×10^{-3}
Methane	0.025×10^{-3}	1.5×10^{-3}	1.2×10^{-3}	0.061×10^{-3}	1.5×10^{-3}	1.5×10^{-3}
TNMHC	0.057×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	0.21×10^{-3}	2.1×10^{-3}	5.0×10^{-3}
Benzene	2.4×10^{-6}	94×10^{-6}	93×10^{-6}	3.2×10^{-6}	100×10^{-6}	62×10^{-6}
2,4-DNT	170×10^{-9}	150×10^{-9}	8400×10^{-9}	200×10^{-9}	BD[a]	BD
2,6-DNT	140×10^{-9}	19×10^{-9}	7100×10^{-9}	300×10^{-9}	BD	BD
2,4,6-TNT	620×10^{-9}	220×10^{-9}	150×10^{-9}	46×10^{-9}	60×10^{-9}	140×10^{-9}
2-NN	160×10^{-9}	80×10^{-9}	270×10^{-9}	15×10^{-9}	BD	BD
N-NSDPA	200×10^{-9}	BD	4.4×10^{-9}	29×10^{-9}	BD	BD
1,3,5-TNB	0.45×10^{-9}	BD	BD	BD	BD	BD
2-NDPA	N/A[b]	N/A	N/A	N/A	BD	BD
1-NP	1/13[c]	BD	39×10^{-9}	59×10^{-9}	BD	BD
Naph	28×10^{-6}	BD	3.7×10^{-6}	0.012×10^{-6}	2.6×10^{-9}	1.8×10^{-6}
B[a]A	BD	2.2×10^{-9}	160×10^{-9}	66×10^{-9}	$100 \times ^{-9}$	320×10^{-9}
B[a]P	360×10^{-9}	BD	240×10^{-9}	310×10^{-9}	BD	BD
Pyrene	32×10^{-9}	BD	NA	N/A	220×10^{-9}	19×10^{-9}
Phenol	9.9×10^{-6}	BD	5.2×10^{-6}	12000×10^{-6}	BD	BD
DBF	150×10^{-9}	BD	85×10^{-9}	60×10^{-9}	180×10^{-9}	190×10^{-9}
DPA	BD	N/A	7.7×10^{-9}	25×10^{-9}	170×10^{-9}	BD

[a]Below detection limit.
[b]N/A - Not on the analyte list.
[c]Detected on one of 13 assays, at very low level.

4.4.1 Emission Factor Comparison.

Changes in the EF for any particular species would not be expected if the explosive configuration (suspended or *surface*) or the size of the detonation has no effect on the amount of the pollutant produced, since the EF is the amount of pollutant released, normalized to the original mass of

material. The EF for several of the gases reveals that either scale or configuration effects are operative. For example, the CO_2 EF is higher for the BangBox and suspended outdoor tests when compared to those from the outdoor *surface* detonations. Since the small-scale BangBox and large-scale suspended EF for CO_2 are similar, it can be surmised that the suspended configuration of the explosive is an important parameter in the CO_2 formation process. As discussed earlier, the presence of entrained soil debris in the detonation fireball during the *surface* tests is believed to depress the fireball temperature, as well as limit the degree of entrainment of ambient air into the fireball. Similar EF discontinuities can be noted for CO, CH_4, and TNMHC species when the BangBox and suspended tests are compared to the *surface* tests. Differences in the semivolatile target analyte EFs from BangBox, suspended, and *surface* TNT tests are less pronounced when compared to those of the gaseous products. The semivolatile category of emission products appears to be least influenced by explosive configuration or scale. These results suggest that small-scale, low cost experiments may be useful in the determination of pollutant releases, if the EF scale effects for some of the less-toxic gaseous species can be appropriately considered at the smaller scales.

4.4.2 Comparison of Carbon Distribution.

The fate of TNT carbon for all TNT test categories is summarized in Table 4.4.2. Here, an average of the mass fraction of carbon released as CO_2, CO, CH_4, TNMHC, particulate organic carbon (OC), and particulate elemental carbon (EC) is shown for the BangBox, *surface*, and suspended TNT detonations. As noted in the results section for each test configuration, the majority of the carbon goes to CO_2. In all cases, the CO_2 category receives in excess of 92 percent of the original TNT carbon. Allotments to the CO_2 category are highest for detonations carried out in the absence of soil and are lowest for those done in close contact with soil. With a few exceptions, each of the other two emission categories (EC and OC) receive about 1 percent of the original carbon. A notable exception is the CO category in the *surface* tests, which receives about 5 percent of the original carbon mass. The particulate organic carbon category for the open air-tests is a worst-case estimate as it appears in this table, since measurements of local Dugway soil reveal a significant particulate organic carbon component in the soil. Distinguishing between soil-derived and TNT-derived particulate OC is not attempted here. However, soil analysis results suggest that nearly all the carbon in the OC category may originate from soil entrained in the cloud. This is not the case with particulate EC, category since soil analysis shows nondetectable levels of EC.

Table 4.4.2 Distribution of Carbon Emissions by Pollutant Category for BangBox and Open-Air Surface and Suspended TNT Detonations.

Species[a]	Mass Fraction of Carbon Released					
	BangBox	Phase A Surface	Phase B Surface	Phase C Surface	Phase B Suspended	Phase C Suspended
CO_2 (gas)	0.977	0.950	0.920	0.936	0.983	0.974
CO (gas)	0.006	0.013	0.053	0.056	0.008	0.008
CH_4 (gas)	BD[b]	0.014	0.002	0.003	BD	0.005
TNMHC (gas)	BD	0.009	0.004	0.005	BD	0.013
OC[c] (particles)	0.0001	0.007	0.014	N/M[d]	0.0001	N/M
EC[e] (particles)	0.017	0.008	0.007	N/M	0.017	N/M

[a]In all cases, the carbon mass fraction release to the compounds included in the semivolatile organic target analyte list is less than 5×10^{-5}.
[b]Below detection limit.
[c]An analysis of Dugway soil suggests that nearly all the particulate organic carbon (OC) detected in the cloud may be attributable to suspended soil. Here, it is conservatively assumed that all detected OC is an emission product from the TNT detonation and is not corrected for soil contributions.
[d]N/M - Measurement for the species of carbon not made.
[e]Elemental carbon.

4.5 Dispersion Model Sreening Analysis

4.5.1 Dispersion modeling has been extensively used to estimate downwind pollutant concentrations that would arise from either a continuous or instantaneous release of pollutants from a point source. An analysis was carried out using the DPG volume source dispersion model RTVSM (Reference 7) and a range of EFs measured for surface TNT detonations during the OB/OD tests. This particular model uses simple Gaussian dispersion calculations to estimate maximum and timed average ground level concentrations. The stable cloud radius was derived using Briggs plume rise techniques (References 8 and 9) which specify that the cloud radius expands linearly at a factor of 0.64 of the cloud height for an instantaneous source. Results can be used to assess potential exposure hazards that personnel in the region of cloud impact with the ground might encounter. Three release scenarios were selected for dispersion analysis that reflect downwind concentrations of three general classes of pollutants. These include (1) criteria gases such as CO; (2) VOC species such as benzene; and, (3) semivolatile organic compounds such as benzo[a]pyrene. Input assumptions for each of the three cases are given in Table 4.5.1. An initial

explosive mass of 1 metric ton (1,000 kg) was used in all model cases along with a stabilized cloud height estimate of 330 m. The cloud height estimate represents a conservative estimate in good agreement with *minimum* stabilized cloud heights actually observed during aircraft sampling of detonation clouds during the various testing phases. This cloud height estimate represents a worst case analysis from the perspective of predicting ground level concentrations since the lower (minimum) cloud height will yield higher ground level concentrations.

Results from the three cases selected are shown Table 4.5.1 with Figure 4.1 showing an output plot of the RTVSM model for CO. Maximum peak instantaneous and maximum 15-minute average ground level concentrations for each of the three cases examined are at low levels. For example, surface detonation of 1 metric ton of TNT would result in peak ground level CO concentrations of 210 $\mu g/m^3$ or about 0.18 ppm. These levels are insignificant in light of the fact that rural "clean air" background CO levels are typically in the vicinity of 0.1 ppm. A similar result occurs for benzene. Where the model predicts downwind peak instantaneous benzene concentrations of 0.43 $\mu g/m^3$, actual background levels in "clean air" are in the range of 0.5 to 1.5 $\mu g/m^3$. The background benzene concentration level is thus nearly the same as that arising from a TNT detonation as predicted by this dispersion model. The semivolatile case reveals even lower peak instantaneous ground concentration levels in the vicinity of 0.43 ng/m^3. Typical polynuclear aromatic hydrocarbon concentrations such as benzo[a]pyrene are encountered in "clean air" at concentration levels ranging from 0.01 to 0.40 ng/m^3 (Reference 10). Here again, benzo[a]pyrene pollutant contributions at downwind ground level locations are in the same range as clean air ambient background concentrations and would not be distinguishable from clean air background levels. Of particular note is the fact that 15 minute average downwind concentrations as "seen" by a ground level receptor at a fixed point during passage of a single diluted puff are lower than the peak instantaneous values by about a factor of ten. Since most personnel exposure criteria are based on exposure intervals of 15 minutes or longer, these levels are more representative of potential downwind exposure levels that may be encountered. These dispersion model results strongly suggest that air emissions from these large scale detonations pose no health threat to personnel downwind of the cloud.

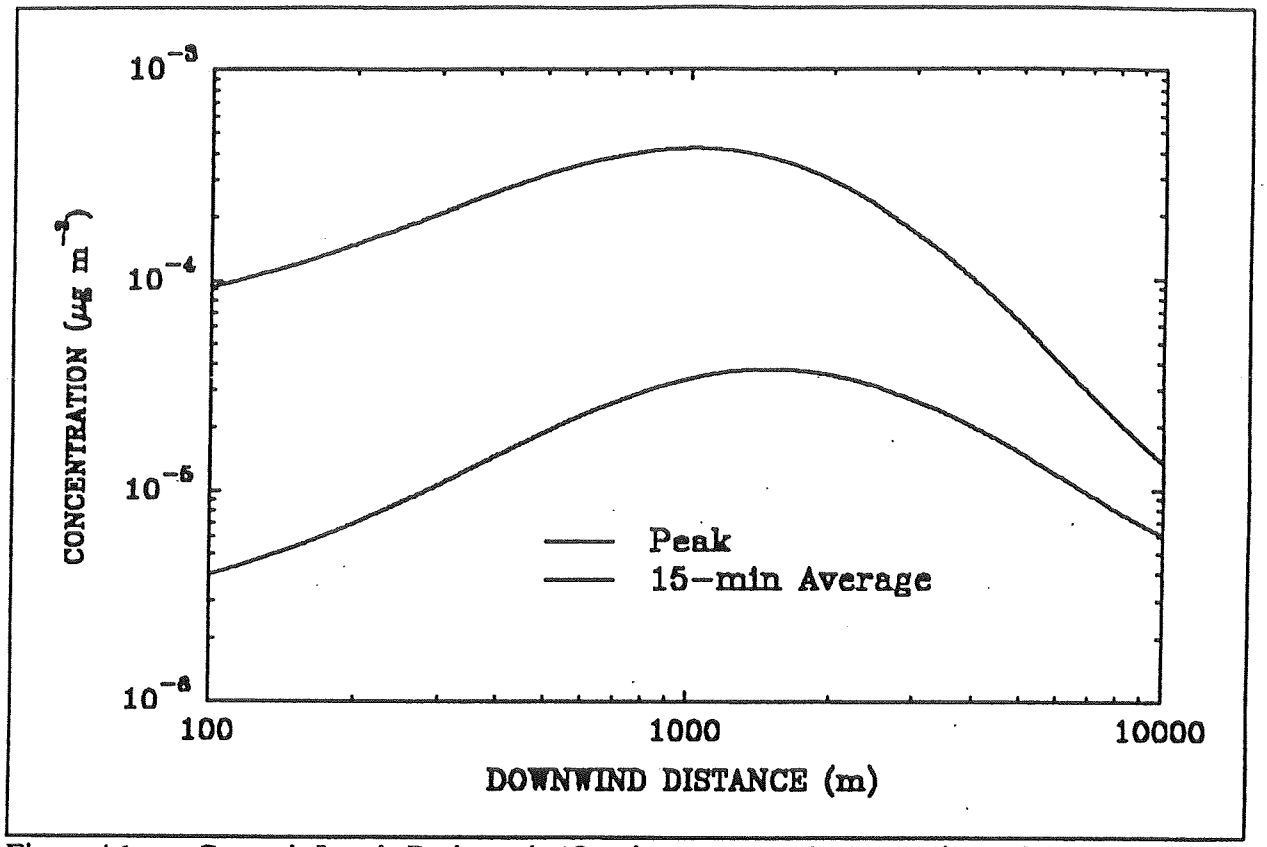

Figure 4.1 Ground Level Peak and 15 min Average Concentration of Benzo[a]pyrene Downwind of a 1000-kg Surface Detonation of TNT.

Table 4.5.1 Input Data and Downwind Ground Level Pollutant Concentrations for Selected Cases Using the DPG Volume Source Dispersion Model.

Input/Output Parameter	Case 1 Gas (CO)	Case 2 VOC (Benzene)	Case 3 Semi-volatile (Benzo[a]Pyrene)[a]
EF	5×10^{-2}	1×10^{-4}	0.1×10^{-6}
Total Release (kg)[b]	50	0.1	0.0001
Stable Cloud Height (m)	330	330	330
Stable Cloud Radius (m)	211	211	211
Wind Speed (m/s^1)	5	5	5
Stability Class	Unstable	Unstable	Unstable
Max Downwind Inst. Conc[c] ($\mu g/m^3$)	210	0.43	0.00043
Max 15 min Avg Conc[d] ($\mu g/m^3$)	19	0.038	0.000038
Downwind range for peak conc (km)	1	1	1
Downwind range for avg conc (km)	1.5	1.5	1.5

[a]Benzo[a]pyrene was only found on the TNT detonations during Phase B test.
[b]Total pollutant release is based on a 1000 kg surface detonation of bulk TNT and an assumption that all of the compound becomes an air emission. This is essentially true for Case 1 and Case 2 but is approximately a 2 order of magnitude over estimate for Case 3 (semi-volatile).
[c]Maximum downwind instantaneous concentration at ground level.
[d]Maximum downwind 15 minute average concentration at ground level.

SECTION 5. SUMMARY OF QA ACTIVITIES FOR OB/OD PROGRAM

5.1. Overview

5.1.1. The OB/OD program was conducted in four phases, a controlled chamber test (BangBox), and three field tests (Phases A, B, and C).

5.1.2. The purposes of the BangBox tests were (1) to characterize the emission products resulting from OB/OD operations, (2) to evaluate candidate sampling and analysis methods for measuring these emission products, and (3) to develop the QA and QC procedures necessary to ensure that the program met its data quality objectives.

5.1.3. Field Test Phase A was a pilot test to evaluate the candidate sampling and analysis techniques selected from the results of the BangBox tests. Field Test Phases B and C were full-scale field tests to assess the impact of OB/OD activities on the environment and to determine if BangBox-type tests adequately simulate the emission products from real world OB/OD operations.

5.1.4. All organizations making measurements in the OB/OD project were expected to have either standard operating procedures (SOP's) or letters of instruction (LOI's) for each phase of the program. Two organizations, SSL and OGC, did not have approved LOI's in place until after the BangBox tests were completed. However, these organizations are very small and one principal analyst handles all the samples. In the view of all auditors, the lack of an approved LOI did not affect the quality of the analyses provided by these two organizations. The SOP's and LOI's were revised as the program progressed and the measurement methods were improved or revised.

5.1.5. A quality assurance project plan (QAPP) containing the SOP's and LOI's was developed for each phase of the program. The QAPP described the quality control (QC) activities that would be followed by the organizations making measurements in that phase of the program. Sample QC activities used in the OB/OD program were (1) matrix spikes, (2) method of standard additions, (3) replicates, (4) split samples, (5) sample chain-of custody, (6) up to date and readable laboratory logbooks, and (7) preventive maintenance on the equipment.

5.1.6. Two organizations were responsible for the external QA, ELI (Provo, Utah) and U.S. Environmental Protection Agency Atmospheric Research and Exposure Assessment Laboratory (USEPA/AREAL) Quality Assurance Division (Research Triangle Park, NC).

5.1.6.1. ELI, the contract QA organization for AMCCOM conducted quality systems audits (QSA) on all organizations making measurements to provide a qualitative assessment of the conformance of the organization to their QC procedures and to it's LOI's/SOP's. The ELI QSA's addressed the following: (1) LOI status, (2) field/laboratory sampling, (3) field/laboratory analysis, (4) instrument/method calibration, (5) preventive/corrective maintenance, (6) internal QC procedures, (7) sample preparation and storage, (8) preparation and use of spiked samples, (9) instrument/equipment selection and use, (10) determination of detection limits/limits of quantification, (11) sample handling and transportation, (12) data reduction and analysis, (13) logbooks, (14) personnel working with samples, (15) building diagrams, (16) research journals, (17) tracking system for samples, and (18) overall assessment/recommendations and comments.

5.1.7. The USEPA audit team conducted QSA's and quality performance audits (QPA's) on the organizations making measurements. QPA's provide a quantitative assessment of an organization's performance by challenging their measurement system with accurately prepared samples which have levels or values that are unknown to the organization being audited. These EPA QPA's included checks on the following: (1) Sample flow-rate accuracy, (2) Carbon monoxide, carbon dioxide, nitrogen oxide, nitrogen dioxide, ozone, and sulfur dioxide air monitor accuracy, (3) percent recovery of semivolatile organic compounds (SVOC's) from soil, particulate, and canister samples, and (4) percent recovery of VOCs from canisters.

5.1.8. Appendix J provides an "in-depth" description of the procedures used for the QSA's and QPA's, the findings of the QSA's, QPA's, and corrective actions taken by the audited organization, and the auditors' assessment of the impact of the findings on the data quality. Tables 5.1 and 5.2 reveal when and by whom QSA's and QPA's were conducted.

5.1.9. A summary of the findings by measurement type and, where appropriate, an assessment of the findings on the data quality of the OB/OD thermal treatment program is provided below.

5.2. Inorganic Gases (Carbon Monoxide, Carbon Dioxide, Nitrogen Oxide, Nitrogen Dioxide, Sulfur Dioxide, Ozone) Measured by Continuous Monitors

5.2.1. All monitors (including the associated data collection system) were operating within an accuracy of ± 10 percent (the data quality goal for the program), with the exception of the carbon dioxide monitor in phase A. This later monitor was reading high by 14 percent, because the zero had shifted. However, this shift did not affect the use of the measurement, because the carbon dioxide measured before the plane entered the plume was subtracted from the carbon dioxide measured in the plume. Since the baseline shift affected both measurements equally, the amount of carbon dioxide formed from the detonation was accurately measured. SNL recalibrates the monitor as soon as the shift in baseline is detected. The logbooks were kept current and SRMs (standard reference materials from the National Institute for Standards and Technology (NIST) were used to calibrate the carbon monoxide, carbon dioxide, nitrogen oxide, and sulfur dioxide instruments. Since there are not SRM's for nitrogen dioxide or ozone, these instruments were calibrated with transfer standards traceable to the NIST.

5.2.2. Two prob - ns occurred throughout the OB/OD program. The auditors continually found that SNL did not have spare parts for the monitors on the aircraft, and SNL failed to check out the monitors before the aircraft left Albuquerque. While these problems did not affect the quality of the data, they did cause extensive delays during the field tests. Sometimes a full day's testing was canceled because one or more of the monitors was not operating and the required spare part was not available on site.

5.3. Flow Rate of Particulate and VOST Samplers

5.3.1. Particulate Sampler

The flow-rate through the aircraft's sampling probe was checked at the probe inlet during the three field tests and determined to be within the ± 5 percent of the reference flow. This was within the ± 10 percent data quality objective for the OB/OD project.

5.3.2. VOST Sampler

The sampler was used only in the BangBox tests. All samplers had flow-rates within 7 percent of the reference standard.

5.4. Volatile Organic Samplers

5.4.1. During all four phases of the program 6-L canisters provided to EPA by OGC were spiked with known quantities of VOCs by EPA at 1 to 5 ppb. The canisters were then returned to OGC. The percent recoveries achieved by OGC for the OB/OD target compounds were consistently excellent and well within the 75- to 125-percent target range. Precision was also excellent, generally less than 5-percent RSD.

5.4.2. QSA's were completed on the VOC sampler in the BangBox test, the three field tests, and also in the OGC laboratory. No deficiencies that would affect data quality were found. During Phase A and once in Phase C, the inlet valve to the canister's sampling manifold failed to open. In these cases the samples were voided.

5.5. Semivolatile Organic Samplers

5.5.1. 32-L Tanks with Filters on Inlet

This sampler was used in the BangBox test in an attempt to simultaneously collect large VOC and semivolatile organic compounds (SVOCs) samples. The SVOC's were expected to be collected on the filter and also in the tanks. EPA placed known quantities of seven SVOC's in the tanks and sent them to BCD and to AWL for extraction, and subsequent analysis for SVOC's. Recoveries of all seven compounds were less than 50 percent, the OB/OD program's lower limit for SVOC analysis. The audit results showed that this was not a viable sampler for the program and it was dropped from the program before the field tests were begun.

5.5.1.1. QSA's by EPA and ELI showed that both laboratories followed the LOI for the method and that the sampler was leak-free prior to use in the BangBox tests.

5.5.2. Semivolatile Organic Sampling Train Sampler

5.5.2.1. This sampler, which used a filter followed by XAD-2® cartridges to collect SVOC's, was used in the BangBox tests in an attempt to collect large quantities of SVOC. EPA placed known quantities of seven SVOC's on XAD-2® sampling cartridges and sent them to BCD and AWL for extraction and analysis. A solution containing the same seven SVOC's accompanied the cartridges to serve as a benchmark measure on the analytical portion of the method. BCD achieved recoveries between 70 and 135 percent for the solution, but recovered less than 50 percent for three of the seven compounds placed on the XAD-2®. AWL achieved less than 50-percent recovery for all seven compounds. It was subsequently determined that the XAD-2® had been heated too long during cleanup prior to use, and all samples were then voided. The VOST sampler was dropped from the program before field tests were begun, because the BangBox tests and the open literature indicated that a high-volume filter would be adequate for collecting SVOC's. The QSA's determined that BCD and AWL followed the LOI for the extraction and analysis of the samples.

5.6. SVOCs Particulate from Sampler (Aircraft) and Fallout Pans

5.6.1. The material collected on the filter and in the fallout pans from detonations was expected to be mostly soil particles containing some SVOC's. EPA placed known quantities of SVOC's on background soil samples from DPG, and these were then extracted and analyzed by AWL. The first spiked soil samples (BangBox Test) contained 5 to 36 μg of seven SVOC's. AWL achieved quantitative recovery for all seven SVOC's using both SFC-MS and GC-MS. For Phase A, no spiked soil samples were used because the objective was to check out the sample collection procedures developed from the BangBox tests. Spiked soil samples were used in Phases B and C, however, where ancillary tests were also done to evaluate the spiking and analytical methods being used in the OB/OD project.

5.6.1.1. Nanogram rather than μg quantities of analytes were used for Phases B and C because the BangBox test results showed that only ng quantities of analytes would likely be encountered in the soil samples from the field test. The analytes spiked on the soil samples in Phases B and C were somewhat different from those used in the BangBox spiked soil samples, i.e., 1-nitropyrene, dibenzofuran, pyrene, 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, 2,4-dinitrotoluene and naphthalene were added and N-nitrosodiphenylamine and the two nitrophenols were deleted from the original list.

5.6.1.2. Low recoveries (less than 50%) were found for all analytes for the Phase B soil sample spikes; these low recoveries were subsequently determined to have resulted from reduced sensitivity of the SFC-MS used to analyze the extracts. The reduced sensitivity resulted from the chromatographic coating being striped from the SFC's column by the acetonitrile carrier and being carried to the MS's quadrapole area where it deposited. The SFC-MS unit was repaired for the Phase C samples and acceptable recoveries were achieved for the analytes except phenol, 1,3,5-trinitrobenzene, 2,6-dinitrotoluene and naphthalene. The samples used for Phase C were spiked using two established methods, the slurry/rotary evaporator technique and the aluminum (foil) roll technique to see if the spiking technique affected the recovery of the analytes from the soil. In the slurry technique the solvent (100 - 200 ml per 400 grams of soil) is removed at elevated temperatures (45-80°C) using a rotary evaporator. There was concern that some of the more labile analytes would be lost. In contrast, the aluminum roll technique lets the solvent (1 ml) air-evaporate. Five soil samples were spiked by the slurry technique and five were spiked by the aluminum roll techniques. The samples were spiked with the same quantities of analytes. All extracts were analyzed by GC-MS and SFC-MS to also determine if the GC-MS and SFC-MS gave equivalent results.

5.6.2. The results of these tests (based on the percent of the analyte recovered from the soils) were:

5.6.2.1. There was no difference in soils spiked by the aluminum roll and those spiked by the slurry/rotary evaporator technique.

5.6.2.2. Phenol was not recovered from any sample. Therefore, phenol should not be used as a target analyte at least if a Soxhlet extraction procedure is used. Whether phenol would be recovered if a sonification technique is used for extraction is unknown.

5.6.2.3. Consistently low recoveries were obtained for diphenylamine. This is expected because amines are tightly bound to soils. Low recoveries were also found in many samples for 1,3,5-trinitrobenzene, 2,6-dinitrotoluene and naphthalene.

5.6.2.4. Samples that were not spiked showed small quantities of 1,3,5-trinitrobenzene and 2,4-dinitrotoluene. This indicated either previous contamination of the soil sample before it was received for spiking or the presence of an interfering ion.

5.6.2.5. The results showed that the analytes can be quantitatively transferred to dichloromethane from the acetonitrile used to extract the analytes from the soil. This is encouraging because it provides a means to remove the acetonitrile solvent before the sample is placed in the SFC-MS system. (Acetonitrile was found to dissolve the gas chromatographic column's stationary phase which caused the column material to enter the MS unit.)

5.6.3. At this time, there are no reference soil samples that contain accurately known recoverable quantities of SVOC's, so the overall accuracy of the extraction and analysis of the DPG soil samples for SVOC's is uncertain. However, AWL obtained the precision normally expected for soil analyses when they extracted and analyzed duplicate field samples and when they reanalyzed extracts from soil samples months after the original analyses.

5.6.4. Quality system audits on AWL when they were extracting and analyzing soil and filter (particulate) samples showed that they were properly calibrating the SFC-MS unit and using the extraction technique in the LOI. Record keeping was a continual problem but in each instance the problems were corrected and it is felt that no samples were misidentified. AWL is a small research laboratory with one principle analyst and it is not accustomed to employing the labor-intensive sample tracking system normally used by laboratories that provide routine analytical services.

5.7. Metals by XRF

5.7.1. Only QSA's were performed, since LBL uses NIST certified calibration standards. Metals analyses (19 metals) were done on samples from the BangBox and from Phase C. The QSA's determined that the laboratory consistently achieved precision of ± 6 percent or better on its QC samples, well within their ± 10 percent QC goals. If the ± 10 percent QC target goal was exceeded, the analysis was voided and the sample was reanalyzed after the instrument was recalibrated. LBL is essentially a three-man operation with one principal analyst. They employ an EPA-approved analytical method.

5.8. Elemental and Volatilizable Carbon

Only QSA's were conducted on the carbon measurement system, because SSL was employing a comprehensive QC program. Sucrose samples placed on filters and rods containing accurately known quantities of carbon containing compounds were used for calibration and for QC checks. The QSA's revealed no deficiencies or deviations from the LOI.

5.9. Real Time Particle Measurements (Aircraft)

Only QSA's were conducted on the two particle counters employed on the aircraft, because there are no field-proven calibration/auditing systems. Both instruments were calibrated against NIST standards less than one year before the field tests, which met the date quality goal. These instruments were used primarily to detect entry into and exit from the plume, and no particle concentration calculations were attempted.

5.10. HCN, NH_3, HCL Samplers

These samplers, which employed impingers, were used in the BangBox tests. Measurable quantities of the three compounds were not detected in the BangBox, and the use of the sampler was discontinued. The QSA showed that the published reference method was followed for sampling and analysis and that certified calibration standards were used to calibrate the colorimeter.

5.11. Fallout and Burn Pan Sampler Placement and Recovery

Extensive QSA's were performed by EPA and ELI during all three field tests. No major deficiencies or deviations from the LOI's were found that would impact on the quality of the data. The Lockheed Engineering and Sciences Company (LESC) personnel were observed to be well-trained, conscientious, and very proficient in executing their duties. No cases of sample misidentification were detected, and all samples were taken in accordance with the LOIs.

5.12. Particulate Weight Determination

5.12.1. The particulate sample filters from the BangBox and phases A and B were transported to AWL for conditioning and particulate weight determination. The filters from Phase C were conditioned and weighed at DPG by SNL. The decision was made to weigh the Phase C filters at DPG to reduce the chance that particulate would be lost from the filters during transport and to provide improved facilities for filter conditioning.

5.12.2. QSA's did not detect any instances where samples were misidentified, or the particulate contaminated or lost after collection. However, AWL's record-keeping system was cumbersome to follow, because the logbook was organized by date and not by sample number. Since the filters were weighed at periodic intervals over several days (until a constant weight was obtained) the auditor had to check numerous pages to determine how many times a specific filter was weighed and the change in weight between determinations.

Table 5.1 Schedule of Quality System Audits During OB/OD Program

Audited Organization	Test Phase	Auditing Organization	
		ELI	EPA
Battelle-Columbus	BangBox	28 Dec 88	NA[a]
Oregon Graduate Center	BangBox	24 Jan 89	NA
	Phase B	18 Jan 90	7 Nov 89
Sunset Laboratory	BangBox	23 Jan 89	NA
	Phase A	9 May 89	NA
	Phase B	17 Jan 90	NA
Lawrence Berkeley Laboratory	BangBox	31 Jan 89	NA
Brigham Young University (PIXE[b] Lab)	Phase B	14 Feb 90	21 Feb 90
Lockheed Engineering and Science Co.	Phase C	6-19 Aug 90	6-27 Aug 90
			20 Feb 90
Environmental Laboratories Inc.	Phase C	NA	6-27 Aug 90
Sandia National Laboratories	BangBox	16-17 Dec 88	30 Nov-2 Dec 88
			Feb 89
	Phase A	NA	Jun 89
	Phase B	13-19 Oct 89	13-27 Oct 89
	Phase C	NA	6 Aug- 19 Sep 90
Alpine West Laboratories	BangBox	18 Jan 89	NA
	Phase A	17 Jul 89	NA
	Phase B	9 Feb 90	19, 24 Oct 89
			5-6 Dec 89
			20-21 Feb 90
	Phase C	NA	16 Aug 90
			15 Nov 90

[a]Not applicable, QSA not conducted by ELI or EPA.
[b]Particle induced X-ray emission.

Table 5.2 Schedule of EPA Quality Performance Audits During OB/OD Program.

Audited Organization	Test Phase	Audit Dates	Measurement Parameters or Analyte Involved
Sandia National Laboratories	BangBox	6-8 Feb 89	Flow rate: particulate samplers, XAD cartridge sampler. Gas analyzers: CO, CO_2, O_3, SO_2, NO, NO_2.
	Phase A	Jun 89	Gas analyzers: CO, CO_2.
	Phase B	Oct 89	Flow rate: aircraft probe.
			Gas analyzers: CO, CO_2, O_3, SO_2.
	Phase C	6-10 Aug 90	Flow rates.
			Gas analyzers: CO, CO_2, O_3, NO, NO_2.
Alpine West Laboratories	BangBox	Dec 88	Spiked soil, spiked XAD-2 cartridges.
			Spiked 32-L tank.
	Phase B	Nov 89	Spiked soil.
	Phase C	Dec 90	Spiked soil.
Battelle-Columbus Division	BangBox	Dec 88	Spiked soil, spiked XAD-2 cartridges.
			Spiked 32-L tank.
Oregon Graduate Center	BangBox	Dec 88	Spiked 6-L canisters.
	Phase B	Nov 89	Spiked 6-L canisters.
	Phase C	Aug 90	Spiked 6-L canisters.

SECTION 6. CONCLUSIONS

6.1. Background

6.1.1. BangBox

The BB conclusions are stated in the BB report, Volume 1.

6.1.2. Field Test Phase A

6.1.2.1. Purpose

Field Test Phase A was designed as a program ORI.

6.1.2.2. Objectives

6.1.2.2.1 Objective 1 - Evaluate the performance of the instrumented FWAC as a sampling platform during large-scale field OB/OD tests.

a. The FWAC proved to be a suitable sampling platform. The aircraft's design enabled the aircraft to enter and sample the plume within approximately 1 min after the detonation, and make repeated penetrations of the plume. The sampling passes made through the cloud permitted real-time analyses of some gases and captured sufficient quantities of gases and particulates for subsequent analyses.

b. Additionally the instruments and procedures used on the FWAC were judged suitable for subsequent testing.

6.1.2.2.2 Objective 2 - Determine if target species can be adequately sampled and measured above background levels.

a. Carbon dioxide and other target species were adequately sampled and measured above background levels using real-time instruments aboard the FWAC.

b. The VOC's were successfully measured above background levels with the 6-L canister sampler. Carbon dioxide and CO were also successfully measured above background with the 6-L canister.

c. The quartz fiber filters collected sufficient particulate for the detection and quantification. of SVOC's.

6.1.2.2.3 Objective 3 - Evaluate the utility of the carbon balance method in the field testing environment.

The utility of the carbon balance method was confirmed. The FWAC ability to enter the plume and measure CO_2 well above background supports the carbon balance method applicability to field testing.

6.1.2.2.4 Objective 4 - Evaluate soil sampling, handling, and assay procedures (e.g. SFC/MS) for field OB/OD tests.

Soil sampling, handling, and assay procedures were proven suitable for capturing and analyzing emittant products released into the soil during field testing.

6.1.3. Field Test Phase B

6.1.3.1. Purpose

Confirm suitability of instruments and procedures developed in Phase A, and determine if relationship exists between BB test data and field test data.

6.1.3.2. Objectives

6.1.3.2.1 Objective 1 - Sample and analyze the combustion products of large-scale OB/OD operations which were conducted in a manner representing treatment site practices.

The combustion products of large-scale OB/OD operations were successfully sampled and analyzed. However, the test could not accommodate evaluation of emission product accumulation at a single site resulting from repeated detonations.

6.1.3.2.2 Objective 2 - Sample and analyze the combustion products produced by large-scale OB/OD operations which were conducted from suspended detonations.

Large-scale OD suspended detonations were successfully conducted, and the resulting clouds sampled and analyzed. While emission products were essentially the same as for non-suspended surface detonations, a more efficient conversion of the explosive carbon into CO_2 and decreased levels of the other carbon compounds were detected.

6.1.3.2.3 Objective 3 - Determine if the field test detonation data can be related to the BB test detonation data.

The initial comparison between the BB and field test data reveals that a relationship between BB and field test data can be established. The pattern that emerges is: (1) small-scale detonations in the BB test produced a more efficient conversion of TNT carbon to CO_2 than did large-scale detonations in the field; (2) the VOC levels experienced during large-scale field testing were higher than those experienced during BB testing; and (3) the semivolatile organic compounds detected and quantified were very similar.

6.1.3.2.4 Objective 4 - Provide the foundation for establishing a database on TNT and selected propellant combustion products.

The initial combustion product database for bulk TNT and selected propellant manufacturing residues was established. A list of analytes and their concentration per mass for air emissions, soil, and residue has been established.

6.1.4. Field Test Phase C

6.1.4.1. Purpose

Supplement the basic TNT and propellant data, and expand the database to include additional explosives and propellants.

6.1.4.2. Objectives

6.1.4.2.1 Objective 1 - Conduct additional TNT detonations to facilitate relating BB test results to field test results.

The additional successful TNT OD conducted during phase C added to the database of air EF's from field test phases A and B. The conclusions are discussed in paragraph 6.1.4.2.3.

6.1.4.2.2 Objective 2 - Conduct additional TNT tests to establish the reproducibility (between test precision) of TNT OD emissions.

The surface TNT tests phases A, B, and C were very reproducible, e.g., EF's for CO_2 varied from 1.26 to 1.29, CO varied from 42×10^{-3} to 61×10^{-3}, and methane varied from 1.2×10^{-3} to 1.5×10^{-3}. Section 4 contains specific results for all the compounds targeted in the OB/OD testing.

6.1.4.2.3 Objectives 3-7 - Sample and analyze the explosive and burning decomposition products of composition B, explosive D, RDX, M1 and M6 propellants, and additional propellant manufacturing residues.

a. The explosives tested during phase C produced results (emissions and levels) very similar to those results obtained for TNT tested in phases A and B. The small-scale BB test showed more efficient conversion of TNT carbon to CO_2 than found during field testing; (2) the VOC levels increased in the large-scale field test, and the semivolatile organic compounds detected and quantified during all tests were very similar.

b. The soil data from phases B and C were very similar (overlapping ranges of the concentration values), therefore all the analysis were performed on the total data package of phases B and C. Phase A was not considered because it was an ORI.

c. The propellant data was very efficient in conversion of carbon to CO_2, however the residue in the pan after burning was tested and showed the presence of 2,4-DNT, which is one of the parent compounds in the M1 and M6 propellants.

d. This phase of the study did not include analysis for metals and non-metals (elementals).

6.2. General Overall Test Program

6.2.1. Purpose

Supply waste characterization data for OB/OD permit applications under RCRA subpart X.

6.2.2. Objectives and Responses

6.2.2.1. Objective 1 - Identify and validate sampling and analytical technology, instrumentation, and procedures needed to provide RCRA subpart X data characterization.

6.2.2.1.1 The results of this phase of the OB/OD thermal-treatment emission study authenticate the innovative technologies and methodologies selected for identifying and characterizing emission products.

6.2.2.1.2 The comparable TNT data from the BB and field tests indicates that the time and costs of characterizing emissions from specific PEP materials in the inventory can be significantly reduced by using properly designed BangBox-like chambers.

6.2.2.1.3 If the comparable results, established during this test remains consistent during further BB testing, the techniques and methods developed will assist in the identification of PEP materials for which OB/OD thermal treatment methods is not applicable and for which alternative

technologies must be developed. With this knowledge, the development of alternative technologies can be focused and more cost-effective.

6.2.2.2. Objective 2 - Identify and quantify emissions and residues produced by OB/OD thermal treatment methods.

6.2.2.2.1 Identification and quantification of emission products and residues produced by OB/OD methods was accomplished for those items tested and the amount of pollutants released into the atmosphere and soil were considered inconsequential. This data was used to authenticate methodology and technology used during this phase of the study.

6.2.2.2.2 This objective will be completed during the next phase of the overall program when item- and site-specific testing will be undertaken.

6.2.2.3. Objective 3 - Provide input for development and validation of an OB/OD dispersion model.

6.2.2.3.1 An OB/OD dispersion model was developed during this phase of the study. The model will require field validation before being made available.

6.2.2.3.2 A dispersion model acceptable to EPA is an essential adjunct to the BB emission characterization data in that it provides the mechanism to generate the downwind concentration receptor locations as inputs required for support of site-specific permit applications.

6.2.2.3.3 The data obtained from sample analysis, as applied to the DPG-RTVSM model, indicates exceptionally low downwind peak and average concentrations for all pollutant categories following downwind dispersion of the detonation cloud.

6.2.2.4. Objective 4 - Identify specific items that can be treated by OB/OD thermal treatment methods without adverse environmental impact.

6.2.2.4.1 The study suggests that the bulk explosives and propellants examined during field testing will produce and release acceptable levels of emittants to the environment by surface OB/OD methods. While these results are encouraging, site-specific testing is needed to provide data to support risk assessments. Only after these risk assessments are completed may a definitive statement be made concerning the effect (if any) OB/OD operations have on human health and the environment.

6.2.2.4.2 For many items, OB/OD thermal treatment operations may be an environmentally safe means of treatment, in addition to being cost-effective. If this proves true, OB/OD should be considered for use as an integral part of a balanced DoD total demilitarization/treatment program.

6.3. Air Emissions

6.3.1. Detonation/Combustion Efficiency

A high degree of carbon conversion to CO_2 occurred for all types of PEP materials examined in this test series.

6.3.1.1. Propellants

All tested propellants consistently showed carbon conversion efficiencies exceeding 99 percent.

This is primarily a result of two factors: (1) The oxygen balance of most of the propellant materials tested was relatively high, and the propellant molecule carried most of the oxygen required for complete combustion; (2) Propellant materials were in steel pans eliminating interaction with adjacent soil. The absence of soil in the flame zone resulted in high flame temperatures and facilitated complete combustion of carbon.

6.3.1.2. Explosives

Carbon conversion efficiencies for the bulk explosive materials tested were lower than those observed for propellants, but were still in excess of 92 percent for all explosive types and configurations tested.

6.3.1.2.1 This observation applies to TNT which has a very low (-73.9 percent) oxygen balance and represents a worst case explosive from the perspective of pollutant emissions.

6.3.1.2.2 The carbon conversion efficiencies in excess of 92 percent found for low oxygen-balance surface-detonated TNT reveals that a mechanism of secondary combustion is in effect during these detonations.

a. Entrainment of ambient oxygen into the fireball region following detonation of the explosive accounts for this secondary combustion of intermediate detonation products to CO_2.

b. Suspended detonations of TNT (for which soils is a relative unimportant consideration) produced higher carbon conversion efficiencies. This suggest the presence of soil in the immediate vicinity of the detonation (typical of surface detonations), restricts the flow of ambient air into the fireball region.

6.3.1.2.3 The carbon conversion efficiencies for other bulk-explosive types examined in this series (i.e., RDX, explosive D, composition B) show that carbon conversion efficiencies are approximately the same as for TNT, even though all of the explosives tested have higher oxygen balances than TNT.

6.3.1.2.4 The data indicates that while the oxygen balance of the explosive molecule is important, it is not the only parameter determining the degree of efficiency of the detonation.

6.3.1.2.5 All explosives have the capability to produce high-carbon-efficiency detonations if sufficient ambient oxygen is entrained following formation of the fireball.

6.3.1.2.6 The configuration of the detonation (surface vs. suspended) appears also to be an important parameter in determination of the carbon conversion efficiency.

6.3.2. Carbon Distribution

6.3.2.1. Carbon not converted to CO_2 is found in other species produced by the combustion such as carbon monoxide, methane, nonmethane hydrocarbons, organic carbon particulate and elemental carbon particulate.

6.3.2.2. In general, each of these categories, with the exception of CO_2 and CO, receives between 0.1 and 1 percent of the total original carbon.

6.3.2.3. The amount of CO formed ranged from 0.5 percent for suspended detonations to 5 percent for surface detonations.

6.3.2.4. Distribution of carbon within the nonmethane hydrocarbon category reveals a relatively high distribution of the carbon to the light, non toxic, nonmethane hydrocarbons, such as ethane, propane, acetylene, etc.

6.3.2.4.1 There is little experimental evidence to suggest that any significant portion of the source carbon goes to the heavier aromatic volatiles, such as benzene and toluene.

6.3.2.5. The elemental carbon (soot) and the organic particulate carbon categories each typically receive on the order of 0.1 to 1 percent of the carbon.

6.3.2.5.1 The amount of particulate organic carbon from soil debris in the cloud and that produced by the detonations could not be separated.

6.3.2.6. Analysis of the particulate organic material collected in these detonation and propellant cloud samples reveals that a considerable fraction is due to the environmentally ubiquitous phthalates, which were also found in the background samples.

6.3.3. Scaling Issues

6.3.3.1. The degree to which the size of the detonation affects relative distribution of pollutants released from the detonation is an important part of this study.

6.3.3.1.1 A comparison of emission factors for the various pollutant species examined in the BangBox and in the field tests shows that emission factors for potentially toxic emissions are relatively constant, despite a near 4,000-fold increase in the scale of the detonation.

6.3.3.1.2 Light gases such as CO and methane show the greatest variation in EF with changes in size of the detonation.

6.3.3.1.3 The other pollutant categories such as NO_x, VOC, and semivolatile categories show less pronounced changes in EF with changes in size of the detonation.

6.3.3.2. These results strongly indicate that BB-type testing can be successfully used to assess pollutant emissions from various explosive types and configurations.

6.3.3.3. Use of such testing will significantly reduce both the time and costs required for emission characterization of PEP materials in the DoD inventory.

6.3.4. Source Pollutant Dispersion Modeling

6.3.4.1. Results of the DPG real-time volume source dispersion model (RTVSM) for estimating ground-level concentrations of analytes from a 1-metric-ton (1000-kg) surface detonation show exceptionally low downwind peak and average concentrations for all pollutant categories following downwind dispersion of the detonation cloud.

6.3.4.2. Surface-detonation TNT events which were conducted to obtain typical EF such as CO (EF = 5×10^{-2}), benzene (EF = 1×10^{-4}) and benzo[a]pyrene (EF = 0.1×10^{-6}) reveal that ground level peak and 15-min average concentrations would be indistinguishable from background levels of these various pollutants.

6.4. Soil Deposition of OB/OD Emissions

6.4.1. OD Emissions

6.4.1.1. Total amounts of emission products for semivolatile organics can also be quantified from the mass of disturbed soil (estimated from the crater dimensions) and the concentration of analytes in the soil. For example, this method shows that 3.7 g of 2,4-dinitrotoluene will be produced and released to the soil following a 907-kg TNT detonation.

6.4.1.2. Emission products of semivolatile organics can be identified and quantified from the fallout soil at specific distances from the explosive source. This method shows that 76 mg (2 percent) of the total 3.7 g of 2,4-dinitrotoluene produced was recovered within 225 m of the detonation site.

6.4.1.3. The major portion of all the semivolatile organic particulate remains in the loose soil of the crater and ejecta area (the immediate vicinity of the crater). The loose soil is subjectively estimated to account for about 97 to 98 percent of all the semivolatiles produced.

6.4.2. OB Emissions

6.4.2.1. Open burning is very effective in volatilizing and burning the parent material. The small quantities of residue left are largely composed of char or elemental carbon.

6.4.2.2. The OB of M1 and M6 propellant resulted in a residue fraction of approximately 0.1 percent of the original mass of propellant. The 2,4-dinitrotoluene, which makes up 10 percent of the parent propellant, is reduced to 0.0025 and 0.013 percent of the residue for M1 and M6 respectively. An even greater reduction occurs in the fallout material, where the maximum 2,4-dinitrotoluene amount was 0.00009 and 0.0004 percent for M1 and M6 propellant respectively, indicating that carbon conversion is still occurring in the plume from the burning propellant.

6.4.2.3. Residue in the burn pan following the Phase C manufacturing residue burn was approximately 0.03 percent of the original mass. Using the maximum measured 2,4-dinitrotoluene

concentration of 24 ng/m^2 as representative of the terrain deposition from a 2-metric ton burn, results in a total deposition of 0.024 mg of 2,4-dinitrotoluene spread over 1000 m^2.

6.4.2.4. The OB of M30 triple base propellant burned during Phase A trials was composed of 28.0 percent nitrocellulose, 22.5 percent nitroglycerin, and 47.7 percent nitroguanidine, respectively, by weight of the parent propellant. After burning, nitroglycerin and nitroguanidine were detected and represents 0.00007 and 0.00008 percent of the residue respectively. These low residue fractions show near complete combustion of the propellant.

SECTION 7. RECOMMENDATIONS

7.1. Multiple Continuous Detonations

Conduct OD tests to determine the environmental impact to the crater area and surrounding fallout area resulting from continuous detonations at a single detonation point. This type detonation procedure is typical of those used during many treatment operations. Data on emission product accumulation in the soil is essential for evaluation of potential short- and long-term contamination. This includes subjecting the soils to Toxicity Characteristic Leaching Procedures (TCLP) to obtain critical data for the site specific characterization studies.

7.2. Buried Detonations

Conduct open detonations tests to determine the environmental impact to the air and terrain resulting from conducting buried OD. Because some treatment operations are conducted in areas which mandate that all detonations are to be buried detonations, this type of test data will be necessary to support permitting. Results of buried detonation tests will also be compared with those of surface detonation tests for an evaluation of these two methods of treatment.

7.3. Soil Extraction and Analysis

Evaluate other types of extraction and analysis programs (e.g. HPLC) in addition to refinement of GC/MS and SFC/MS, to permit rapid analysis of a large number of samples.

7.4. BangBox Design and Construction

7.4.1. Design and construct a BB to handle all typical explosive ordnance configurations (e.g. shells, mines, bombs), with a soil component using concepts and needs that have been established by the current phase of the OB/OD study. This facility will provide the means of developing a comprehensive database for selected families of PEP items.

7.4.2. Conduct OB and OD studies of those propellants and explosives used in field test phase C. The recommended testing will provide data for comparison to the large scale field tests and is necessary to establish that small scale tests will characterize emission products and confirm that large scale field tests are not necessary. The relationship between BB and field testing has been proven for TNT, but must also be established for other explosives before a generic statement can be made.

7.5. Models

7.5.1. Provide the empirical data from BB and field tests, to designated DoD personnel so that they may both verify and/or improve on existing thermodynamic equilibrium models and develop new models.

7.5.2. Complete the development and validation of the OB/OD Dispersion Model. This model is required to determine the downwind dose at receptor locations for use in risk analysis.

7.6. Technical Steering Committee

Retain the technical steering committee in its present composition to provide technical guidance on future testing. The aggregate knowledge of munitions testing (including sampling and analyses) and interpretation that is collectively possessed by the TSC, with its membership consisting of DoD, EPA, academia, USATHAMA, USAEHA, USAMC Environmental Office, and contractors, will continue to provide an invaluable interface between government agencies, academia, and industrial communities.

7.7. International Cooperation

Expand upon existing relationships between the OB/OD study program and friendly foreign government agencies investigating environmental consequences of OB/OD operations. The German Ministry of Defense has recommended that we continue these relationships, and has also requested a copy of the current OB/OD report. Contacts established with foreign agencies through

official channels offer considerable potential for expanding the U.S. database on PEP combustion products and enhancement of our technology.

APPENDIX A - FILTER SYSTEM FLOW MEASUREMENTS

Accurate determination of particle concentration requires an accurate measurement of the volume of air sampled. Because of the varying air densities encountered during OB/OD tests, clearly defined standard reporting conditions must be established and the methods for converting from actual to standard conditions must be understood. All air volumes reported in this study are based on continuously measured flow rates and sampling durations.

The flow rate on the centerline of the transport tube was continuously monitored with a Pitot tube. As noted in the previous section, the flow in the tube is highly turbulent (Reynolds number greater than 50,000), and it is reasonable to assume that the average linear velocity down the tube and the centerline velocity are the same. The basic relationship between the velocity and the velocity pressure measured with the Pitot tube is given in equation A.1 below.

Equation A.1 Pitot Tube Velocity and Pressure.

$$V = 1096 \left(\frac{VP}{0.075 \cdot F} \right)^{0.5}$$

where V is the actual velocity in feet per minute and VP is the velocity pressure in inches of water. The 1096 term is a factor derived from the Bernoulli equation using the acceleration due to gravity, the relative densities of the manometer fluid (water) and air , and units of measurement conversions. The 0.075 term represents the density of air at standard conditions in pounds per cubic foot and F is a density correction factor to allow for differences between actual and standard conditions as given by equation A.2 below.

Equation A.2 Density Correction Factor.

$$F = \left(\frac{Press_{ambient}(mmHg)}{760} \right) \left(\frac{298}{273.1 + Temp_{ambient}(^{\circ}C)} \right)$$

Air velocity through the probe and transport tube is sufficiently fast enough that there is little change in air temperature at the Pitot tube from that measured outside the aircraft. Consequently, the externally measured ambient temperature is used for all density-correction calculations. Similarly, the static pressure regain in the transport tube is too small (a few cm of water) to significantly alter the ambient pressure from that measured by the pressure altitude sensor; therefore, the externally measured ambient pressure is used in the calculations as well. The tube velocity at ambient conditions, the density correction factor, and the tube cross-sectional area (71.26 cm^2) are multiplied together to obtain the volumetric flow rate at standard conditions. After combining all the factors and the conversion factors between different systems of units, the final equation is given by equation A.3 below.

Equation A.3 Volumetric Flow rate.

$$Q = 90.71\left(VP \cdot \frac{PRESS_{amb}\ (mmHg)}{273.1 + TEMP_{amb}(^{\circ}C)}\right)^{0.5}$$

where Q is the volumetric flow rate through all three filters in standard liters per second. Typical flow rates encountered with three quartz filters under normal (50 m s^{-1}) flight velocity is about 100 L s^{-1}. The factor 90.71 is a composite of the Bernoulli equation constant (1096), the cross-sectional area of the transport tube, and units of measurement conversions.

APPENDIX B - SOIL AND FALLOUT SEMIVOLATILE ORGANIC DATA

This appendix contains an example of the soil and fallout data that are on file for the OB/OD Phases A, B, and C tests. One page of the data are given in Table B.1, taken from the Phase B soil sampling and fallout data. The data sheet includes a brief description of the source of the sample, a QA custody number (which permits tracking of the sample), the sample size (in grams) on which the laboratory assay was based, and the actual laboratory results (ng/sample). These inputs were used to compute the concentrations in $\mu g/kg$ (equivalent to ppb) and ng/m^2. In computing the concentration per square meter (ng/m^2) the total weight of sample collected and the number of square meters sampled were used. The weights shown for background, ejecta, and core samples were corrected for moisture content.

All computations were accomplished in Lotus 123®, version 2.2. The complete set of data may be requested from AMCCOM.

Table B.1 OB/OD Phase B Soil Sample Data.

Sample Source	QA Custody Number	Sample Size (g)	Compound													
			2,4-DNT	2,6-DNT	2,4,6-TNT	2-NN	N-NSDPA	1,3,5-TNB	2-NDPA	1-NP	Naph	B[a]A	B[a]P	Pyrene	Phenol	DBF
TNT-Trial-1-Ejecta																
Site 2 Outside 1m	02873	402.1														
ng/sample			3200	BD[a]	39000	BD	27	6500	BD	BD	1200	BD	BD	150	BD	140
µg/kg			7.96	BD	97.0	BD	0.0671	16.2	BD	BD	2.98	BD	BD	0.373	BD	0.348
TNT-Trial-1-Ejecta																
Site 2 Outside 4m	02874	280.7														
ng/sample			BD	BD	3500	BD	BD	BD	BD	BD	58000	3000	BD	15000	BD	5100
µg/kg			BD	BD	12.47	BD	BD	BD	BD	BD	206.7	10.68	BD	53.4	BD	18.2
TNT-Trial-1-Ejecta																
Site 6	02945	897.5														
ng/sample			2000	70	320000	18	1000	35000	BD	BD	15000	500	BD	1100	BD	200
µg/kg			2.23	0.08	357	0.02	1.11	38.9	BD	BD	16.7	0.557	BD	1.23	BD	0.222
TNT-Trial-1-Fallout																
Site 2-50m Composite	02897	202														
ng/sample			6500	440	9100	BD	14	31	BD	BD	15000	1300	BD	7300	BD	120
µg/kg			32.2	2.18	45.1	BD	0.0694	0.154	BD	BD	74.4	6.44	BD	36.2	BD	0.595
ng/m^2			376	254	5259	BD	8.09	17.9	BD	BD	8669	751	BD	4219	BD	69.4
TNT-Trial-1-Fallout																
Sit 2-100m Composite	02898	14.1														
ng/sample			110	BD	2200	BD	BD	BD	BD	BD	3100	720	BD	41	BD	410
µg/kg			7.80	BD	156	BD	BD	BD	BD	BD	219	51.1	BD	2.91	BD	29.1
ng/m^2			72.8	BD	1455	BD	BD	BD	BD	BD	2050	476	BD	27.1	BD	71

[a] Below d[illegible]on.

APPENDIX C - GAS SAMPLE DATA REDUCTION PROCEDURES

Introduction

The Twin Otter aircraft is used in conjunction with OB/OD tests to collect gas and particle samples from detonation or combustion clouds of various explosives and propellants. The gas sampling instruments are set up to collect and analyze gases from the aircraft air sampling tube by means of (1) direct air sampling from the tube and (2) an 80-L sampling bag that can be filled from the sampling tube during penetration of the smoke plume. Normally the gas bag is filled during several consecutive passes through the plume.

A data acquisition system (DAS) is used to acquire analog voltage signals from the gas sampling instrumentation in real-time. The gases sampled are Carbon Dioxide (TECO Model 41H); Carbon Monoxide (TECO Model 48); Oxides of Nitrogen (TECO Model 42); and Ozone (TECO Model 49). Carbon Dioxide voltages are measured at two outputs that yield an offset voltage reading (350 ppm/w background substraction) and a direct reading voltage. Measuring both voltages allows for a measurement range that covers the range of 0 to 800 ppm CO_2. The data is stored on a "hard" disk, allowing retrieval of the raw data files and further processing, using Lotus® spreadsheets.

Each test event includes a sampling flight, a background flight and periodic span and zero checks on all instruments. Prior to each flight, zero and span data are gathered on the ground to assure proper instrument operation.

In-flight gas measurements are made from the tube until a plume pass is begun, whereupon a valve is switched to fill the teflon bag. After three passes are completed, the gases are drawn from the bag and analyzed by the various gas instruments. During analysis of the bag sample, a voltage signal to the DAS is switched "on" to mark the beginning of the measurement period and "off" to mark the end of the period. As a result, a mark is recorded in the data file to show when the instruments were sampling from the bag. At the conclusion of the sampling flight, the zeros and spans are again measured to check and allow for correction of instrument drift.

Raw Data Files

The raw data file contains all voltage outputs from the gas instruments, along with sample time and the tube/bag valve position. Zero and span average and standard-deviation values are calculated for each gas from the appropriate sampling times as recorded in the operator's notebook. A data quality check on the raw data from each instrument is carried out by graphing the voltage data as a function of time. Examination of these plots reveals when a stable reading from the bag is obtained. The graphs typically show a plateau region indicating when each instrument has stabilized on the gas concentration in the bag. The average and standard deviation values for the bag are calculated from this region. An example of the raw voltage and time data, along with the associated average voltage from the plateau region is given for the September 6, 1990 M-1 propellant burn test in Table C-1. The zero and span data are handled in a similar file not shown here for brevity.

Background Correction

Background flights are conducted to determine background readings for each gas of interest in the ambient atmosphere. Background flights are flown in the same general vicinity as the sample flights and generally on the same day. Background flights are similar to sample flights, in that zero and span data are taken before and after each flight. However, during the flight, background gas data from both the tube and the bag are taken.

Raw Gas Data Summary File

The data from the raw data file (Table C-1) are collected into one file, showing zero, span, sample, and background voltages for each gas. An example of this file for the September 6, 1990 M-1 propellant burn test is shown in Table C-2.

Gas Concentration Data File

Voltages for each gas were collected into a final spreadsheet, where the bag gas concentrations is calculated using an instrument response factor, M, by the following formula:

Equation C.1 Bag Gas Concentration Calculation.

$$M = \frac{S}{\frac{V_{si} + V_{sf}}{2} - \frac{V_{si} + V_{sf}}{2}}$$

where

M = instrument response factor (ppm/volt)

S = span gas value (ppmv)

V_{si} = initial span reading (volt)

V_{sf} = final span reading (volt)

V_{zi} = initial zero reading (volt)

V_{zf} = final zero reading (volt).

The final bag gas concentration is calculated from the measured sample and zero-voltage averages and the response factor, M, as given by the following expression:

Equation C.2 Final Bag Gas Concentration Calculation.

$$C = (V_{sam} - \frac{V_{zi} + V_{zf}}{2}) * M$$

where C is the bag concentration in ppm, V_{sam} is the average sample voltage from the bag, and V_{zi} and V_{zf} are as defined above.

The instrument response factor, M, is calculated on a daily basis for each instrument and was entered into a final spreadsheet file, which is used to convert the voltage signal from the instrument to engineering units of parts per million (ppmv). An example of this file is given in Table C-3 for the September 6, 1990 M-1 propellant burn. All daily calibration data, including the span gas cylinder values in ppmv (column 2), the bag sample voltage (column 3) the initial and final zero voltage for each gas, columns 4 and 5, and the initial and final span voltages (columns 6 and 7) are included in the file. The initial and final zero and span voltages are averaged (columns 8 and 9) and are used to calculate an instrument response factor M, (column 10). The response factor is

multiplied by the difference between the average sample voltage (column 3) and the average zero voltage (column 8) to yield the gas concentration in ppmv (column 11). An example of this file is given in Table C-3. The final column in this table shows the gas concentration in units of ppm for each sample collected.

Finally, the background-corrected gas concentration used in all emission factor calculations is determined by subtracting the sample value from the background value for each gas of interest.

Table C-1 Example of Voltage Data from Gas Instruments During Sampling from Bag Filled During M-1 Propellant Burn, Mon, 6 Sep 90.

Time HH:MM:SS	Valve Position 0=Tube 2=Bag	CO_2 Real volts	CO_2 Shift volts	CO volts	NO volts	NO_2 volts	NO_x volts	Ozone volts
12:31:50	2.000	4.990	2.661	0.347	1.025	1.792	1.470	-0.005
12:31:55	2.000	4.985	2.666	0.522	1.030	1.797	1.489	-0.005
12:32:00	2.000	4.990	2.729	0.527	1.846	-0.127	1.763	-0.005
12:32:05	2.000	4.985	2.710	0.542	1.831	-0.107	1.777	0.00
12:32:10	2.000	4.985	2.686	0.542	1.904	0.586	2.046	0.000
For brevity, the entire data collection period is not shown								
12:35:10	2.000	5.029	2.720	0.288	1.978	0.488	2.095	0.000
12:35:15	2.000	5.020	2.710	0.337	1.978	0.449	2.114	-0.010
12:35:20	2.000	4.990	2.700	0.044	1.973	0.439	2.085	-0.005
12:35:25	2.000	4.980	2.715	0.078	1.968	0.435	2.085	0.000
12:35:30	2.000	5.010	2.715	0.225	1.968	0.444	2.085	-0.010
	Average	4.995	2.712	0.087	1.974	0.450	2.093	-0.005
	Stand Dev	0.011	0.019	0.214	0.019	0.037	0.016	0.004

Table C-2a Summary Instrument Voltage Data From All Calibrations, Test Flights, and Background Flights Conducted on 6 Sep 90.

		CO_2 REAL volts	CO_2 SHIFT volts	CO volts	NO volts	NO_2 volts	NO_x volts	O_3 volts
September 06, 1990 Pre-test zero and span summary data								
ZERO	AVG	-0.005		0.006	-0.005	-0.003	-0.006	-0.006
	STD	0.002		0.017	0.002	0.004	0.003	
SPAN CO_2 Lo, NO_x	AVG	3.347	0.349	NA[a]	2.727	1.930	3.216	NA
	STD	0.015	0.015	NA	0.004	0.023	0.005	NA
SPAN CO_2 Hi,CO,O_3	AVG	4.400	1.402	3.971	NA	NA	NA	0.397
	STD	0.023	0.022	0.044	NA	NA	NA	0.004
September 06 M-1 PROPELLANT BURN #1 Bag Sample Summary Data								
12.303-12.336	AVG	4.989	2.274	0.118	1.441	0.454	1.560	-0.002
	STD	0.009	0.035	0.208	0.015	0.024	0.014	0.006
September 06 M-1 PROPELLANT BURN #2 Bag Sample Summary Data								
12.536-12.592	AVG	4.995	2.712	0.087	1.974	0.450	2.093	-0.005
	STD	0.011	0.019	0.214	0.019	0.037	0.016	0.004
September 06 M-1 PROPELLANT BURN #3 Bag Sample Summary Data								
12.742-12.821	AVG	4.963	2.121	0.071	1.377	0.445	1.488	-0.005
	STD	0.079	0.031	0.218	0.016	0.021	0.013	0.004

[a]NA - Only one level of span gas used in calibration for CO, NO_xs, and O_3.

Table C-2b Summary Instrument Voltage Data from All Calibrations, Test Flights, and Background Flights Conducted on 6 Sep 90.

		CO_2 REAL volts	CO_2 SHIFT volts	CO volts	NO volts	NO_2 volts	NO_x volts	O_3 volts
September 06, 1990 Post-test zero and span data								
ZERO	AVG	-0.020		0.019	-0.007	-0.013	-0.013	-0.006
	STD	0.007		0.016	0.011	0.007	0.009	0.005
SPAN CO_2Lo, NO_x	AVG	3.435	0.436	NA[a]	2.766	1.890	3.242	NA
	STD	0.019	0.021	NA	0.010	0.035	0.012	NA
SPAN CO_2Hi, CO, O_3	AVG	4.542	1.545	3.951	NA	NA	NA	0.399
	STD	0.019	0.018	0.034	NA	NA	NA	0.024
September 06, 1990 Background flight summary data4								
BKG. TUBE	AVG	3.395	0.397	0.198	-0.007	-0.005	-0.007	0.045
	STD	0.013	0.013	0.273	0.010	0.009	0.008	0.007
BKG. BAG	AVG	3.402	0.403	0.542	-0.004	0.001	-0.010	0.025
	STD	0.036	0.035	0.928	0.013	0.008	0.008	0.008
September 06, 1990 Post-background flight zero and span summary data								
ZERO	AVG	-0.020		0.048	-0.007	-0.019	-0.012	-0.006
	STD	0.007		0.019	0.009	0.011	0.009	0.005
SPAN CO_2Lo, NO_x	AVG	3.348	0.348	NA	2.782	1.845	3.241	NA
	STD	0.011	0.010	NA	0.011	0.013	0.013	NA
SPAN CO_2Hi, CO, O_3	AVG	4.390	1.389	3.956	NA	NA	NA	0.394
	STD	0.011	0.009	0.019	NA	NA	NA	0.006

[a]NA - Only one level of span gas used in calibration for CO, NO_xs, and O_3.

Table C-3a Summary Gas Instrument Data That Includes Zero, Span, and Sample Data For M-1 Propellant Burn on 6 Sep 90.

	GAS SPAN (ppm)	V_{sam}[a] (volts)	V_{zi}[b] (volts)	V_{zf}[c] (volts)	V_{si}[d] (volts)	V_{sf}[e] (volts)	V_{za}[f] (volts)	V_{sa}[g] (volts)	M	BAG CONC (ppm)
M-1 PROPELLANT BURN #1 9/6/90 THE CO2 SHIFTED VOLTAGE IS USED FOR THE CO2 VALUE BECAUSE THE ACTUAL VOLTAGE IS OFF-SCALE										
NO	1.098	1.441	-0.005	-0.007	2.727	2.766	-0.006	2.747	0.399	0.577
NO_x	1.383	1.560	-0.006	-0.013	3.216	3.242	-0.010	3.229	0.427	0.670
NO_2	0.280	0.454	-0.003	-0.013	1.930	1.890	-0.008	1.910	0.146	0.093
CO	7.900	0.118	0.006	0.019	3.971	3.951	0.013	3.961	2.001	0.211
CO_2 LOW	338.000	2.274	-0.005	-0.020	3.347	3.435	-0.013	3.391	103.704	546.933
CO_2 HIGH	450.000				4.400	4.542		4.471		
O_3	0.400	-0.002	-0.006	-0.006	0.397	0.399	-0.006	0.398	0.990	0.004
M-1 PROPELLANT BURN #2 9/6/90										
NO	1.098	1.974	-0.005	-0.007	2.727	2.766	-0.006	2.747	0.399	0.790
NO_x	1.383	2.093	-0.006	-0.013	3.216	3.242	-0.010	3.229	0.427	0.898
NO_2	0.280	0.450	-0.003	-0.013	1.930	1.890	-0.008	1.910	0.146	0.108
CO	7.900	0.087	0.006	0.019	3.971	3.951	0.013	3.961	2.001	0.149
CO_2 LOW	338.000	2.712	-0.005	-0.020	3.347	3.435	-0.013	3.391	103.704	592.356
CO_2 HIGH	450.000				4.400	4.542		4.471		
O_3	0.400	-0.005	-0.006	-0.006	0.397	0.399	-0.006	0.398	0.990	0.001

[a]Average sample voltage from the bag.
[b]Initial zero reading.
[c]Final zero reading.
[d]Initial span gas reading.
[e]Final span gas reading.
[f]Average of initial and final zero reading.
[g]Average of initial and final span gas reading.

Table C-3b Summary Gas Instrument Data That Includes Zero, Span, and Sample Data For M-1 Propellant Burn on 6 Sep 90.

	GAS SPAN (ppm)	V_{sam}[a] (volts)	V_{zi}[b] (volts)	V_{zf}[c] (volts)	V_{si}[d] (volts)	V_{sf}[e] (volts)	V_{za}[f] (volts)	V_{sa}[g] (volts)	M	BAG CONC (ppm)
M-1 PROPELLANT BURN #3 9/6/90										
NO	1.098	1.377	-0.005	-0.007	2.727	2.766	-0.006	2.747	0.399	0.552
NO_x	1.383	1.488	-0.006	-0.013	3.216	3.242	-0.010	3.229	0.427	0.640
NO_2	0.280	0.445	-0.003	-0.013	1.930	1.890	-0.008	1.910	0.146	0.088
CO	7.900	0.071	0.006	0.019	3.971	3.951	0.013	3.961	2.001	0.117
CO_2 LOW	338.000	3.121	-0.005	-0.020	3.347	3.435	-0.013	3.391	103.704	531.067
CO_2 HIGH	450.000				4.400	4.542		4.471		
O_3	0.400	-0.005	-0.006	-0.006	0.397	0.399	-0.006	0.398	0.990	0.001
BACKGROUND FLIGHT 9/6/90 BAG SAMPLE										
NO	1.098	-0.004	-0.007	-0.007	2.766	2.782	-0.007	2.774	0.395	0.001
NO_x	1.383	-0.010	-0.013	-0.012	3.242	3.241	-0.013	3.242	0.425	0.001
NO_2	0.280	0.001	-0.013	-0.019	1.890	1.845	-0.016	1.868	0.149	0.000
CO	7.900	0.542	0.019	0.048	3.951	3.956	0.034	3.954	2.015	1.025
CO_2 LOW	338.000	3.402	-0.020	-0.020	3.435	3.348	-0.020	3.392	104.235	354.606
CO_2 HIGH	450.000				4.542	4.390		4.466		
O_3	0.400	0.025	-0.006	-0.006	0.399	0.394	-0.006	0.397	0.994	0.031

[a]Average sample voltage from the bag.
[b]Initial zero reading.
[c]Final zero reading.
[d]Initial span gas reading.
[e]Final span gas reading.
[f]Average of initial and final zero reading.
[g]Average of initial and final span gas reading.

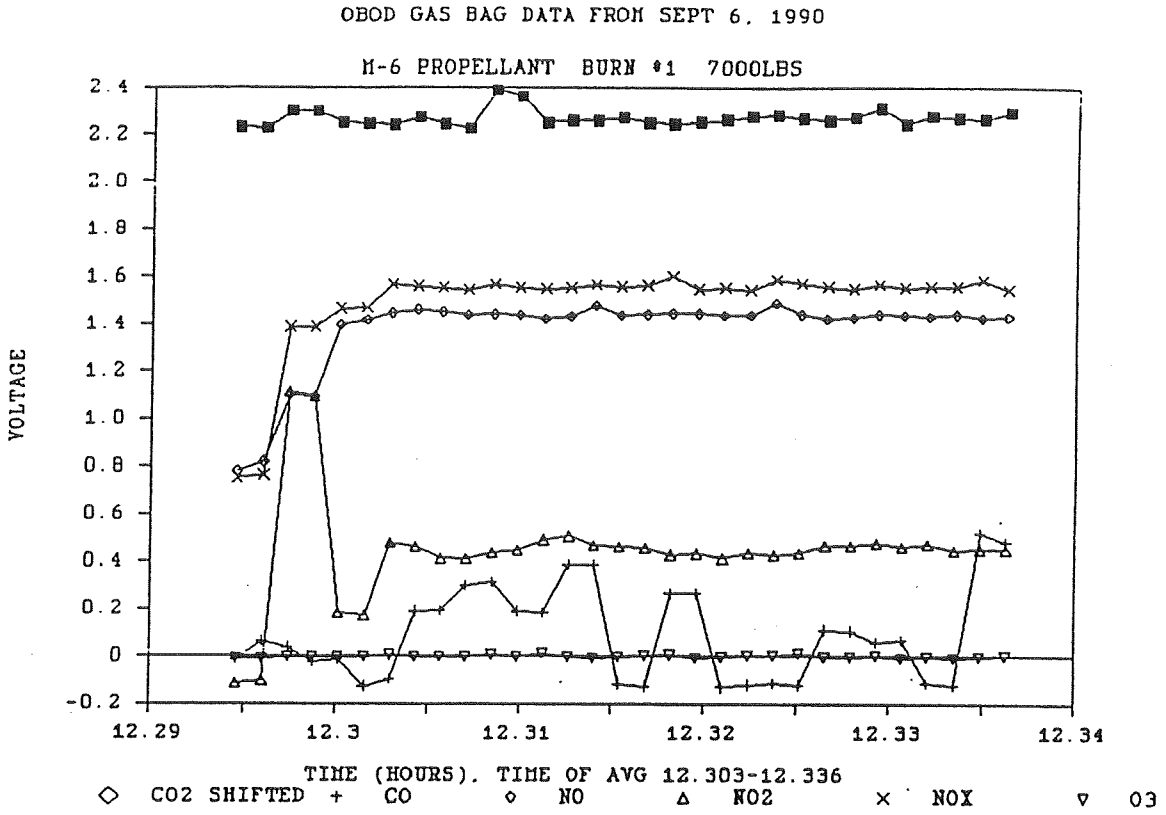

Figure C-1 Raw Voltage Data From Gas Instruments While Sampling From Bag Following The First M-1 Propellant Test.

■ valve open position voltage

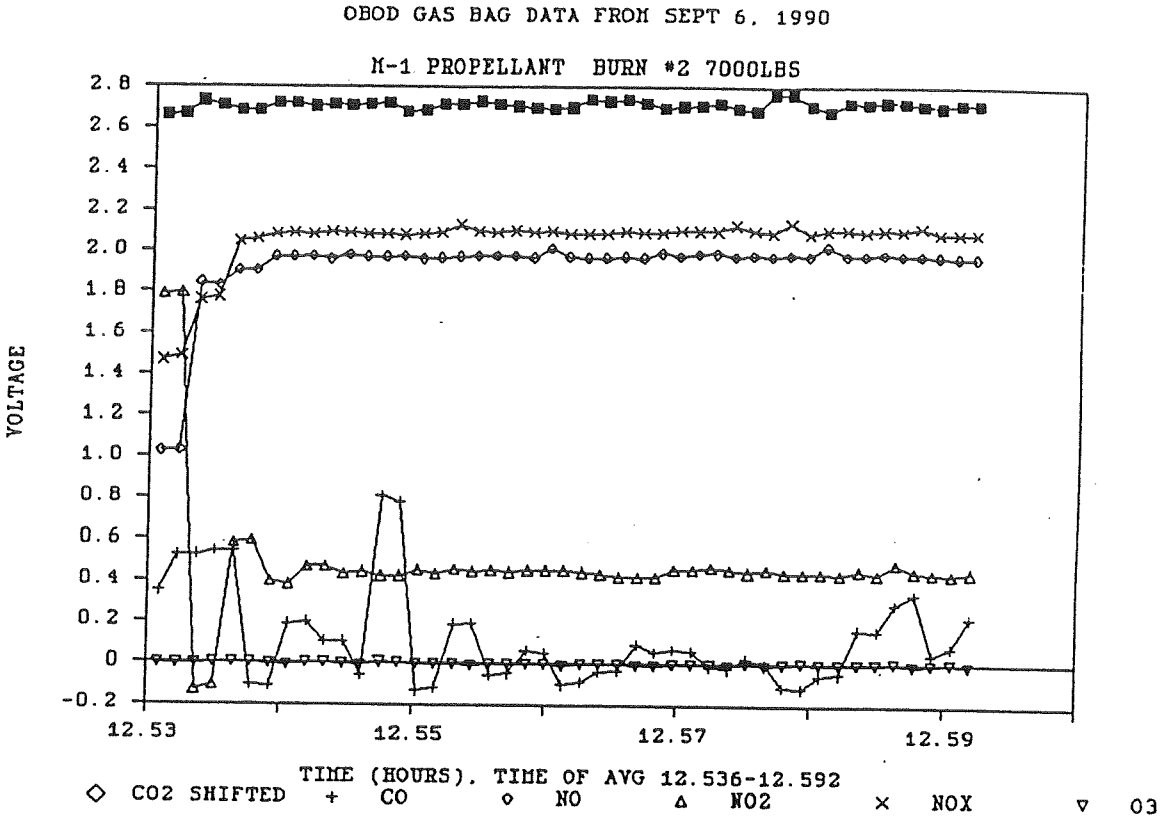

Figure C-2 Raw Voltage Data From Gas Instrument While Sampling From Bag Following Second M-1 Propellant Burn.

■ valve open position voltage

APPENDIX D - PARTICULATE MATTER DATA REDUCTION

Particulate matter data is handled in conjunction with other data to calculate average cloud particulate matter concentrations, and in the special case of propellant burns, a particulate matter emission factor. The calculation begins with the weight gain on each of the three filters used to collect the particulate sample. The weight gain is determined from a weighing of the filter prior to sampling and after sampling. Control filters are weighed along with sample filters to correct for differences in filter weight that are attributable to filter handling or storage conditions. For example, in the Phase C test, the data is contained in a worksheet named PHZCWGT.WK1 shown excerpted in Table D-1. Also included in this spreadsheet for each filter sample is a measure of the total volume of air sampled through the filter during all aircraft passes through the plume as measured by a pitot tube installed on the centerline of the transport tube. The total volume is determined by a continuous measure of the linear air velocity (as calculated from velocity pressure) through the tube whenever the filter sample port was open. An average velocity, calculated over the entire filter sampling interval and corrected for atmospheric pressure changes and temperature, is multiplied by the cross sectional area of the tube to yield the total sampled volume of air at standard conditions (25 °C and 1 atmosphere).

The average background corrected particle mass concentration, C, in the cloud as measured over multiple aircraft passes through the cloud is given by:

$$C = \frac{M_s}{V_s} - \frac{M_b}{V_b}$$

where M_s and M_b is the total particulate mass measured on the sample and background filters, and V_s and V_b is the total air volume drawn through the filter for the sample and background sample.

In the case of the propellant burns, the particle emissions are assumed to originate from the combustion process only (no entrained soil).

Table D-1 Filter Weight and Volume Data.

Date	Test Description	Adjusted Total Mass (mg)	Total Sample Volume (m^3)	Mass Conc (mg m^{-3})
August 29	Background	3.9	226.15	0.017
August 29	M-6 Propellant #3	27.2	10.07	2.7
August 30	Background	3.1	214.48	0.014
August 30	M-6 Propellant #4	30.5	10.78	2.8
September 05	Background	2.9	223.28	0.013
September 05	M-1 Propellant #1	15.8	11.90	1.3
September 06	M-1 Propellant #2	24.6	9.58	2.6
September 06	Background	3.0	182.79	0.016
September 18	Background	7.0	193.33	0.036
September 18	Comp B #1 (3x)	2190.8	10.05	218.0
September 18	Comp B #2 (3x)	1649.7	8.66	190.5

Under these circumstances, a total particulate matter emission factor can be calculated by the following:

$$EF_{part} = \frac{C_{part}}{C_{tot}} * f_c$$

where EF_{part} is the particulate matter emission factor, C_{part} is the average cloud particulate matter concentration, C_{tot} is the background corrected total carbon content in the sampled volume, (Table D-2) and c_f is the carbon mass fraction in the original propellant material.

APPENDIX G - SEMIVOLATILE ORGANIC ASSAY

The semivolatiles collected on soil particles and sampled by Teflon® coated glass fiber filters and soil ejecta and fallout were all assayed by SFC/MS and most samples were also assayed by GC/MS. The RDX semivolatile data is shown in this appendix as an example of the data available for each detonation or burn. RDX was chosen because two of the compounds, N-nitrosodiphenylamine and RDX are not identified and quantified with the GC/MS method of assay; however, they are identified and quantified with the SFC/MS method of assay. Table G.1 gives the QA custody number used to identify each sample from the initial field collection through the data analysis, the origin of the collected sample, and the weight of the soil that was extracted for the sample assay. Tables G.2a through G.2d show the concentration determined for each sample by the two methods of assay. Duplicate samples were collected for all the assays from sites D1, D3, and D5 (e.g. samples number 4065 and 4069 are independent background samples).

Table G.1 Sample Identification and Weight of Particles in Sample.

QA CUSTODY NUMBER	LOCATION	SAMPLE TYPE	SAMPLE SOURCE	WEIGHT OF SAMPLE (g)
3613	Aircraft	Filter	Air (Trial 1)	
3614	Aircraft	Filter	Air (Background)	
3615	Aircraft	Filter	Air (Trial 2)	
4065	Site D1, D3, D5	Background	Detonation site	372.8
4069	Site D1, D3, D5	Background	Detonation site	372.2
4067	Site D2, D4, D6	Background	Detonation site	377.8
4634	Site D1, D3, D5	Ejecta	Detonation crater	375.9
4640	Site D1, D3, D5	Ejecta	Detonation crater	359.1
4646	Site D2, D4, D6	Ejecta	Detonation crater	386.6
4622	Site D1, D3, D5	Fallout	50m from detonation	369.8
4623	Site D1, D3, D5	Fallout	50m from detonation	396.1
4624	Site D1, D3, D5	Fallout	100m from detonation	236.2
4625	Site D1, D3, D5	Fallout	100m from detonation	102.4
4626	Site D1, D3, D5	Fallout	150m from detonation	22.8
4627	Site D1, D3, D5	Fallout	150m from detonation	2.57
4628	Site D1, D3, D5	Fallout	200m from detonation	26.3
4629	Site D1; D3, D5	Fallout	200m from detonation	1.02
4648	Site D2, D4, D6	Fallout	50m from detonation	356.3
4649	Site D2, D4, D6	Fallout	100m from detonation	268.4
4650	Site D2, D4, D6	Fallout	150m from detonation	13.4
4651	Site D2, D4, D6	Fallout	200m from detonation	2.41

Table G.2a Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations.

SEMIVOLATILE COMPOUNDS	3613		3614		3615		4065		4069		4067	
	SFC/MS (ng/Ml)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)
2,4-Dinitrotoluene	410	230	220	210	240	330	220	500	270	920	210	410
2,6-Dinitrotoluene	33	18	160	33	70	20	120	69	75	41	21	28
2,4,6-Trinitrotoluene	61	18	260	BD[a]	160	BD	240	71	220	65	61	BD
2-Nitronaphthalene	85	BD	350	BD	91	BD	190	45	120	31	68	26
N-Nitrosodiphenylamine	BD	NA[b]	BD	NA	BD	NA	BD	NA	BD	NA	BD	NA
1,3,5-Trinitrobenzene	92	BD	190	BD	48	BD	110	1	51	2	71	35
2-Nitrodiphenylamine	60	BD	180	BD	60	BD	110	400	80	430	44	230
1-Nitropyrene	66	BD	150	BD	83	BD	300	BD	170	BD	74	BD
RDX	2200	NA	4600	NA	3400	NA	1400	NA	1100	NA	400	NA
Naphthalene	330	1600	210	970	310	1900	120	81	170	160	41	140
Benz[a]anthracene	96	190	91	BD	65	BD	66	91	68	BD	63	56
Benzo[a]pyrene	270	BD	76	BD	41	BD	53	BD	61	BD	55	BD
Pyrene	180	380	260	410	320	500	1	28	23	17	14	27
Phenol	---[c]	---	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	150	140	110	53	3000	120	30	33	18	48	BD	51
Diphenylamine	45	64	250	43	150	38	91	7	92	12	95	11

[a]BD - below detection limit.
[b]NA - a target analyte not detected by GC/MS.
[c]Phenol was lost in the extraction of the semivolatile.

Table G.2b Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations.

SEMIVOLATILE COMPOUNDS	4634		4640		4646		4622		4623		4624	
	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)
2,4-Dinitrotoluene	740	660	340	440	130	220	320	110	120	170	110	18
2,6-Dinitrotoluene	340	100	93	35	31	1	310	7	100	BD[a]	87	BD
2,4,6-Trinitrotoluene	250	77	100	56	110	16	530	270	2000	1600	1000	42
2-Nitronaphthalene	340	71	110	35	50	7	580	49	220	BD	79	BD
N-Nitrosodiphenylamine	650	NA[b]	590	NA	230	NA	1400	NA	BD	NA	BD	NA
1,3,5-Trinitrobenzene	290	130	47	420	79	BD	340	BD	58	BD	66	BD
2-Nitrodiphenylamine	73	BD	49	BD	66	18	240	240	220	BD	120	BD
1-Nitropyrene	BD	BD	83	BD	18	52	370	BD	40	BD	80	BD
RDX	4600	NA	5300	NA	1900	NA	4000	NA	18000	NA	6800	NA
Naphthalene	2000	2600	1900	2000	1200	2000	530	210	420	260	210	87
Benz[a]anthracene	910	520	750	740	680	210	4300	1100	4000	1000	BD	130
Benzo[a]pyrene	BD	BD	97	BD	160	210	BD	BD	1160	BD	120	BD
Pyrene	200	120	1900	1700	1200	20	1000	700	1600	2100	600	190
Phenol	---[c]	---	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	260	170	340	390	340	290	130	77	BD	180	BD	27
Diphenylamine	180	150	160	100	BD	2	BD	19	BD	63	BD	3

[a]BD - below detection limit.
[b]NA - a target analyte not detected by GC/MS.
[c]Phenol was lost in the extraction of the semivolatile.

Table G.2c Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations.

SEMIVOLATILE COMPOUNDS	4625		4626		4627		4628		4629		4648	
	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)
2,4-Dinitrotoluene	81	110	49	150	280	140	410	290	270	270	730	1300
2,6-Dinitrotoluene	70	BD[a]	34	BD	340	40	100	15	BD	19	29	170
2,4,6-Trinitrotoluene	490	77	280	BD	390	60	160	63	20	40	340	480
2-Nitronaphthalene	110	14	88	17	300	78	170	59	22	28	130	410
N-Nitrosodiphenylamine	430	NA[b]	440	NA	550	NA	690	NA	170	NA	370	NA
1,3,5-Trinitrobenzene	26	BD	18	BD	510	BD	210	41	6	11	33	BD
2-Nitrodiphenylamine	120	BD	120	BD	200	BD	130	BD	29	140	250	BD
1-Nitropyrene	150	BD	130	BD	310	BD	300	130	8	BD	16	BD
RDX	13000	NA	16000	NA	3700	NA	29000	NA	1000	NA	11000	NA
Naphthalene	180	82	740	BD	550	170	250	1800	750	220	450	2200
Benz[a]anthracene	900	180	37	37	560	BD	800	110	61	80	640	420
Benzo[a]pyrene	100	BD	74	90	420	BD	BD	BD	BD	BD	680	BD
Pyrene	580	320	280	110	640	BD	920	200	230	72	1900	2600
Phenol	---[c]	---	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	320	250	BD	63	240	110	BD	200	35	31	BD	290
Diphenylamine	BD	12	BD	25	220	50	480	380	26	35	240	520

[a]BD - below detection limit.
[b]NA - a target analyte not detected by GC/MS.
[c]Phenol was lost in the extraction of the semivolatile.

Table G.2d Data of the Supercritical-Fluid Chromatography/Mass Spectrometry and Gas Chromatography/Mass Spectrometry for the RDX Detonations.

SEMIVOLATILE COMPOUNDS	4649		4650		4651	
	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)	SFC/MS (ng/mL)	GC/MS (ng/mL)
2,4-Dinitrotoluene	43	59	500	90	230	230
2,6-Dinitrotoluene	4	9	11	29	160	BD[a]
2,4,6-Trinitrotoluene	130	BD	1700	54	230	23
2-Nitronaphthalene	170	20	BD	50	350	8
N-Nitrosodiphenylamine	9	NA[b]	88	NA	35	NA
1,3,5-Trinitrobenzene	2	52	14	BD	230	BD
2-Nitrodiphenylamine	19	60	BD	42	84	33
1-Nitropyrene	BD	BD	BD	BD	170	BD
RDX	2300	NA	BD	NA	690	NA
Naphthalene	220	160	200	76	100	BD
Benz[a]anthracene	49	76	BD	BD	85	BD
Benzo[a]pyrene	6	BD	34	BD	190	BD
Pyrene	1	35	120	BD	100	43
Phenol	---[c]	---	---	---	---	---
Dibenzofuran	BD	99	150	140	110	64
Diphenylamine	BD	46	BD	140	110	10

[a]BD - below detection limit.
[b]NA - a target analyte not detected by GC/MS.
[c]Phenol was lost in the extraction of the semivolatile.

APPENDIX H - REFERENCES

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APPENDIX I - ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AEHA	U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland
AFB	Air Force Base
AMC	U.S. Army Materiel Command, Alexandria, Virginia
AMCCOM	U.S. Army Armament, Munitions and Chemical Command, Rock Island, Illinois
amino-PAH	aminopolycyclic aromatic hydrocarbons
ANOVA	analysis of variance
AP	ammonium perchlorate
APS	aerodynamic particle sizer
ASASP	active scattering aerosol spectrometer probe
AWL	Alpine West Laboratories, Provo, Utah
BB	BangBox
BCD	Battelle Columbus Division, Columbus, Ohio
BD	target analyte not found in concentrations above detection limits
BYU	Brigham Young University, Provo, Utah
CAA	Clean Air Act
CDD	chlorinated dibenzodioxin
CDF	chlorinated dibenzofuran
CI-SIM	chemical ionization, selective-ion monitoring
CSI	Columbia Scientific Instruments
C·V	concentration times cloud volume method
CWA	Clean Water Act
DMC	Data Management Center
DMPS	differential mobility particle sizer
DoD	Department of Defense
DPG	U.S. Army Dugway Proving Ground; Dugway, Utah
EC	electron capture *or* elemental carbon
ECD	electron capture detector
EDAX	energy-dispersive X-ray analysis
EER	Energy and Environmental Research Corporation, Irvine, California

EF	emission factor(s)
EI	electron impact
EI-MS	mass spectrometer used in the electron impact ionization mode
EI/MS	electron impact ionization/ mass spectrometry
EIS	environmental impact statement
ELI	Environmental Labs, Incorporated, Provo, Utah
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
EPO	Environmental Protection Office, U.S. Army Dugway Proving Ground, Dugway, Utah
ER	expansion ratio
FID	flame ionization detector
FSSP	forward scattering spectrometer probe
FTIR	Fourier Transform Infrared Spectrometry
FWAC	fixed-wing aircraft
GC	gas chromatograph(y)
GC-ECD	gas chromatography with an electron capture detector
GC-FID	gas chromatography with a flame ionization detector
GC/MS	gas chromatography-mass spectrometry
GLP	good laboratory practices
HE	high explosive
HMX	octamethylenehexanitramine
HNBB	hexanitrobibenzyl
HRGC/HRMS	combined capillary column gas chromatography/high resolution mass spectrometry
HS	high-speed
LASD	Los Angeles Sheriff Department
LBL	Lawrence Berkeley Laboratory, Berkeley, California
LC	liquid chromatography
LOD	limit of detection
LOI	letter(s) of instruction

MR	multiple range
MRI	Midwest Research Institute, Kansas City, Kansas
MS	mass spectrometry (or mass spectrometer)
MSA	Mine Safety and Appliance Company
NA	not targeted for analysis *or* not applicable
NASA	National Aeronautical and Space Administration
NATICH	National Air Toxics Information Clearinghouse
NBS-SRM	National Bureau of Standards (now NIST)- Standard Reference Material
ND	no data *or* detection limit not determined
NEPA	National Environmental Policy Act
NF	not found in the sample matrix *or* not determined
NIST	National Institute of Science and Technology
nitro-PAH	nitropolycyclic aromatic hydrocarbons
NIOSH	National Institute for Occupational Safety and Health
NOSIH	Naval Ordnance Station, Indian Head, Maryland
NO_x	nitrogen oxides
NS	not sampled
OB	open burning
OB/OD	open burning/open detonation
OC	organic carbon
OD	open detonation
OGC	Oregon Graduate Center, Beaverton, Oregon
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbons
PANH	polycyclic aromatic nitrogen heterocycles
PAOH	polycyclic aromatic oxygen heterocycles
PCDD	polychlorinated dibenzodioxins
PCDF	polychlorinated dibenzofurans
PETN	pentaerythritol tetranitrate
PEP	propellants, explosives, and pryotechnics
PIC	products of incomplete combustion
PICI/SIM	Positive ion chemical ionization/selective ion monitoring

PID	photoionization detector
PIP	product improvement program
PM	program manager
PMS	Particle Measuring Systems, Inc.
PUF	polyurethane foam
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
QAA	quality assurance agency
QAPP	quality assurance project plan
QAU	quality assurance unit
RCRA	Resource Conservation and Recovery Act
RDX	hexamethylenetrinitramine
RFD	Reno (Nevada) Fire Department
RIC	relative ion count
RSD	relative standard deviation
RTP	Research Triangle Park, North Carolina
SDPDA	Special Defense Property Disposal Account
SEM	scanning electron microscope/microscopy
SFC	supercritical fluid chromatography
SFC/MS	supercritical fluid chromatography/mass spectrometry
SF_6	sulfur hexafluoride
SIM	selected-ion monitoring (or selective-ion monitoring)
SNL	Sandia National Laboratories, Albuquerque, New Mexico
SOP	standing operating procedures
SS	stainless steel
SSC	stainless steel canister
SSL	Sunset Laboratory, Forest Grove, Oregon
STEL	short-term exposure limit
STP	standard temperature and pressure (25°C and 760 torr)
TCD	thermal conductivity detector
TDP	test design plan

TEAD	U.S. Army Tooele Army Depot, Tooele, Utah
TECO	Thermo Electron Instruments (Company)
TECOM	U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland
THC	total hydrocarbon
TLV	threshold limit values
TNT	2,4,6-trinitrotoluene
TSC	technical steering committee
TSP	total suspended particulate
TWA	time-weighted average
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland
UV	ultraviolet
VOC	volatile organic compounds
VOST	semivolatile organic sampling train
VSDM	Volume Source Diffusion Model
XRF	X-ray fluorescence *or* X-ray fluorescence spectrometer

APPENDIX J - GLOSSARY

B-48 The Sandia National Laboratories (SNL) mobile laboratory on-site at the U.S. Army Michael Army Airfield, Dugway Proving Ground, Utah. This laboratory contained filter support equipment and test equipment and parts for repairing instrumentation and sample collectors aboard the sampling aircraft.

BangBox An inflatable 16-m diameter hemisphere used for conducting closed chamber tests involving detonation of small amounts of explosive and burning of small amounts of propellant.

burn pans Steel pans used to contain propellants during burning and prevent soil contamination by residues.

cloud volume method a procedure which uses carbon as a tracer for the products of a detonation or propellant burn in a cloud. Assumes that cloud of detonation or combustion products is homogeneous in relative composition. Volume of cloud is not required for computation of the mass of an analyte.

carbon balance method a procedure which uses carbon as a tracer for the products of a detonation or propellant burn in a cloud. Assumes that cloud of detonation or combustion products is homogeneous in relative composition. Volume of cloud is not required for computation.

composition B An explosive composed primarily of RDX and TNT in an approximately 60/40 ratio (by weight).

donor charge A small explosive charge used to initiate the detonation of a substantially larger explosive charge. Sometimes referred to as an "initiator", "initiating charge", or "primer".

double-base propellant	A propellant consisting primarily of nitrocellulose and nitroglycerine. Mix used during OB/OD field test was approximately 50 percent nitrocellulose and 35 percent nitroglycerin.
ejecta	Soil displaced from the point of a surface detonation and which is deposited near the detonation crater.
exotics	Volatile organic compounds which, if detected during laboratory assay, would most likely be found at trace levels.
explosive D	An explosive consisting primarily of picric acid. Frequently referred to as "yellow D" due to its characteristic yellow color. Relatively insensitive and requires a substantially larger initiating charge than other military explosives to ensure complete detonation.
field test	A series of open-air trials using techniques and material identical to those used in, or proposed for, actual operations.
FWAC	A fixed-wing aircraft outfitted to sample, analyze, and collect combustion emissions from the open detonation of explosive and open burning of propellants.
Interim Test	A series of open-air trials using end-item PEP material which were conducted at the Tooele Army Depot during 1986.
kickout	Pieces of propellant ejected from burn pans either by low-level shock waves or thermal-generated drafts.
M1 Propellant	A single-base propellant used to fire projectiles by field artillery howitzers, and guns.
M6 Propellant	See M1 Propellant

Operational readiness inspection	A trial, frequently referred to as an "ORI", designed to ensure methods, equipments, and personnel are prepared to undertake subsequent data-gathering trials.
PBXN-6	Mixture of RDX and Viton A® in a 95/5 ratio. Referred to as "RDX" within this report.
PETN	A military explosive (pentaerythritol tetranitrate) commonly used in detonating cord.
propellant manufacturing residue	Incompletely manufactured propellant. No scrap material included in residue used during OB/OD field testing.
RDX	A military explosive consisting primarily of hexamethylenetrinitroamine. See PBXN-6.
single-base propellant	A propellant consisting of approximately 85 percent nitrocellulose.
sputter	Pieces of propellant ejected from burn pans by the energy of their burning.
sputter pan	A square metal pan designed and located so as to capture particles of propellants lofted out of burn pans during open burning testing.
supercritical fluid chromatography	SFC ia a chromatographic technique where a supercritical fluid is used as the mobile phase. SFC has efficiencies comparable to that of gas chromatography and a solvating mobile phase such as in liquid chromatography.

surface detonation	A detonation which was set up with explosives set on the ground, or placed in container set on the ground.
transport tube	The tube used to transport outside air into the FWAC for instrument sampling.
triple base propellant	A propellant consisting primarily of nitrocellulose, nitroglycerine, and nitroguanadine. Triple-base propellent used during OB/OD field testing was approximately 28 percent nitrocellulose, 22 percent nitroglycerin, and 48 percent nitroguanidine.
suspended detonation	A method used in the OB/OD Phase B and C tests to suspend 907 kg of TNT in steel drums 40 feet off the ground for subsequent detonation.
TNT	An explosive consisting almost exclusively of trinitrotoluene.
washout explosive	Explosive reclaimed from munitions by a process of opening a munition and removing the explosive filler by flushing the casing/container with high-pressure hot water.
yellow D	See explosive D.

APPENDIX K - OB/OD PROGRAM SYNOPSIS

1. Original Study Purpose

The original OB/OD study was intended to provide munitions and propellent thermal treatment emissions data to satisfy increasingly stringent state and Federal permitting requirements.

2. Interim Test

The initial effort, now referred to as the Interim Test, was conducted at the Tooele Army Depot with the objective of directly obtaining this data. End-item munitions and propellants were tested, and a variety of samplers, real-time analyzers, and assay procedures used to characterize their combustion products. This test did not meet its objectives because the technology to detect and quantify emissions at desired levels had either not been developed, or was not made available to the project.

3. Program Reevaluation

Upon conclusion of the Interim Test and after consultation with certain EPA agencies, the decision was made that an orderly, scientific methodology was necessary to provide accurate and replicable test data which would satisfy current and anticipated requirements of state and Federal environmental regulatory agencies. This would necessarily involve use of state-of-the-art technologies and instruments capable of meeting anticipated regulatory agency requirements.

4. Current OB/OD Phase

4.1 Objectives

4.1.1 The recently-concluded phase of the OB/OD Thermal Treatment Emissions Study was designed and conducted as the first step of this premise, i.e., to find, test, and authenticate technologies and procedures which could then be used to obtain data to support OB/OD permitting. An ancillary objective was to ascertain if small-scale controlled testing could be related to large-scale

field testing and thus reduce the time and expense which typify large-scale testing.

4.1.2 The types of bulk explosives and propellants tested are components of a large percentage of demilitarization account end items. Munition-specific variables such as shell-casing components were not tested; however, with high-order detonation of complete munitions, the same combustion products are expected.

4.2 Results

4.2.1 The primary consequence of this testing was the assessment of instruments' and procedures' abilities to accurately capture and analyze combustion products, and the evaluation of scaling BB data to field data for detonations and burns. The secondary consequence was characterization of emission products imparted into the atmosphere and soil for the items tested.

4.2.2 The emission data along with meteorological diffusion models can generate expected downwind dosage values which can be compared with ambient air concentration limits set by states. The ejecta concentration data for the soil in the crater area can be used to estimate the total amount of the analyte that remains in the soil after a detonation. Fallout concentrations can be used to determine the analyte and the amount that is deposited on the undisturbed surface.

4.2.3 Results of the small-scale BangBox and large-scale field tests are highly encouraging. Both procedures and instruments were proved to be accurate and capable of meeting the requirements of the study. The amount of pollutants released into the atmosphere and soil were considered inconsequential.

4.2.4 The data indicates that, for those items tested, there is no serious impact to the environment; however, further studies must be done to determine the full environmental impact of OB/OD thermal treatment methods for the following reasons:

4.2.4.1 Bulk explosives constitute only a small fraction of the demilitarization inventory.

4.2.4.2 Their combustion products may not represent combustion products of encased munitions

4.2.4.3 Tests were site-specific only to a single locale.

4.2.4.4 The procedures used did not represent procedures customarily used at some treatment facilities, e.g. buried detonations.

4.3 Status

4.3.1 The current phase of the OB/OD study authenticated acceptable technology and methodology that can be used to obtain the munition- and site-specific emission characterization data. This data may then be used as part of the information needed to obtain permits for continued OB/OD operations. The data can be acquired by either constructing a single BangBox at a single site or constructing a BangBox at each specific site for emission characterization of site-specific munitions and soil.

4.3.2 An OB/OD dispersion model was also developed during the field trials of the study. A model acceptable to EPA is an essential adjunct to the BangBox emission characterization data in that it provides the mechanism to generate downwind concentrations at receptor locations, and input required for risk assessment to support site-specific permit applications. The model will require refinement and field validation before being made available to potential users.

4.3.3 As site- and munition-specific emissions data are collected and evaluated, they can provide part of the basis for risk assessment input which will evaluate which munitions, and explosive and propellants in the DoD inventory are applicable to OB/OD treatment, and which are not. For those not appropriate, the emissions characterization data can be used to more effectively focus efforts on the development and permitting of required alternative technologies.

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Office, Assistant Secretary of the Navy Installations and Environment Attn: Nancy Stehle Crystal Plaza 5, Room 236 Washington, DC 20360-5000	2
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Atmospheric Research and Exposure Assessment Laboratory 1
Quality Assurance Division
Research, Monitoring, and Evaluation Branch (MD-77B)
Research Triangle Park, NC 27711

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Hazardous Waste Branch 1
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Appendix F

Sampling and Analysis Plan for Closure of New Bomb

APPENDIX G

G.1 SAMPLING AND ANALYSIS PLAN FOR CLOSURE

Table of Contents

1.0 Introduction 1
1.1 Site Description 1
1.2 Objectives of Sampling and Analysis Plan 1
1.3 Work Organization and Responsibilities 2
2.0 Sampling Activities 3
2.1 Area of Concern 3
2.2 List of Parameters to be Sampled and Analyzed 3
2.3 Field Screening Techniques 3
2.4 Sampling Scheme and Methodology 4
2.5 Sampling Methods 4
2.5.1 Sampling Protocols 4
2.5.2 Sample Documentation 5
2.5.3 Sampling QA/QC Objectives and Procedures 5
3.0 Laboratory Analysis 7
3.1 Laboratory Analysis Protocols 7
3.2 Laboratory QA/QC Procedures 8
3.3 Data Validation Procedures 9
4.0 Evaluation of Site Characterization Data 11
Attachment A - Forms

1.0 Introduction

This Sampling and Analysis Plan (SAP) presents the sampling and analytical requirements for characterization of the New Bomb Area at the time of closure. Included in the SAP are objectives, scope of work, technical approach, methodologies, procedures, and quality assurance/quality control (QA/QC) protocols that will be utilized to characterize the surface and subsurface soil conditions in the New Bomb Area.

The SAP has been prepared by IT Corporation (IT) in accordance with Nevada Department of Conservation and Natural Resources (NVDCNR) Comment No. 7 to address closure plan requirements in 40 Code of Federal Regulations (CFR) 270.23(a)(2), 40 CFR 270.14(b)(13), and 40 CFR 264.112. The SAP is a part of the closure plan that addresses closure requirements and activities under the clean closure scenario for the New Bomb Area.

1.1 Site Description

New Bomb Area of Hawthorne Army Depot (HWAD) is utilized by the U.S. Army to conduct thermal treatment for demilitarization of unserviceable explosive items, which primarily consist of cartridges, projectiles, bombs, rockets, small arms, artillery, mortar, and powders. Treatment is accomplished by underground detonation (UD) and open burning (OB) in the UD unit located at the base of a 185-foot-high ridge within the New Bomb Area. Underground detonation and open burning are conducted by the HWAD contractor under the direction of the government staff assigned to quality assurance surveillance.

A typical UD operation takes place in a 20-foot-long by 6-foot-wide by 4-foot-deep earthen cell located at the base of the ridge. A total of 20 cells are available for UD with 10 cells located in the northern canyon and another 10 cells located in the southern canyon. Location of the UD cells and approximate extent of the affected areas are shown in Figure II-10 (Section II.F). OB is performed at the UD unit as well, until such time the Old Bomb Area located at the main base is permitted. OB is performed in metal pans approximately 16 feet long, 6 feet wide, and 1 foot deep in size.

1.2 Objectives of Sampling and Analysis Plan

The goal for closure of the UD unit is clean closure. Therefore, the objectives for the sampling and analysis at the UD unit include:

- Characterize the soil media in the area of the UD unit
- Compare the characterization results with background levels and risk-based levels
- Delineate, if any, the contaminated area(s) for remediation.

1.3 Work Organization and Responsibilities

Field sample collection will be performed by HWAD and/or contractor personnel trained in sampling at hazardous waste sites. A sampling task manager will be assigned to be responsible for sample collection, field analysis, labeling, documentation, packaging, and shipment or transfer of the samples to the designated laboratory for analysis. A sampling program coordinator or project manager will be responsible for sample data management, which involves tracking of samples from the time of collection through the reporting of analytical results, including knowing the status of each sample at all times. The project manager, with support from other project personnel at the home office, will compare the characterization results with appropriate background levels and risk-based levels to delineate, if any, the contaminated area(s) for remediation. If remediation is deemed necessary, the project manager will prepare and submit a remedial action plan, which presents remediation methods, verification sampling, and postclosure care activities.

2.0 Sampling Activities

The sampling activities that are to be performed in conjunction with the closure activities at the UD unit are described in the following sections.

2.1 Area of Concern

The area of concern (i.e., area to be sampled) includes the canyons where the UD cells and OB pans are located and the adjacent hillsides where the detonation and burn residues may have been deposited. The area of concern covers approximately 1,000 feet by 2,000 feet and is shown in Figure II-10 (Section II.F).

2.2 List of Parameters to be Sampled and Analyzed

The list of parameters to be sampled and analyzed is presented in Table II-8A (List of Potential Contaminants of Concern [COC]) in the Closure Plan. The list of potential COCs is adapted from the established basewide proposed closure goals (PCG) for soils at HWAD from the document "Hawthorne Army Depot, Remedial Investigation, Group B Solid Waste Management Units, Final Data Package," (Final Data Package; Tetra Tech, 1996) Volume 1, January 1996.

The list of potential COCs takes into consideration historical activities at HWAD, residues detected at other U.S. Department of Defense (DoD) OB/OD sites, and potential transformation products of explosives. The chemicals in the representative munitions items have been evaluated and representative constituents have been included as potential COCs in Table II-9A. Also, data collected according to the Waste Analysis Plan for the New Bomb Area were examined to ensure detected constituents were included as potential COCs. Polychlorinated biphenyls (PCB) and dioxins were excluded from the constituents of concern as there is no reason to believe they are present at the New Bomb Area.

2.3 Field Screening Techniques

Field screening for unexploded ordnance (UXO) and other materials (such as shrapnel), resulting from New Bomb operations, is performed after each treatment event and will be repeated at the time of closure. Procedures for the field screening (cleanup) are described in the Standing Operating Procedures (SOP) for New Bomb. Field screening for UXO will be performed prior to any field sampling activities.

2.4 Sampling Scheme and Methodology

A 200-feet-by-200-feet grid system will be laid out over the area of concern for sampling purposes. Surface soil samples will be randomly collected from the surface (up to 6 inches) at each grid node over the entire grid system. Subsurface soil samples will be randomly collected at a depth of approximately 2 to 4 feet from the central locations of the UD cells where underground detonations have occurred. It is estimated that 50 surface soil samples and 20 subsurface soil samples will be randomly collected.

2.5 Sampling Methods

Sampling methods, including sampling procedures, equipment, containers, preservation techniques, chain-of-custody, decontamination, and QA/QC procedures and objectives, are presented below.

2.5.1 Sampling Protocols

Sampling protocols, including sampling procedures, equipment, containers, preservation techniques, labeling, and decontamination, are described herein.

Surface and subsurface soil samples will be collected from the New Bomb UD area encompassing the north and south canyons where a total of 20 UD cells are located. Prior to sampling, the area will be inspected and cleared by an UXO team. A 200-feet-by-200-feet grid system will then be laid out over the area. Surface soil samples will be collected from 0 to 6 inches below grade at each grid node using a fresh or decontaminated small hand tool, such as stainless steel spoons or gardening trowels. Subsurface soil samples will be collected from a 2- to 4-foot depth interval below grade at the central locations of the UD cells using a shovel or hand auger to reach the desired depth, and then using the same sampling equipment as for the surface samples. Depending on analytical requirements, a sufficient quantity of soils (e.g., 100 grams) will be collected in precleaned containers (e.g., laboratory-supplied sample jars for various analyses). At a minimum, all samples will be placed on ice immediately after collection to chill the samples to 4 degrees Celsius (°C).

Sample labels will be placed on all containers at the time the sample is collected. Sample labels will be filled out with waterproof ink and will include the following information: sample identification, sampling date, sample location, and analyses to be performed. In addition, upon completion of sample collection activities, a combined Request for Analysis and Chain-of-Custody Record form will be completed by the sampling team members as a part of sample documentation described in Section 2.5.2.

Note that extra amount of soils may be needed for QA/QC samples. At least one duplicate sample will be collected per sampling event. Field QA/QC procedures are outlined in Section 2.5.3.

2.5.2 Sample Documentation

An integral part of the QA/QC procedures for the field sampling activities will be maintaining complete field documentation.

A Field Activity Daily Log (FADL) will be completed each day when work is performed. Site observations and a description of sampling activities will be documented on the FADL by the sampling task manager or his/her designee (such as the QC officer). Each sample collected will be recorded on a Sample Collection Log that includes the date and time of sample collection, sample method, bottle requirements, and analytical parameters. Sampling activities involving off-site testing and analysis will be documented by a combined Request for Analysis/Chain-of-Custody Record form. This form will serve as the official record of sample custody. Chemical analytical results will be filed with the Request for Analysis/Chain-of-Custody Record forms. Examples of these field documentation forms are provided in Attachment A.

2.5.3 Sampling QA/QC Objectives and Procedures

The objectives of sampling QA/QC procedures are to generate field samples that can provide scientifically valid and legally defensible data. Several types of QA/QC samples are incorporated into the field sampling program. At least one field duplicate sample will be collected for each day of sampling or every 20 samples, whichever comes first, to ensure that the field sampling crew is obtaining samples that are representative of conditions at the site. All samples will be thoroughly mixed during sampling. This is critical because inadequate mixing of the samples could yield inaccurate analytical results. If the sampling equipment utilized to collect the samples is decontaminated between uses, a rinsate sample will be collected after decontamination to ensure that proper decontamination procedures are followed.

3.0 Laboratory Analysis

Analytical methods, including laboratory methods, detection limits, quantitation limits, QA/QC procedures, and data validation procedures, are described below.

3.1 Laboratory Analysis Protocols

Unless otherwise noted, the soil samples collected from the New Bomb UD unit will be analyzed in the laboratory by analytical protocols as contained in "Test Methods for Evaluating Solid Waste" (SW-846, Third Edition, 1986) and Appendix I in Appendix D of "RCRA Part B Permit Application for Underground Detonation at Hawthorne Army Depot, Nevada" (Part B Permit, July 1993, as revised). The chemical groups are presented in Table II-9A (Part B Permit, July 1993, as revised) and their analytical methods are summarized below:

- Toxicity Characteristic Leaching Procedure, Method 1311 of SW-846.
- Gap Test for Determination of Explosive Reactivity, Method 5 of Appendix I.
- Internal Ignition Test for Determination of Explosive Reactivity, Method 6 of Appendix I.
- Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC), Method 8330 of SW-846.
- Analysis for Explosives, HPLC, Method 1 of Appendix I.
- Analysis for Metals, Method 6010 and/or 7000-series methods of SW-846 to achieve required reporting limits.
- Analysis for Volatile Organics, Method 8240 of SW-846 or latest update.
- Analysis for Semivolatile Organics, Method 8270 of SW-846 or latest update.
- Analysis for Polynuclear Aromatic Hydrocarbons (PAH), Method 8310 of SW-846 or latest update.

Method detection limits and quantitation limits for the above analytical methods are based on several factors, and will be supplied by the laboratory at the time of analysis.

3.2 Laboratory QA/QC Procedures

The laboratory QA/QC procedures outlined below are designed to provide scientifically valid and legally defensible data. Several types of quality control indicators are incorporated into the QA/QC program. These indicators are introduced into the sample testing process to provide a mechanism for the assessment of the analytical data.

Several quality control samples are included in each QC batch and are processed identically to the other environmental samples. These QC samples include a Method Blank (MB), a Laboratory Control Sample (LCS), and a Matrix Spike/Matrix Spike Duplicate (MS/MSD). An additional pair of samples will be collected to ensure enough samples are obtained to perform the MS/MSD analyses.

The LCS is a QC sample that is created by adding known concentrations of a full or partial set of target analytes to a matrix similar to that of the environmental samples in the QC batch. The LCS analyte recovery results are used to monitor the analytical process and provide evidence that the laboratory is performing the method within acceptable guidelines. Failure to meet the established recovery guidelines requires the repreparation and reanalysis of all samples in the QC batch.

At times, a Laboratory Control Sample Duplicate (LCSD) is also included in the QC batch. An LCSD is a QC sample that is created and handled identically to the LCS. Analyte recovery data from the LCSD are assessed in the same way as those of the LCS. The LCSD recoveries, together with the LCS recoveries, are used to determine the reproducibility (precision) of the analytical system. Precision data are expressed as relative percent differences (RPD). Failure of the RPDs to fall within the laboratory-generated acceptance windows requires the repreparation and reanalysis of all samples in the QC batch.

The MB is a QC sample consisting of all the reagents used in analyzing the environmental samples contained in the QC batch. Method Blank results are used to determine if interference or contamination in the analytical system could lead to the reporting of false positive data or elevated analyte concentrations. All target analytes must be below the reporting limits except for the common laboratory contaminants indicated as follows:

Volatile (GC or GC/MS)	Semivolatile (GC/MS)	Metals
Methylene chloride	Phthalate Esters	Copper
Acetone		Iron

2-Butanone	Zinc
	Lead

The listed volatile and semivolatile compounds may be present in concentrations up to 5 times the reporting limits. All other organic analyte concentrations must be below the reporting limits. The listed metals may be present in concentrations up to 2 times the reporting limit, or must be twenty-fold less than the results of the environmental samples. Failure to meet these MB criteria requires the repreparation and reanalysis of all samples in the QC batch.

A MS/MSD are a pair of environmental samples to which known concentrations of a full or partial set of target analytes are added. The MS/MSD results are determined in the same manner as the results of the environmental sample used to prepare the MS/MSD. The analyte recoveries and the RPD of the recoveries are calculated and used to evaluate the effect of the sample matrix on the analytical results. When evaluating the MS/MSD data, special attention is given to the RPD values. When these values fail to meet acceptance criteria, the data are reviewed to determine the cause. If, in the analyst's judgment, sample matrix effects are indicated, no corrective action is performed. Otherwise, the MS/MSD and the environmental sample used to prepare them are reprepared and reanalyzed.

In addition to these batch-related QC indicators, each organic environmental and QC sample is spiked with surrogate compounds. Surrogates are organic chemicals that behave similarly to the analytes of interest and that are rarely present in the environment. Surrogate recoveries are used to monitor the individual performance of a sample in the analytical system.

3.3 Data Validation Procedures

Each sample result collected as a part of the sampling and analysis program will be verified and validated in accordance with the procedures provided in the U.S. Environmental Protection Agency (USEPA) guidance developed for the USEPA Contract Laboratory Program (CLP) (USEPA, February 1988, updated February 1994; USEPA, July 1988, updated February 1994). Verification of laboratory chemical data will be the responsibility of the laboratories performing the analysis. Validation of all data will be the responsibility of the HWAD and/or its contractor.

Typically, the data validation process includes an assessment of the following QC requirements:

- Sample holding time and preservation (verification of sampling, extraction, and analysis dates from a review of chain-of-custody records, extraction logs, and run logs)

- Gas chromatography/mass spectrometry (GC/MS) tuning and GC instrument performance for organics
- Initial and continuing calibration
- Method, preparation, and calibration (inorganics) blank contamination (including trip blanks for volatile organic compounds [VOC])
- Surrogate spike recoveries (organics)
- LCS spike recoveries
- MS/MSD spike recoveries and precision between results
- Internal standards performance (organics)
- Inductively Coupled Plasma (ICP) interference check sample (ICS) results (inorganics)
- ICP serial dilution results (inorganics).

In addition, for detected analytes, the data validation process includes an evaluation of the reliability of the quantitation, with consideration of several other factors, such as retention time, spectral match, calibration range, matrix interference, and internal standards.

4.0 Evaluation of Site Characterization Data

Site characterization data are to be compared to relevant action levels that will be developed at the time of closure.

ATTACHMENT A
FORMS

INTERNATIONAL TECHNOLOGY CORPORATION

DAILY LOG	DATE			
	NO.			
	SHEET		OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SIGNATURE	DATE:

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

SAMPLE COLLECTION LOG

PROJECT NAME _____

SAMPLE NO. _____

SAMPLE LOCATION _____

SAMPLE TYPE _____

COMPOSITE ____ YES ____ NO

COMPOSITE TYPE _____

DEPTH OF SAMPLE _____

WEATHER _____

CONTAINERS USED	AMOUNT COLLECTED

COMMENTS:

PREPARED BY: _____

COMMENTS: (Continued)

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

PREPARED BY: _____

LEGEND

1. A SAMPLE COLLECTION LOG IS TO BE COMPLETED FOR EACH SAMPLE.
2. ALWAYS COMPLETE BOTH SIDES. IF SECOND SIDE IS NOT USED, DRAW A LINE THROUGH IT AND MARK N/A. FILL IN CONTROL BLOCK AND PREPARED BY.
3. ALL ENTRIES ON LOG ARE TO BE COMPLETED, IF NOT APPLICABLE MARK N/A.
4. DATE: USE MONTH/DAY/YEAR; I.E., 10/30/85
5. TIME: USE 24-HOUR CLOCK; I.E., 1835 FOR 6:35 P.M.
6. PAGE: EACH SAMPLE TEAM SHOULD NUMBER PAGE ____ OF ____ FOR THE DAY'S ACTIVITIES FOR ALL SHEETS PREPARED ON A SINGLE DAY, I.E., IF THERE ARE A TOTAL OF 24 PAGES (INCLUDING FRONT AND BACK) NUMBER 1 OF 24, 2 OF 24, ETC.
7. SAMPLE LOCATION: USE BORING OR MONITORING WELL NUMBER, GRID LOCATION (TRANSECT), SAMPLING STATION I.D., OR COORDINATE TO PHYSICAL FEATURES WITH DISTANCES. INCLUDE SKETCH IN COMMENT SECTION IF NECESSARY.
8. SAMPLE TYPE: USE THE FOLLOWING - SOIL; WATER (SURFACE OR GROUND); AIR (FILTERS, TUBES, AMBIENT, PERSONNEL); SLUDGE; DRUM CONTENTS; OIL; VEGETATION; WIPE; SEDIMENT.
9. COMPOSITE TYPE: I.E., 24-HOUR, LIST SAMPLE NUMBERS IN COMPOSITE, SPATIAL COMPOSITE.
10. DEPTH OF SAMPLE: GIVE UNITS, WRITE OUT UNITS SUCH AS INCHES, FEET. DON'T USE ' OR ".
11. WEATHER: APPROXIMATE TEMPERATURE, SUN AND MOISTURE CONDITIONS.
12. CONTAINERS USED: LIST EACH CONTAINER TYPE AS NUMBER, VOLUME, MATERIAL (E.G., 2 - IL GLASS; 4 - 40 ML GLASS VIAL; 1 - 400 ML PLASTIC; 1 - 3 INCH STEEL TUBE; 1 - 8 OZ. GLASS JAR).
13. AMOUNT COLLECTED: VOLUME IN CONTAINERS (E.G. 1/2 FULL).

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 405042
Page 1 of ____

Project Name/No. [1] _____
Sample Team Members [2] _____
Profit Center No. [3] _____
Project Manager [4] _____
Purchase Order No. [6] _____
Required Report Date [11] _____

Samples Shipment Date [7] _____
Lab Destination [8] _____
Lab Contact [9] _____
Project Contact/Phone [12] _____
Carrier/Waybill No. [13] _____

Bill to: [5] _____
Report to: [10] _____

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation)	Date: Time:	1. Received by [28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No. ______
Page____of ____

Project Name

Project No.

Samples Shipment Date

ONE CONTAINER PER LINE

Sample 14 Number	Sample 15 Description/Type	Date/Time 16 Collected	Container 17 Type	Sample 18 Volume	Pre-19 servative	Requested Testing 20 Program	Condition on 21 Receipt	Disposal 22 Record No.
							FOR	LAB
							USE	ONLY
							FOR	LAB
							USE	ONLY
							FOR	LAB
							USE	ONLY
							FOR	LAB
							USE	ONLY
							FOR	LAB
							USE	ONLY
							FOR	LAB
							USE	ONLY
							FOR	LAB
							USE	ONLY

Non-Conformance Report

1	PROJECT NAME:	2	JOB NO.
3	LOCATION:	4 DATE:	5 NCR NO.

6 DESCRIPTION OF NON-CONFORMANCES:

PREPARED BY: _____ DATE: _____
Quality Control Representative

REVIEWED BY: _____ DATE: _____
Quality Control Manager

7 DISPOSITION:

RECOMMENDED BY: _____ DATE: _____

REVIEWED BY: _____ DATE: _____
Quality Control Representative

8 ACTION VERIFICATION:

IMPLEMENTED BY: _____ DATE: _____

VERIFIED BY: _____ DATE: _____
Quality Control Representative

9 NCR CLOSE-OUT _____ DATE: _____
Quality Control Manager

APPENDIX H

H.1 BORING LOG 1984
H.2 INSTILLATION REPORT MONITORING WELL 1996
H.3 HAWTHORN WATER QUALITY DATA
H.4 SURFACE WATER RUN-OFF DATA
H.5 GEOTECHNICAL DATA NEW BOMB
H.6 WELL #2 ANALYTICAL DATA

APPENDIX H

H.1 BORING LOG 1984

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT 38-26-0535-85 DATE 17 Nov 84

LOCATION Hawthorne Army Ammunition Plant DRILLERS Smithson, Schroeder

DRILL RIG Mobile B53 BORE HOLE NBA 1

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN.	DESCRIPTION	REMARKS
15		Grey silty coarse sand with gravel greater than one inch diameter	
20		Silty medium to coarse sand with increasing numbers of rocks	Rocks being struck by auger
25			
30			

HSHB-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT 38-26-0535-85 DATE 17 Nov 84

LOCATION Hawthorne Army Ammunition Plant DRILLERS Smithson, Schroeder

DRILL RIG Mobile B53 BORE HOLE NBA 1

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN.	DESCRIPTION	REMARKS
30			
35			- No water in hole -
40		Bottom of Hole	Refusal
45			

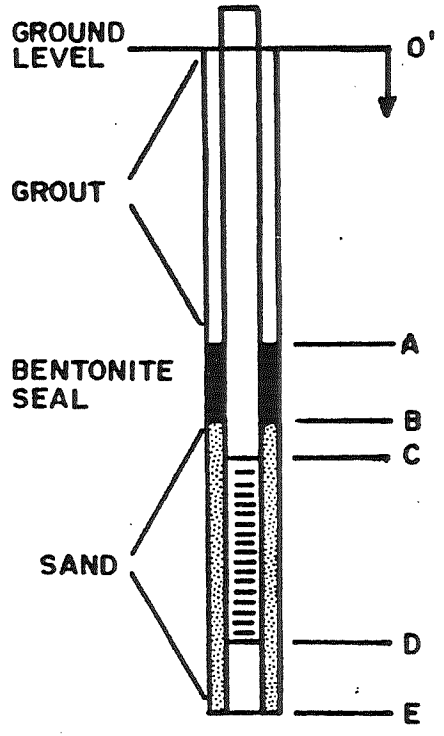
HSHB-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

GROUNDWATER MONITOR WELL SUMMARY

PROJECT Hawthorne AAP DATE 17 Nov 84



A – TOP OF BENTONITE SEAL
B – TOP OF SAND
C – TOP OF WELL SCREEN
D – TOP OF SEDIMENT TRAP
E – TOTAL WELL DEPTH

WELL NO.	NBA-01						
A	31'						
B	32'6"						
C	34'6"						
D	44'4"						
E	44'6"						
GROUT THICKNESS	2"						
BENTONITE SEAL THICKNESS	2"						
LENGTH OF PIPE	44'6"						
LENGTH OF STANDPIPE	3'						
LENGTH OF SCREEN	10'						
LENGTH OF SEDIMENT TRAP	2"						
SCREEN SLOT SIZE	.001"						
INITIAL WATER LEVEL	No water						
24 HOUR WATER LEVEL	No water						
GROUND LEVEL ELEVATION	Unknown						
REMARKS							

AEHA Form 93, 1 Aug 81 (HSE-ES)

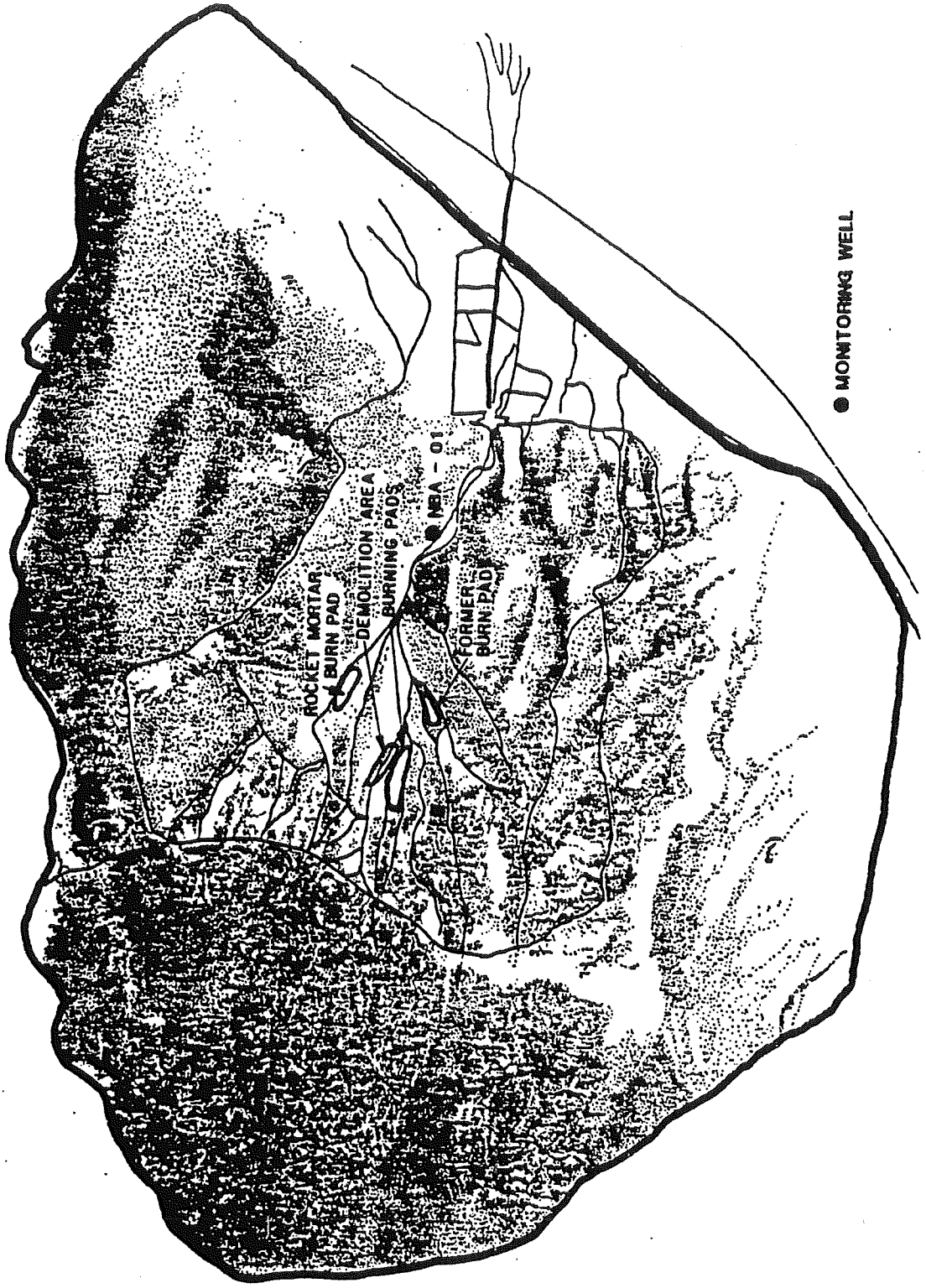


FIGURE 2. SITE PLAN OF NEW BOMB OB/OD FACILITY

APPENDIX H

H.2 INSTILLATION REPORT MONITORING WELL 1996

HAZWRAP

HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM

761041-7

Regulatory Support for Hawthorne Army Depot, Nevada

Monitoring Well Installation Report, New Bomb Area

November 1996

Prepared by
IT Corporation
Monroeville, Pennsylvania

HAZWRAP SUPPORT CONTRACTOR OFFICE
Oak Ridge, Tennessee 37831
operated by
Lockheed Martin Energy Systems, Inc.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

Regulatory Support
for
Hawthorne Army Depot, Nevada

Monitoring Well Installation Report, New Bomb Area

Table of Contents

List of Tables/List of Figures/List of Appendices ii
1.0 Introduction 1
2.0 Facility Setting and Monitoring Well Location 1
3.0 Summary of Field Activities 2
4.0 Summary of Analytical Results 4
5.0 Conclusions 5
6.0 References 5

List of Tables

Table	Title
1	Summary of Monitoring Well Sampling and Chemical Analysis Program

List of Figures

Figure	Title
1	Proposed Monitoring Well Location at New Bomb

List of Appendices

Appendix	Title
A	Monitoring Well Installation Work Plan
B	Boring Log
C	Sample Collection Logs
D	Soil Cuttings Analytical Data
E	Monitoring Well Abandonment Notification

1.0 Introduction

This report summarizes the field activities associated with the planned installation of a monitoring well at the Hawthorne Army Depot (HWAD) New Bomb area near Hawthorne, Nevada. These field activities occurred at the request of the Nevada Division of Environmental Protection (NDEP) under the supervision of IT Corporation (IT) to characterize downgradient groundwater quality at the New Bomb area. No groundwater samples were collected because the water table was not encountered at the site. Soil cutting samples were collected and analyzed to ensure the proper disposal of the cuttings generated during the planned monitoring well installation activities. Concentrations of inorganics in one surface soil sample were used to supplement existing data on naturally occurring background concentrations for New Bomb area soils.

2.0 Facility Setting and Monitoring Well Location

The New Bomb underground detonation (UD) area is located approximately 22 miles south of HWAD in Mineral County, Nevada. The New Bomb area occupies approximately 3,000 acres of land leased from the U.S. Forest Service (USFS). Underground detonation of unusable or unstable munitions is conducted by the HWAD contractor within the New Bomb area. An in-depth discussion of the site's physiographical, topographical, and geological characteristics is presented in the Resource Conservation and Recovery Act (RCRA) Part B Permit Application for Underground Detonation at Hawthorne Army Ammunition Plant, Nevada prepared by The Earth Technology Corporation (1993).

Two distinct stratigraphic units are present in the immediate New Bomb UD area, mafic volcanic rocks and alluvium of the Quaternary Period. According to Plate No. 2 of the *Geology and Mineral Deposits of Mineral County, Nevada, Bulletin No. 58* (Ross, 1961) numerous faults have been mapped in the region. Two of these faults are located near the New Bomb area (Figure 1). An existing monitoring well was installed to refusal at a depth of 44 feet below ground surface in November 1984 (Figure 1). This monitoring well did not intercept the water table and has historically been dry. The most probable reason why no groundwater has been observed in the existing well is that the well is located in an area where bedrock is close to the surface, and the alluvial deposits are not deep enough to intercept the water table. The area where the new monitoring well is located is further downgradient (Figure 1), in an effort to encounter a sequence of alluvium where the water

table can be encountered. The location of the planned well is Nevada R 30 E, T 5 N, section 34, SE 1/4 of NE 1/4.

3.0 Summary of Field Activities

This section summarizes the field procedures conducted during the installation of the planned monitoring well at the New Bomb UD area. All work was conducted as outlined in the NDEP-approved Work Plan, Revision No. 1, submitted to the Agency on June 20, 1996 (Appendix A).

Health and Safety. On August 5, 1996, prior to commencement of the drilling activities, HWAD personnel conducted a brief health and safety meeting, and special attention was given to the hazards of unexploded ordnance (UXO) at the New Bomb area. A map of the New Bomb area was presented outlining the area which had been previously swept for the presence of UXO. Activities for monitoring well installation occurred within this perimeter.

Prior to the commencement of work each day, IT personnel conducted a tailgate safety meeting following the site-specific Health and Safety Plan (Chapter 4.0 of the HWAD Final Project Plan, Revision 1.0; IT, 1996a). During this meeting, pertinent health and safety issues were discussed, including the use of personal protective equipment (PPE), and chemical and physical hazards present at the site. All drilling activities were completed in Level D PPE.

Drilling Activities. Stewart Brothers Drilling Company of Milan, Mew Mexico was selected as the drilling subcontractor for the New Bomb monitoring well installation. On August 5, 1996, drilling began to install monitoring well NB-MW02 at the New Bomb area. On August 6, the total depth of the well, 200 feet, was reached. Groundwater was not encountered, and no potential intermittent water producing zones were observed. Drilling activities utilized a Failing F-10 auger rig with 6-5/8 inch inside diameter (I.D.) hollow stem augers. The air rotary drilling method discussed in the work plan (IT, 1996b) as an alternate method was not used.

The field geologist completed a detailed boring log for the monitoring well, during installation activities. This boring log describes the lithology encountered and relates any

pertinent information regarding well installation. The boring log for monitoring well NB-MW02 is provided in Appendix B.

Soil Sample Collection. Four soil samples and one field duplicate sample were collected for chemical analysis of the constituents shown in Table 1. Sample NB-MW02-S1 was collected from the surface soil (0 to 6 inches in depth), while the remaining four samples, NB-MW02-S2 through NB-MW02-S5 were randomly collected from the thirteen 55-gallon open-top steel drums to containerize soil cuttings. Appendix C contains the sample collection logs for the soil samples.

Monitoring Well Construction. As stated in the work plan (IT, 1996b) at the request of NDEP, the monitoring well was to be installed even if no groundwater was encountered. The reasoning for this request by NDEP was to monitor the potential future occurrence of seasonal groundwater, if no groundwater was encountered during the August 1996 installation.

After reaching the total depth of the boring, an attempt was made to construct the monitoring well. The riser pipe and screen were placed inside the hollow stem augers, and the sand pack was placed around the well as the augers were pulled from the hole. The monitoring well was constructed of 4-inch I.D. schedule 40 polyvinyl chloride (PVC) riser. All sections, including the screen, were flush-threaded. The monitoring zone was constructed using a 0.010-inch, continuous slotted screen, 15 feet in length. As the augers were being pulled from the hole, the augers broke off, leaving approximately 40 feet of augers and the leading bit in the hole. Since no water had been encountered and the well was still dry, it was decided, with NDEP approval, that the well should be plugged and abandoned to prevent potential problems associated with leaving the borehole open and allowing contaminants, if any, to migrate downward to potential uncontaminated aquifer zones below 200 feet. Abandonment was completed by filling the PVC casing with cement bentonite grout as well as the remaining annular space.

Waste Handling Procedures. The drill cuttings produced during monitoring well installation were treated as potentially contaminated solid material and were containerized in 55-gallon drums, pending the analytical data results. The drilling subcontractor provided the 55-gallon open-top steel drums for containerization of all potentially contaminated solid

materials including drill cuttings and PPE. All drums were properly marked with a paint marker indicating the drum contents and the date of generation. The full drums were staged in the immediate area until the analytical results were received.

Decontamination Procedures. Intrusive equipment (rig, drill steel, samplers, etc.) were cleaned prior to and after use with a high-pressure steam cleaner. This cleaning procedure was conducted at the main base area of the HWAD facility where a designated decontamination area had been established.

4.0 Summary of Analytical Results

This section presents a summary of the analytical results for the soil samples collected during well installation procedures. The Toxicity Characteristic Leaching Procedure (TCLP) results are presented in the first subsection followed by the total metals results for the surface soil sample. The analytical data from Quanterra Environmental Services are provided in Appendix D.

TCLP Sample Results. Three samples and one field duplicate sample were submitted for full TCLP analysis to characterize the drum cuttings generated during well installation activities. The only analyte detected above the detection limits was barium, which was identified in all the samples at concentrations just slightly above the detection limit. No organic compounds were identified above the respective detection limits. The highest barium result was 0.20 milligrams per liter (mg/L), which is considerably below the regulatory TCLP criterion of 100 mg/L (40 Code of Federal Regulations [CFR] 261.24).

Total Metals Sample Results. One surface soil sample was collected and analyzed for total metals. The analytical results will be utilized to supplement currently available background levels for metals in soil for the New Bomb site. Samples were tested for ten metals including aluminum, antimony, barium, beryllium, cadmium, chromium, lead, mercury, selenium, and silver. The detected metal concentrations for this sample are as follows: aluminum (3,440 milligrams per kilogram [mg/kg]), arsenic (0.87 mg/kg), barium (40.2 mg/kg), beryllium (0.21 mg/kg), chromium (1.9 mg/kg), and lead (4.6 mg/kg). All other metals were below analytical detection limits. These results are all below the 95 percent upper tolerance limit (UTL) for naturally occurring constituents in the Hawthorne

Valley background samples (Tetra Tech, 1996, as presented in *Surface Runoff Drainage Area Sampling Results - New Bomb Area*, IT, 1996c).

5.0 Conclusions

The objective of this report was to present the field activities associated with the installation of a monitoring well at the HWAD New Bomb UD Area near Hawthorne, Nevada. Since groundwater was not encountered and because of complications encountered during monitoring well construction, the monitoring well was abandoned, as approved by NDEP and following Nevada Department of Conservation and Natural Resources (NDCNR) Division of Water Resources (DWR) recommendations. A copy of abandonment notification is presented in Appendix E.

These results demonstrate that there is no known downgradient groundwater contamination at the New Bomb area, to a depth of 200 feet below ground surface, as a result of thermal treatment operations that have been performed since World War II.

Analytical results from TCLP analysis of four soil samples collected to characterize the soil boring cuttings showed that only barium was detected at concentrations which slightly exceeded the detection limits. The elevated concentration of barium did not exceed the TCLP standard and the soil cuttings are characterized as nonhazardous. A single surface soil sample was collected to obtain background metals concentrations for the New Bomb Area. This sample contained detectable total metal concentrations of aluminum, arsenic, barium, beryllium, chromium, and lead.

6.0 References

Earth Technology Corporation, 1993, RCRA Part B Permit Application for Underground Detonation at Hawthorne Army Ammunition Plant, Hawthorne, Nevada.

IT, 1996a, Regulatory Support for Hawthorne Army Depot, Nevada, Final Project Plan, Revision 1.0, prepared by IT Corporation, Monroeville, Pennsylvania, July 1996.

IT, 1996b, Monitoring Well Installation Work Plan, Revision 1.0, New Bomb Area, Hawthorne Army Depot, prepared by IT Corporation, Monroeville, Pennsylvania, June 20, 1996.

IT, 1996c, "Surface Runoff Drainage Area Sampling Results, New Bomb Area," prepared by IT Corporation, Monroeville, Pennsylvania, October 2, 1996.

Ross, D. C., 1961, "*Geology and Mineral Deposits of Mineral County, Nevada,*" Bulletin No. 58, Mackay School of Mines, University of Nevada, Reno.

Tetra Tech, 1996, "Final Investigation - Derived Waste Management Plan," Hawthorne Army Depot, Hawthorne, Nevada, prepared for the U.S. Army Corps of Engineers by Tetra Tech, Inc., San Francisco, California, March.

TABLE

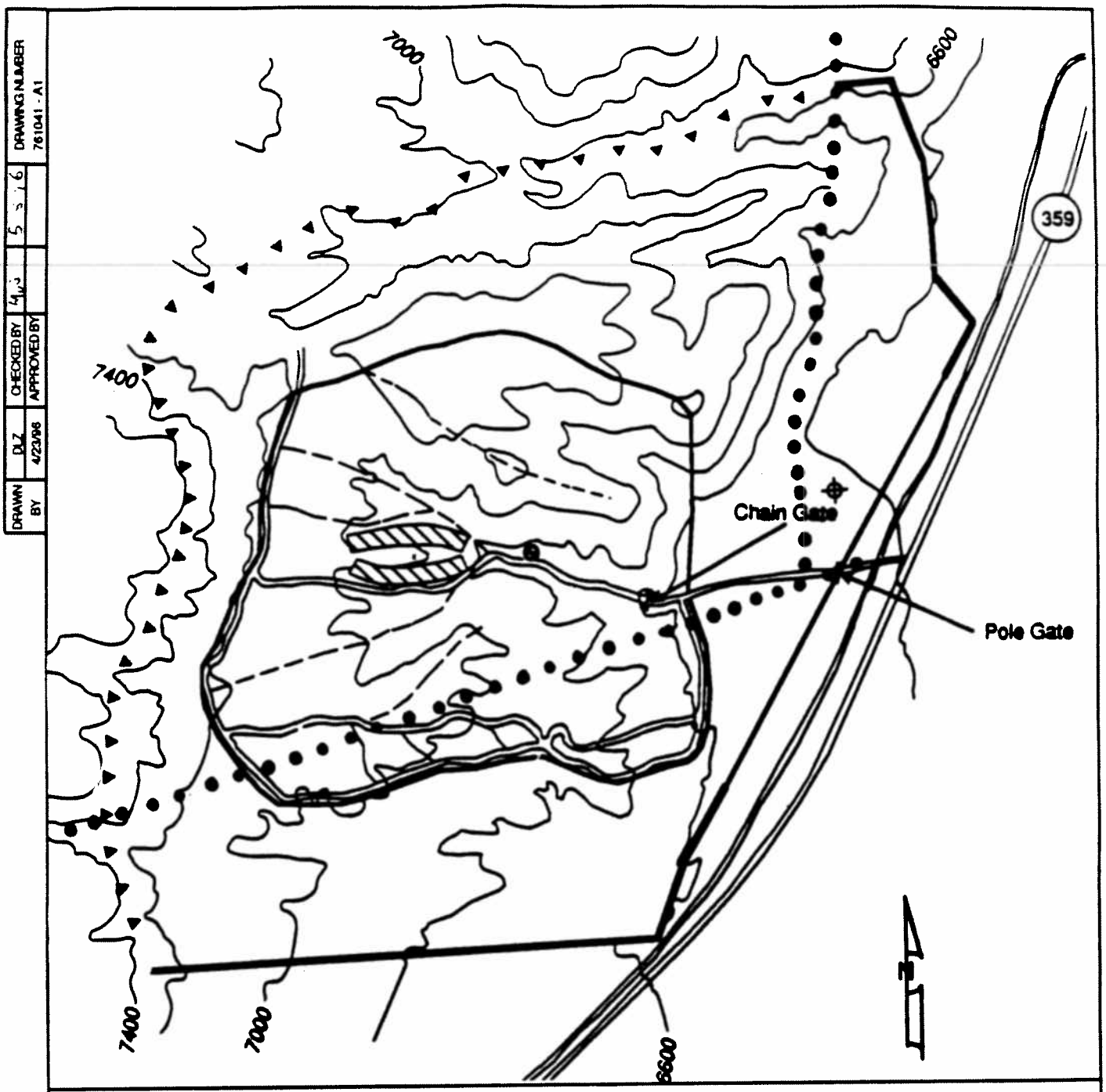
Table 1
Summary of Monitoring Well Sampling and Chemical Analysis Program
New Bomb Area, Hawthorne Army Depot, Nevada

Sample ID	Sample Type	Metals by Methods 6010/7470	Full TCLP by Method 1311
NB-MW01-S1	Surface Soil	1	-
NB-MW01-S2	Soil Cutting	-	1
NB-MW01-S3	Soil Cutting	-	1
NB-MW01-S4	Soil Cutting	-	1
NB-MW01-S5	Soil Cutting/ Field Duplicate	-	1

Notes: (1) Quality assurance/quality control (QA/QC) samples will included one field duplicate sample for the analytical program.

(2) All methods followed SW-846 protocol, unless otherwise noted.

FIGURE



DRAWN BY DLZ 4/23/98
CHECKED BY
APPROVED BY
DRAWING NUMBER 761041 - A1

FIGURE 1

Proposed Monitoring Well Location at New Bomb

HAWTHORNE ARMY DEPOT

INTERNATIONAL TECHNOLOGY CORPORATION

APPENDIX A
MONITORING WELL INSTALLATION WORK PLAN

INTERNATIONAL TECHNOLOGY CORPORATION

June 20, 1996

Project Number 761041

Greg Lovato
Nevada Department of Conservation and Natural Resources
Bureau of Waste Management
333 West Nye Lane
Carson City, Nevada 89710

Transmittal
Monitoring Well Installation Work Plan, Revision 1.0
New Bomb Area, Hawthorne Army Depot

Dear Mr. Lovato:

Enclosed for your review, as attachment No. 1, is the revised monitoring well installation work plan for the New Bomb area at Hawthorne Army Depot (HWAD). The work plan has been revised based on your review comments dated June 3, 1996. This well is to be installed at Nevada Department of Conservation and Natural Resources' (NDCNR) request as part of the Part B permit application for underground detonation (UD) that currently takes place at the New Bomb area.

Also included is information required by the Nevada Division of Water Resources (DWR), including a waiver application and affidavit to abandonment.

Please review the information and send your comments to Mr. Herman Millsap at HWAD and Mr. Mark Weisberg at IT Corporation (IT). Please call me with any questions at (412) 858-3996. To expedite the schedule and allow coordination with the driller that will be working on site for the Installation Restoration Program (IRP), please respond by July 31, 1996.

Sincerely,
IT CORPORATION

Mark Weisberg, CHMM
Project Manager

cc: Herman Millsap - HWAD
Paul Seday - HAZWRAP
George Jackson - Nevada DWR

WORK PLAN, REVISION NO. 1

MONITORING WELL INSTALLATION

NEW BOMB AREA
HAWTHORNE ARMY DEPOT

Table of Contents

List of Tables/List of Figures/List of Appendices ii
1.0 Introduction 1
2.0 Facility Setting and Proposed Monitoring Well Location 1
3.0 Coordination Prior to Well Installation 2
4.0 Waiver Request 2
5.0 Scope of Work 3

List of Tables

Table	Title
1	Summary of Monitoring Well Sampling and Chemical Analysis Program
2	Affidavit to Abandonment

List of Figures

Figure	Title
1	Proposed Monitoring Well Location at New Bomb

List of Appendices

Appendix	Title
A	USFS Approval Letter for Monitoring Well Installation
B	NDCNR Division of Water Resources Waiver
C	Calculation Sheet No. 1 - Calculation of Screen Slot Size and Filter Pack Material

1.0 Introduction

This Work Plan addresses the issues concerning the installation of one monitoring well at the Hawthorne Army Depot (HWAD) New Bomb area near Hawthorne, Nevada. The monitoring well is to be installed under the supervision of IT Corporation (IT) to characterize downgradient groundwater quality at the New Bomb area. Soil cuttings will be evaluated to ensure the proper disposal of cuttings generated during the monitoring well installation activities. Assuming that soil cuttings are not contaminated, concentrations of inorganics will be used to establish naturally occurring background concentrations for New Bomb area soils. Following the monitoring well installation, four quarterly groundwater samples will be collected from the monitoring well to characterize the water quality downgradient of the New Bomb area (Table 1).

2.0 Facility Setting and Proposed Monitoring Well Location

The New Bomb underground detonation (UD) area is located approximately 22 miles south of the HWAD in Mineral County Nevada. The New Bomb area occupies approximately 3,000 acres of land leased from the U.S. Forest Service (USFS). Underground detonation of unusable or unstable munitions is conducted by the HWAD contractor within the New Bomb area. An in-depth discussion of the site's physiographical, topographical, and geological characteristics is presented in the Resource Conservation and Recovery Act (RCRA) Part B Permit Application for Underground Detonation at Hawthorne Army Ammunition Plant, Nevada prepared by The Earth Technology Corporation (1993).

Two distinct stratigraphic units are present in the immediate New Bomb UD area, mafic volcanic rocks and alluvium of the Quaternary Period. According to Plate No. 2 of the *Geology and Mineral Deposits of Mineral County, Nevada, Bulletin No. 58* (Ross, 1961), the area is heavily faulted. An existing monitoring well was installed to refusal at a depth of 44 feet below ground surface in November 1984 (Figure 1). This monitoring well did not intercept the water table and has historically been dry. The most probable reason why no groundwater has been observed in the existing well is that the well is located in an area where bedrock is close to the surface, and the alluvial deposits are not deep enough to intercept the water table. The proposed area for the new monitoring well is located further downgradient (Figure 1), in an effort to encounter a sequence of alluvium where the water

table can be encountered. The proposed location of this well is Nevada R 30 E, T 5 N, section 34, SE 1/4 of NE 1/4.

3.0 Coordination Prior to Well Installation

Before the monitoring well is installed at the New Bomb area, IT will obtain utility digging clearance to ensure no underground utilities are encountered during well installation. IT will also inform Day/Zimmerman Hawthorne Corporation (DZHC) two (2) weeks in advance of well installation so they may inspect and clear the area for potential unexploded ordnance (UXO). IT has supplied HWAD with all necessary information so the USFS may be contacted to approve the proposed well installation [Note: USFS approval is contained in Appendix A]. The well installation will not be initiated until written approval is received from the Nevada Department of Conservation and Natural Resources (NDCNR).

4.0 Waiver Request

IT has obtained a waiver from NDCNR Division of Water Resources (DWR) (Appendix B) in conjunction with NRS 534.025, 534.040 and NAC 534.435, as specified by Mr. George Jackson, Nevada DWR, in a fax dated May 1, 1996. As required by the Nevada DWR, the waiver request contained the following:

- Name and address of property owner as it appears on County Records (U.S. Forest Service).
- Assessors Parcel number(s) of property where well is to be drilled (Nevada R 30 E, T 5 N, section 34, SE 1/4 of NE 1/4).
- Legal description of property and street address if available (approximately 3,000 acres of USFS land leased to the U.S. Army through a special use permit for demolition purposes).
- Number of wells requesting to be drilled (one monitoring well).
- Description of well construction (see monitoring well construction details below).
- A brief description as to why the well is needed, i.e. what is to be monitored, what is expected to be encountered (the objective of the well installation is to characterize downgradient groundwater quality at the New Bomb area; no significant contamination is expected to be found).

- NAC regulation to be waived (NAC 534.435 Observation or Monitor Wells; Waiver to Drill; Casing; Permit to Appropriate Not Required).

- Proposed project completion date (well installation estimated to occur during the summer of 1996, with collection of groundwater samples estimated to be completed by late summer 1997).

- Affidavit signed by owner (affidavit to abandonment per DWR guidelines; Table No. 2).

5.0 Scope of Work

This work plan defines the procedures necessary to drill and install a 4-inch diameter monitoring well complete with a submersible pump, at a location which is hydraulically downgradient of the New Bomb RCRA UD unit.

Personal Protective Equipment. It is anticipated that all drilling activities will be completed in Level D personal protective equipment (PPE). Examples of typical Level D PPE includes the following: steel-toed boots, long pants, long sleeved shirts, safety glasses with sideshields, hardhat, leather work gloves (for non-intrusive work), Nitrile gloves (for intrusive work), uncoated Tyvek coveralls (for intrusive work) and, hearing protection, when necessary.

Decontamination Area. A decontamination area will be constructed near the proposed area of the monitoring well installation activities. This unit will be of sufficient quality to last for the duration of the task and will be capable of containing all overspray and decontamination fluids. The decontamination pad will be completely dismantled at the end of the drilling activities and will not permanently alter the site. Any contaminated debris will be drummed and stock piled in an area designated by the facility operation, DZHC.

Drilling Activities. The proposed monitoring well will be drilled to a total depth not to exceed 200 feet. All drilling will be done using an air rotary casing hammer with 9-5/8-inch outer diameter (O.D.) steel casing or 6-1/4 inch inside diameter (I.D.) hollow stem augers. Since air rotary drilling may have a drying effect on the formation surrounding the well, groundwater sampling will wait a reasonable interval until the well recovers before development and sampling. If necessary, biodegradable foaming agents which are acceptable

for environmental drilling and air will be utilized to keep the annular space from collapsing during drilling activities.

Soil Sample Collection. Four soil samples will be collected for chemical analyses of the constituents shown in Table 1. One sample will be representative of the surface soil (0 to 6 inches in depth), while the remaining three samples will be randomly collected from the 55-gallon open-top steel drums.

Monitoring Well Construction. The monitoring well will be constructed of 4-inch I.D. schedule 80 polyvinyl chloride (PVC). All sections, including the screen, will be flush-threaded. The screen slot size and filter pack material was selected using the EPA guidance document "RCRA Groundwater Monitoring: Draft Technical Guidance," EPA/530-R-93-001 (Calculation Sheet 1 - Appendix C). The monitoring zone will be constructed using a 0.010-inch, continuous slotted screen, 15 feet in length. Approximately eight feet of screen will be placed below the groundwater surface with a seven foot zone above. A solid bottom cap with flush thread construction will be placed at the end of the screen. The annular materials will consist of sand filter pack, a bentonite plug, and a cement bentonite grout. The filter pack will consist of silica sand with a uniformity coefficient of 2.35 and 90 percent retained by a 0.014-inch sieve, and will be placed from the total depth to a minimum of two feet above the top of the screened zone. To ensure proper sealing of the monitoring zone, a bentonite plug of at least two feet will be placed directly above the sand pack. The plug will be placed on top of filter pack and hydrated for a minimum of one-half hour, before the remainder of the annulus is grouted with a cement/bentonite grout. The grout will be mixed at a ratio of 94 pounds of portland cement, 5 pounds high solids bentonite and 7 gallons of potable water. The grout mixture will be placed on top of the bentonite plug using a tremie pipe or hose placed at the top of the bentonite plug.

Protective Casing. The surface completion will consist of a 6-inch diameter, locking, steel protective casing. The protective casing will be installed in a concrete pad, with minimum dimensions of 24-inches by 24-inches by 12-inches thick. The concrete pad will be tapered on all sides to allow for drainage away from the protective casing.

Monitoring Well Development. In the event that groundwater is encountered, the monitoring well will be developed by a combination of pumping and use of a surge block.

Development will continue until the water appears sediment free, as determined by IT field personnel. The drilling subcontractor will provide the pump and surge block used for monitoring well development.

Submersible Pump Installation. A Goulds brand Guardian System Model 10GN submersible pump with variable speed motor, complete with Tefzel motor leads and variable speed pump controller, or a similar type of pump recommended for groundwater sample collection, will be supplied by the drilling subcontractor and installed in the monitoring well. The drilling subcontractor will provide all necessary installation hardware (i.e., fittings, hoses, clamps, etc) for a complete turn-key installation. IT personnel will arrange with the HWAD on-site contractor, DZHC, for provision of standard 230 VAC electric service at the well head. If groundwater is not encountered, the pump will not be installed in the well.

Backfill and Restoration. If the well is initially dry, it will not be plugged, but will be left open for continued water level monitoring and groundwater sample collection, until approved for plugging by NDEP. When approved for plugging, the borehole will be backfilled with cement/bentonite grout. Backfilling will be done in accordance with all applicable regulations. A concrete cap, minimum 12-inches thick, will be installed above the grout fill and made flush with the ground surface. The concrete cap will be installed after the cement/bentonite grout has had a sufficient time to harden.

Groundwater Sampling. Following the development process, the well will be allowed to equilibrate for 24 to 48 hours. After this time, a static water level will be measured and recorded. A new well volume will be calculated and then three to five well volumes of groundwater will be removed from the well. This process, referred to as "purging the well", is completed to evacuate the water column from the well, so that a representative groundwater sample may be collected. If the well does not have sufficient yield to recharge 3 well volumes, the well should be purged only once. During purging, field readings for temperature, specific conductance, pH, and turbidity will be obtained and recorded in the field log book. Purging will cease when the following equilibration/stabilization has occurred:

- pH plus or minus 0.05 %
- Turbidity plus or minus 10%
- Specific conductance plus or minus 3%

If stabilization does not occur after 5 well volumes are removed, purging will cease and the well will be sampled. The groundwater sample must be collected within 24 hours of completion of the purging process. Volatile organic compound and semivolatile organic compound samples will be obtained first, and in that order. Groundwater samples will be submitted to the designated laboratory for the chemical analyses indicated in Table 1. Measures will be taken to ensure sample integrity, including:

- Use of preservatives as specified in SW-846 method description
- Use of sample identification labels showing sample identification number, date and time of sample collection, parameters or analytical method requested, preservatives used, name and signature of sampler
- Samples will be placed in coolers with ice packs to ensure that samples are maintained at 4 degrees celsius
- Completion of a chain-of-custody record with the signature and date for each person who has custody of the sample from the time it is collected to until all analyses have been conducted.

A total of four rounds of successive quarterly groundwater samples will be collected, beginning after the monitoring well has been installed and developed.

Waste Handling Procedures. The drill cuttings produced during monitoring well installation will be treated as potentially contaminated solid material until the analytical data from the cutting samples are evaluated. The drilling subcontractor will provide 55-gallon open-top steel drums for containerization of all potentially contaminated solid materials including drill cuttings and PPE. All drums will be properly marked with a weather resistant marker or grease pencil, indicating the drum contents and the date of generation.

The drilling subcontractor will provide 55-gallon poly-drums for containerization of all potentially contaminated groundwater produced during the development process. All groundwater will be considered potentially contaminated and will be containerized and stockpiled in the New Bomb area until results of the groundwater analyses are available and proper disposal arrangements are made. All drums will be properly marked with a weather resistant marker or grease pencil, indicating the drum contents and the date of generation.

The drilling subcontractor will be responsible for removal of all municipal waste from the site generated during the well installation.

Decontamination Procedures. Intrusive equipment (rig, drill steel, samplers etc.) will be cleaned prior to and between drilling each borehole, if more than one are drilled, using a high-pressure steam cleaner. Contaminated equipment will not be permitted to leave the site prior to decontamination. Decontamination fluid will be collected in 55 gallon poly-drums which will be supplied by the drilling subcontractor.

Field Documentation. Field notes will be recorded on Field Activity Daily Logs (FADLs) during the project. Entries on the FADL will be made using indelible pens and will include, as a minimum:

- Date, time, and personnel present
- Documentation of existing weather conditions
- Field equipment calibration data and equipment identification number
- Field instrument measurements
- Unusual events
- Sample location and number
- A general description of the day's field activities
- IT personnel and visitors on site
- Communication with regulatory agencies, or others
- Changes to plans and specifications with reference to Modification Log
- Duration of construction equipment on site
- OVA or PID measurements.

Field notes taken during well installation and sampling activities will include the following observations:

- Determination of well screen slot size and filter pack sizing
- Calibration of field instruments to be used
- Purge volumes and rates
- Any problems encountered or field changes in procedure from approved installation and sampling plans
- Pumping rates for sampling VOCs

- Field observations, general weather, odor from well, color, other pertinent observations
- Names of sampling personnel
- Method of sampling
- Type of pump used for sampling.

A visual classification of soils log (boring log) will be prepared which contains the following information required from the EPA guidance document "RCRA Ground-Water Monitoring: draft technical Guidance" EPA/530-R-93-001, NTIS PB93-139350:

- General
  - Project (facility) name
  - Hole name/number
  - Date started and finished
  - Geologist's name
  - Driller's name
  - Sheet number
  - Hole location; map and elevation (surveyed)
  - Rig type, bit size/auger size, hammer type
  - Sampling equipment used
  - Classification scheme used for soils (e.g., USDA textural classification system, or unified soil classification system)
  - Classification scheme used for rocks
- Information Columns
  - Depth of borehole
  - Sample depth/number/type
  - Blow counts and advance rate
  - Percent sample recovery
  - Narrative description
  - Depth to saturation (nearest 0.01 foot)
- Narrative Description
  - Soil/unconsolidated material/rock type
  - Color and stain
  - Texture
  - Gross petrology
  - Friability
  - Moisture content
  - Degree of weathering

- Presence of carbonate minerals
- Fractures
- Solution cavities
- bedding, formation boundaries
- Discontinuities (e.g., foliation)
- Water-bearing zones
- Dip of bedding, foliations, etc.
- Sedimentary structures
- Presence of organic matter
- Odor
- Suspected contaminants

- Drilling Observations
  - Loss of circulation
  - Advance rates
  - Rig chatter
  - Depth to water table or saturation
  - Drilling difficulties
  - Changes in drilling method or equipment
  - Readings from detective equipment, if any
  - Amount of water yield or loss with depth
  - Amounts and types of any drilling fluids used
  - Presence of running sands
  - Caving/hole stability
  - Reason for termination of borehole

- Other Remarks
  - Equipment failures
  - Possible contamination of soil/groundwater
  - Deviations from drilling plan
  - Weather.

The following information will be submitted on the well construction log and well construction diagram, including dimensions where appropriate:

- Well name/number
- Date/time of well construction
- Borehole diameter and well casing diameter
- Reference elevation for all depth measurements
- Depth at which groundwater is first encountered
- Depth to static water level and changes in static water level with depth
- Depth of location of any loss of drill air circulation, loss of tool or equipment
- Depth of any grouting or sealing

- Amount of cement used for grouting or sealing
- Static water level upon completion of boring
- Well depth (+/- 0.1 ft)
- Casing length
- Casing materials
- Casing and screen joint type
- Screened interval
- Screen materials
- Screen slot size/design
- Filter pack material, gradation, uniformity coefficient, and size
- Filter pack volume (calculated and actual)
- Filter pack placement method
- Annular sealant composition
- Annular seal placement method
- Annular sealant volume (calculated and actual)
- Surface sealant composition
- Surface seal placement method
- Surface sealant volume (calculated and actual)
- Surface seal and well apron design/construction
- Well development procedure and groundwater turbidity measured at the completion of well development
- Type and design/construction of protective casing
- Well cap and lock
- Ground surface elevation (+/- 0.1 ft)
- Survey reference point elevation (+/- 0.1 ft).

IT will submit a technical report for the monitoring well installation which includes the boring log and well construction log. This information will be submitted as part of the revised Part B application for the New Bomb facility.

The report will also document that the following activities were performed appropriately:

- Selection of construction materials for the casing and screen
- Selection of well diameter, screen length, and screen slot size
- Selection and emplacement of the appropriate filter pack
- Selection and emplacement of the annular sealants
- Providing proper security of well
- Surveying the location and elevation of the top of casing
- Adequately developing the well.

The technical report will also include tabular summaries for analytical results and will contain detected and nondetected results with qualifiers. Copies of analytical reports and field notes will be included for reference in appendices.

TABLES

Table 1
Summary of Monitoring Well Sampling and Chemical Analysis Program
New Bomb Area, Hawthorne Army Depot, Nevada

Sample ID	Sample Type	TCL Vols by Method 8240	TCL Semivols by Method 8270	Metals by Methods 6010/7470	Full TCLP by Method 1311	Explosives[a] by Method HPLC or GC
NB-MW01-S1-(date)	Surface Soil	-	-	1	-	-
NB-MW01-S2-(date)	Soil Cutting	-	-	-	1	-
NB-MW01-S3-(date)	Soil Cutting	-	-	-	1	-
NB-MW01-S4-(date)	Soil Cutting	-	-	-	1	-
NB-MW01-GW1-(date)	Groundwater (1st quarter)	1	1	1	-	1
NB-MW01-GW2-(date)	Groundwater (2nd quarter)	1	1	1	-	1
NB-MW01-GW3-(date)	Groundwater (3rd quarter)	1	1	1	-	1
NB-MW01-GW4-(date)	Groundwater (4th quarter)	1	1	1	-	1

[a] Explosives include 2,4-Dinitrotoluene (DNT); total DNT; HMX; RDX; Tetryl; and 2,4,6-trinitrotoluene (TNT), per HWAD UD Part B Waste Analysis Plan.

Notes:

(1) QA/QC samples will include one TCL Vols trip blank; one matrix spike; one matrix spike duplicate; and one field duplicate sample for the analytical program.

(2) Toxic Contaminant Leaching Procedure (TCLP) parameters follow *Investigation-Derived Waste Management Plan, HWAD*, March 1996, Table 4-1, prepared by Tetra Tech, Inc.

(3) TCL = Target Compound List; Vols = volatile organic compounds; Semivols = semivolatile organic compounds.

(4) All methods will follow SW-846 protocol, unless otherwise noted.

TABLE 2

AFFIDAVIT TO ABANDONMENT

I, LTC John G. Zodrow
Hawthorne Army Depot
Hawthorne, NV 89415-5000 (ADDRESS WHERE OWNER CAN BE REACHED)

PHONE NO (702) 945-7001

the owner/agent of said parcel number Range 30 East, Township 5 North, Section 34, Southeast Quarter of Northeast Quarter, or the operator of the project if on public land, fully understands that if a waiver is granted for the drilling of (monitor, dewatering, mining and milling, oil & gas, exploratory, construction and/or environmental) wells, I will be required to plug and abandon said wells (NAC 534.428) upon project completion, in accordance with rules and regulations for drilling wells in the State of Nevada. If the length of the project shall be more than one year, it is my responsibility to request and extension of time from the Division of Water Resources (DWR).

If I should release IT Corporation (Environmental Consultant) from completing the environmental work, i.e. monitoring, well abandonment etc., it is my responsibility to notify DWR of the change.

I will make any purchaser of said parcel aware of these conditions.

John G. Zodrow
Owner/Agent
JOHN G. ZODROW
LTC, U.S. Army
Commanding
10 May 96

Subscribed and sworn before me this
10th day of May, 1996

Notary Public in and for the County of Washoe, State of Nevada.

My commission expires Feb 16, 1997.

Kathleen L. McKnight
Signature

KATHLEEN L. McKNIGHT
Notary Public - State of Nevada
Appointment Recorded in Lyon County
MY APPOINTMENT EXPIRES FEB 16, 1997

FIGURES

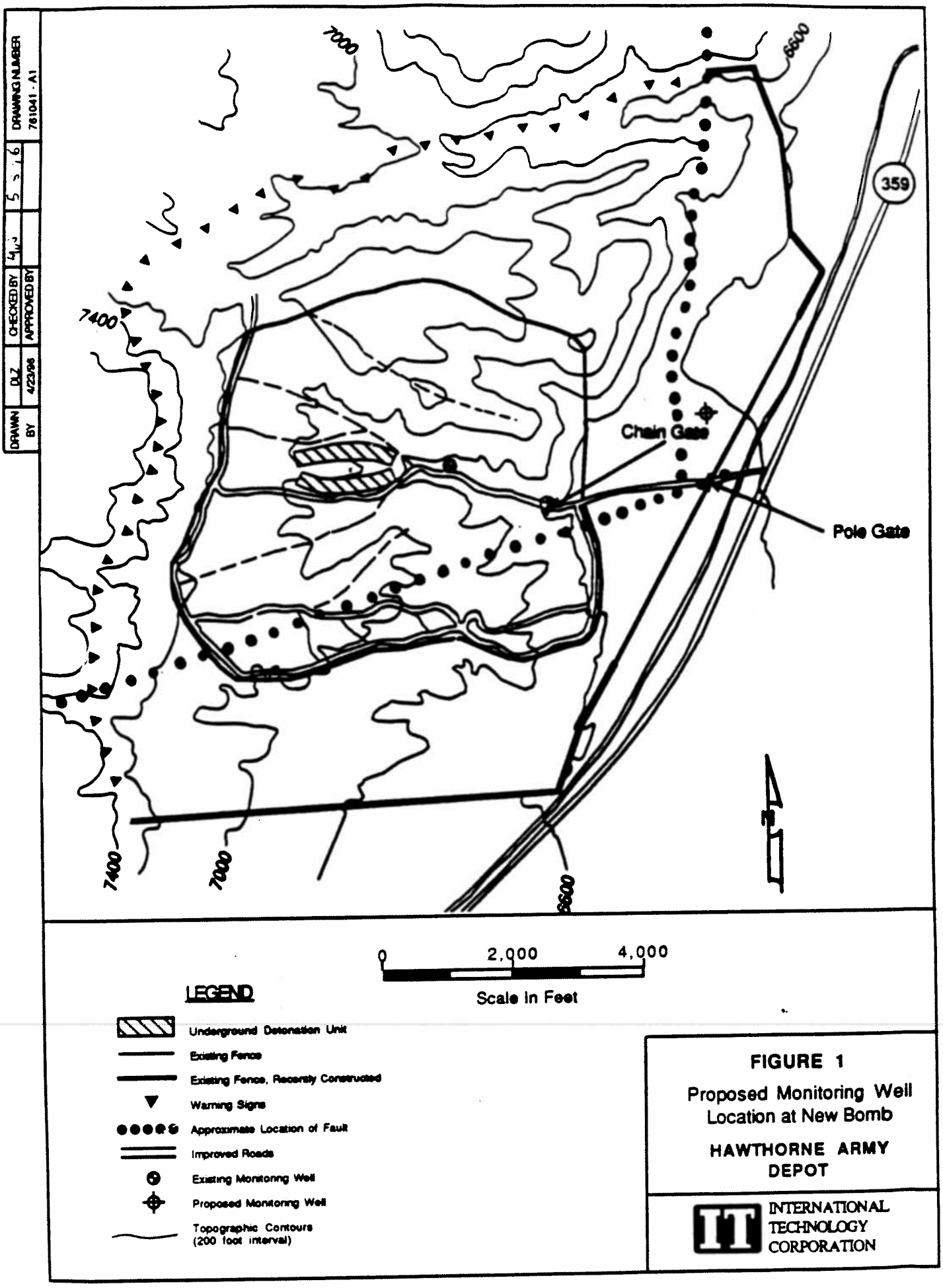


FIGURE 1

Proposed Monitoring Well Location at New Bomb

HAWTHORNE ARMY DEPOT

INTERNATIONAL TECHNOLOGY CORPORATION

APPENDIX A

OR-10 H

United States Department of Agriculture | Forest Service | Toiyabe National Forest, Bridgeport Ranger District | P.O. Box 595, Bridgeport, Ca. 93517, (619) 932-7070

Reply to: 2720

Date: June 3, 1996

Lt. Colonel John G. Zodrow, Commander
Hawthorne Army Depot
Hawthorne, NV 89415-5000

Dear Colonel Zodrow:

Your May 14, 1996, request for installation of a monitoring well at "New Bomb" is approved with the understanding that the well will be in compliance with all applicable state regulations.

If you have any questions, please contact Cliff Shaw at this office.

Sincerely,

KATHLEEN LUCICH
District Ranger

APPENDIX B

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380 • Fax (702) 687-6972

Waiver - M/O-1057
AMENDED

June 13, 1996

Mark Weisberg
IT
2790 Mosside Blvd.
Monroeville, Pennsylvania 15146-2792

Re: Amended location of one (1) monitor well at the NEW BOMB AREA AT HAWTHORNE ARMY DEPOT, approximately 22 miles south of Hawthorne, NV. Local Nos. 110C N05 E30 34AD

Dear Mr. Weisberg:

As provided in Section 534.450 of the Regulation for Water Well and Related Drilling, as adopted under Chapter 534 of the Nevada Administrative Code, and for good cause shown, authorization is herewith granted for the subject well(s) as described in your letter dated May 14, 1996. This office waives only NAC 534.360(3), 534.380(1) and 534.380(8) of the regulation. The annulus of each well must be cemented with cement slurry with no more than 3% bentonite by weight from the approximate depth of the two foot bentonite plug to land surface. Full compliance with the remainder of the statute and regulation is required. The subject wells must be properly plugged and abandoned as required under NAC 534.420 upon project completion. Please include as accurate a description as possible and a plat map showing the location of each well with the completion reports. It is expressly understood this authorization does not relieve the operator of the permitting requirements of other state, federal and local agencies.

If any questions arise please contact this office at 702-687-4380.

Sincerely yours,

George G. Jackson

George G. Jackson, P.E.
Hydraulic Engineer II

cc: NDEP

APPENDIX C

Calculation Sheet No. 1
Calculation of screen slot size and Filter Pack Material

Formation is silty sand from log of New Bomb Area Monitoring Well No. 1, November 1984.

Assume 70% retained grain size of 0.004 inch.

Multiply 70% grain size by 5 as per pg. 6-41 enclosure 2 from Nevada Department of Conservation Letter Dated June 3, 1996.

$$0.004 \times 5 = 0.02 \text{ inch}$$

Draw curve with 70% at 0.02 inch.

40% retained = 0.033 inch
90% retained = 0.014 inch

$$\text{Uniformity coefficient} = \frac{0.033}{0.014} = 2.35$$

Slot size that will retain 90% of Sand Pack $\approx$ 0.01

APPENDIX B
BORING LOG

IT CORPORATION

Boring Number
NB-MW02

VISUAL CLASSIFICATION

Project Name: *Hawthorne Army Depot*	Project No.: *761041*
Coordinates: *Not Surveyed*	Elevation: *Not Surveyed*
Drill Rig/Method: *6 5/8" ID Hollow Stem Augers/Failing F-10 Rig*	Date Started: *8-5-96*
Sampling Method: *No Samples Collected*	Date Completed: *8-6-96*
Drilling Firm/Crew: *Stewart Brothers Drilling/E.Lovesea,P.Jamarillo*	GWL (ATD):
Engineer/Geologist: *W. Stannope*	Checked By: *WS*

DEPTH (feet)	SAMPLE NUMBER	SAMPLES	PID (ppm)	BLOWS (per 6 inches)	RECOVERY (inches)	USCS SYMBOL	GRAPHIC LOG	DESCRIPTION	WELL PROFILE	REMARKS
0						sp		Alluvium, brown (10YR 5/3), SAND, silt, gravel, and rock fragments, angular to subangular quartz and feldspar grains, unconsolidated, dry		drilling begins at 1020 8-5-96
5										
10										
15										
20										
25										
30										
35										
40										
45										
50										
55										
60										
65										67.5' drilling ends for the day
70										8-6-96 at 0830 drilling begins
75										Monitoring well was constructed using 4" schedule 40 PVC riser pipe with a 15.0' section of slotted PVC well screen (0.010" slot size). While pulling augers from the hole, the augers broke, leaving approximately 40.0' of augers down hole. PVC pipe is intact, however, the well is dry and no water bearing zones were encountered. Monitoring well is then plugged by filling inside of PVC pipe and remaining angular space with cement bentonite grout as directed by the NDCNR DWR.
80										
85										
90										
95										
100										
105										
110										
115										
120										

NOTES: No split barrel samples were collected, subsequently lithology was logged from drill cuttings. Therefore, blows and recovery were not recorded. PID readings were taken at 5.0 feet intervals, all readings were 0 ppm. Depth to groundwater was checked every 10.0 feet.

IT CORPORATION

VISUAL CLASSIFICATION

Boring Number
NB-MW02

Project Name: *Hawthorne Army Depot* | Project No.: *761041*

DEPTH (feet)	SAMPLE NUMBER	SAMPLES	PID (ppm)	BLOWS (per 6 inches)	RECOVERY (inches)	USCS SYMBOL	GRAPHIC LOG	DESCRIPTION	WELL PROFILE	REMARKS
120–260						SP		Alluvium, brown (10YR 5/3), SAND, silt, gravel, and rock fragments, angular to subangular quartz and feldspar grains, unconsolidated, dry		
200–205								Bottom of Boring 201.0'		8-6-96 drilling ends at 1500

NOTES: No split barrel samples were collected, subsequently lithology was logged from drill cuttings. Therefore, blows and recovery were not recorded. PID readings were taken at 5.0 feet intervals, all readings were 0 ppm. Depth to groundwater was checked every 10.0 feet.

APPENDIX C
SAMPLE COLLECTION LOGS

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	5	9	6
TIME	1	0	1	5		
PAGE	1 OF 1					
PAGE	0	0	0	0	1	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne

SAMPLE NO. ~~NB-MW01-960806~~ 960805 (WS) NB-MW02-~~S~~2-960807

SAMPLE LOCATION New Bomb area HWAD (see diagram)

SAMPLE TYPE Surface Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-6 inches

WEATHER Hot, Sunny, Windy - 80's

CONTAINERS USED	AMOUNT COLLECTED
1 x 8oz jar	Full.

COMMENTS:

A surface soil sample was collected from 0-6 inches below ground surface at the New Bomb monitoring well location. The sample was placed in an 8 oz. glass jar. No preservatives were added. The sample was collected for total metals analysis ~~(EPA)~~ (6010/7470 Series). The sample was placed in a cooler on ice. It will be analyzed by Quanterra Analytical Services in West Sacramento, CA.

PREPARED BY: W. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	8	8	0	7	9	6
TIME	1	6	1	0		
PAGE 1 OF 1						
PAGE	0	0	6	0	2	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-MW02-S1-960807 and NB-MW02-S5-960807

SAMPLE LOCATION NB-MW02 Soil cuttings.

SAMPLE TYPE soil composite (field duplicate)

COMPOSITE ✓ YES ____ NO

COMPOSITE TYPE mixture

DEPTH OF SAMPLE NA

WEATHER Hot, sunny - breezy Mid 80s

CONTAINERS USED	AMOUNT COLLECTED
2 x 16 oz glass jar	full

COMMENTS:

A surface soil sample was collected from the drill cuttings from the installation of monitoring well NB-MW02. A total of 13 drums were filled with soil cuttings. The 13 drums were divided into 3 groups and a composite sample was collected from each of the three drum groups. This sample was identified by NB-MW02-S1-960807. A field duplicate sample was also collected and is identified as NB-MW02-S5-960807. This sample was obtained from drums 1 through 5.

PREPARED BY: W. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	7	9	6
TIME	1	6	2	5		
PAGE 1 OF 1						
PAGE	0	0	0	0	3	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-MW02-~~S3~~ 03 - 960807

SAMPLE LOCATION New Bomb area HWAD

SAMPLE TYPE soil composite

COMPOSITE ✓ YES ____ NO

COMPOSITE TYPE mixture

DEPTH OF SAMPLE NA

WEATHER Hot - Sunny Mid 80s

CONTAINERS USED	AMOUNT COLLECTED
1 x 16oz glass jar	full

COMMENTS:

A soil cuttings sample was collected from the drill cutting collected during the installation of Monitoring Well NB-mw02. ~~The~~ A total of thirteen (13) drums were filled with soil cutting. The drums were divided into 3 groups and a composite sample was collected from each of the three groups. This sample was obtained from drums 6 through 9, and (MS)

PREPARED BY: M. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	8	8	0	7	9	6
TIME	1	6	3	5		
PAGE	1 OF 1					
PAGE	0	0	0	0	4	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-MW02-S4 960807

SAMPLE LOCATION New Bomb Area, HWAD

SAMPLE TYPE soil composite

COMPOSITE ✓ YES ____ NO

COMPOSITE TYPE Mixture

DEPTH OF SAMPLE NA

WEATHER Hot, sunny mid 80s

CONTAINERS USED	AMOUNT COLLECTED
1 x 16 oz glass jar	full

COMMENTS:

A soil cutting sample was collected from the drill cuttings collected during the installation of monitoring well NB-MW02. A total of 13 drums were filled with soil cuttings. The drums were divided into 3 groups and a composite sample was collected from each group. This sample was obtained from drums Nos. 10 – 13.

PREPARED BY: W. Stanhope

APPENDIX D
SOIL CUTTINGS ANALYTICAL DATA

Quanterra Environmental Services

Quanterra Incorporated
880 Riverside Parkway
West Sacramento, California 95605

916 373-5600 Telephone
916 372-1059 Fax

September 5, 1996

QUANTERRA PROJECT NUMBER: 088981
PO/CONTRACT: NA

Bill Stanhope
IT Corporation
2790 Mosside Blvd.
Monroeville, Pennsylvania 15145-2792

Dear Mr. Stanhope:

This report contains the analytical results for the sixteen soil samples which were received under chain of custody by Quanterra Environmental Services on 10 August 1996. This sample set is associated with your Hawthorne Army Depot project.

The case narrative is an integral part of this report.

If you have any questions, please call me at (916)374-4362.

Sincerely,

Diana L. Brooks
Project Manager

DB/myg

Enclosures

Quanterra
Environmental Services

TABLE OF CONTENTS

QUANTERRA PROJECT NUMBER 088981

Case Narrative

Quanterra's Quality Assurance Program

Sample Description Information

Chain of Custody Documentation

Volatile Organics - Toxicity Characteristic List TCLP Leachate - Method 8240
Includes Samples: 2 - 5
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Semivolatile Organics - Toxicity Characteristic List TCLP Leachate - Method 8270
Includes Samples: 2 - 16
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Chlorinated Pesticeds - Toxicity Characteristic List (TCLP) TCLP Leachate Method 8080
Includes Samples: 2 - 5
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Chlorinated Herbicides - Toxicity Characteristic List TCLP Leachate - Method 8150
Includes Samples: 2 - 5
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Quanterra
Environmental Services

TABLE OF CONTENTS
(Continued)
QUANTERRA PROJECT NUMBER 088981

Nitroaromatic and Nitramines by HPLC - Method 8330
Includes Samples: 6 - 16
Sample Data Sheets
Method Blank Report
Laboratory QC Reports

Toxicity characteristics (TCLP) List
Includes Samples: 1 - 16
Sample Data Sheets
Method Blank Report
Laboratory QC Reports

Quanterra
Environmental Services

CASE NARRATIVE

QUANTERRA PROJECT NUMBER 088981

TCLP Organochlorine Pesticides - Method 8080

The recovery of dieldrin and/or endrin in the laboratory control sample and matrix spike/matrix spike duplicate exceeded the control limits reported. This is attributed to differences in standard preparation methods from the suppliers of these standards. As this compound was not detected in any of the samples, this anomaly does not have an adverse affect on the sample data.

TCLP Semivolatile Organics - Method 8270

2,3,4,6-Tetrachlorophenol and Naphthalene are no longer part of the matrix spike/matrix spike duplicate spike mix for this test and thus recoveries are not available.

TCLP Volatile Organics - Method 8240

The duplicate control sample surrogate recovery for 1,2-Dichloroethane-d4 was above control limits. There were no positive hits found in the samples, thus this will not impact your sample data.

Selected Metals - Various Methods

The matrix spike for Mercury has a percent recovery outside of control limits. Re-analysis of the sample confirmed the recovery.

The matrix spike/matrix spike duplicate for Aluminum had recoveries outside of control limits due to the sample concentration being four time or greater than the spike concentration.

The matrix spike duplicate for Lead had recoveries outside of control limits due to the sample concentration being four time or greater than the spike concentration.

No other anomalies were associated with this report.

Quanterra
Environmental Services

QUANTERRA'S QUALITY ASSURANCE PROGRAM

Quanterra has implemented an extensive Quality Assurance (QA) program to ensure the production of scientifically sound, legally defensible data of known documentable quality. A key element of this program is Quanterra's Laboratory Control Sample (LCS) system. Controlling lab operations with LCS (as opposed to matrix spike/matrix spike duplicate samples), allows the lab to differentiate between bias as a result of procedural errors versus bias due to matrix effects. The analyst can then identify and implement the appropriate corrective actions at the bench level, without waiting for extensive senior level review or costly and time-consuming sample re-analyses. The LCS program also provides our client with information to assess batch, and overall laboratory performance.

Laboratory Control Samples - (LCS)

Laboratory Control Samples (LCS) are well-characterized, laboratory generated samples used to monitor the laboratory's day-to-day performance of routine analytical methods. The results of the LCS are compared to well-defined laboratory acceptance criteria to determine whether the laboratory system is "in control". Three types of LCS are routinely analyzed: Duplicate Control Samples (DCS), Single Control Samples (SCS), and method blanks. Each of these LCS are described below.

Duplicate Control Samples. A DCS is a well-characterized matrix (blank water, sand, sodium sulfate or celite) which is spiked with certain target parameters and analyzed at approximately 10% of the sample load in order to establish method-specific control limits.

Single Control Samples. An SCS consists of a control matrix that is spiked with surrogate compounds appropriate to the method being used. In cases where no surrogate is available, (e.g. metals or conventional analyses) a single control sample identical to the DCS serves as the control sample. An SCS is prepared for each sample lot. Accuracy is calculated identically to the DCS.

Method Blank Results. A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples.

Quanterra
Environmental Services

SAMPLE DESCRIPTION INFORMATION
for
IT Corporation

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
088981-0001-SA	NB-MW02-S1-960805	SOIL	05 AUG 96	10:15	10 AUG 96
088981-0002-SA	NB-MW02-S2-960807	SOIL	07 AUG 96	16:10	10 AUG 96
088981-0003-SA	NB-MW02-S3-960807	SOIL	07 AUG 96	16:25	10 AUG 96
088981-0004-SA	NB-MW02-S4-960807	SOIL	07 AUG 96	16:35	10 AUG 96
088981-0005-SA	NB-MW02-S5-960807	SOIL	07 AUG 96	16:10	10 AUG 96
088981-0006-SA	NB-S1-960808	SOIL	08 AUG 96	11:10	10 AUG 96
088981-0007-SA	NB-S2-960808	SOIL	08 AUG 96	11:15	10 AUG 96
088981-0008-SA	NB-S3-960808	SOIL	08 AUG 96	11:25	10 AUG 96
088981-0009-SA	NB-S4-960808	SOIL	08 AUG 96	11:45	10 AUG 96
088981-0010-SA	NB-S5-960808	SOIL	08 AUG 96	12:05	10 AUG 96
088981-0011-SA	NB-S6-960808	SOIL	08 AUG 96	12:20	10 AUG 96
088981-0012-SA	NB-S7-960808	SOIL	08 AUG 96	12:40	10 AUG 96
088981-0013-SA	NB-S8-960808	SOIL	08 AUG 96	12:50	10 AUG 96
088981-0014-SA	NB-S9-960808	SOIL	08 AUG 96	13:35	10 AUG 96
088981-0015-SA	NB-S10-960808	SOIL	08 AUG 96	14:05	10 AUG 96
088981-0015-MS	NB-S10-960808 (MS)	SOIL	08 AUG 96	14:05	10 AUG 96
088981-0015-SD	NB-S10-960808 (MSD)	SOIL	08 AUG 96	14:05	10 AUG 96
088981-0016-SA	NB-S11-960808	SOIL	08 AUG 96	13:35	10 AUG 96

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 323531
Page 1 of 2

Project Name/No.[1] 761041 Hawthorne Army Depot
Sample Team Members[2] B. Stanhope
Profit Center No.[3] 3211210
Project Manager[4] M. Weisberg
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 08-09-96
Lab Destination[8] Quanterra-W. Sacramento
Lab Contact[9] V. Herd
Project Contact/Phone[12] B. Stanhope / 412 372-7701
Carrier/Waybill No.[13] 2349392555 FEDERAL EXPRESS

Bill to:[5] IT-Corp / AP
2790 Mosside Blvd.
Monroeville, PA 15146

Report to:[10] B. Stanhope
IT Corp.
2790 Mosside Blvd.
Monroeville PA 15146

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
NB-MW02-S1-960807	Soil	8-5-96 (1015)	1x 8oz glass	8oz	None	Al, As, Ba, Be, Cd, Cr, Pb, Hg, Se, Ag	Good.	
NB-MW02-S2-960807		8-7-96 @ 1610	1x 16oz glass	16oz		Full TCLP		
NB-MW02-S3-960807		8-7-96 @ 1625						
NB-MW02-S4-960807		8-7-96 @ 1635						
NB-MW02-S5-960807		8-7-96 @ 1610					8/10/96	
NB-S1-960808		8-8-96 @ 1110				TCLP*, Total Metals, 8330		
NB-S2-960808		8-8-96 @ 1115						
NB-S3-960808		8-8-96 @ 1125						

Special Instructions:[23]

Possible Hazard Identification:[24] Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal:[25] Return to Client ☐ Disposal by Lab ☒ Archive ____ (mos.)

Turnaround Time Required:[26] Normal ☒ Rush ☐

QC Level:[27] I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) William Stanhope	Date: 8-9-96 Time: 1400	1. Received by[28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation) Julia DeBruce	Date: 8-10-96 Time: 0911

Comments:[29] * TCLP analytes for samples are As, Ba, Cd, Cr, Pb, Hg, Se, Ag, Nitrobenzene, and 2,4-Dinitrotoluene.

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 323531
Page 2 of 2

Project Name Hawthorne Army Depot Project No. 761041 Samples Shipment Date 8-9-96

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
NB-S4-960808	Soil	8-8-96 @ 1145	1 x 16oz glass	16oz	None	TCLP* Metals, Total 8330	Good	
NB-S5-960808		8-8-96 @ 1205						FOR LAB USE ONLY
NB-S6-960808		8-8-96 @ 1220						
NB-S7-960808		8-8-96 @ 1240						
NB-S8-960808		8-8-96 @ 1250						
NB-S9-960808		8-8-96 @ 1335						
NB-S10-960808	(VS) 1405	8-8-96 @ ~~1250~~ VS						
NB-S11-960808		8-8-96 @ 1335						

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

MCA 2/15/91

Quanterra
Environmental
Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate - Method 8240

Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	101	%
4-Bromofluorobenzene	110	%
1,2-Dichloroethane-d4	103	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	98	%
4-Bromofluorobenzene	108	%
1,2-Dichloroethane-d4	101	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	102	%
4-Bromofluorobenzene	108	%
1,2-Dichloroethane-d4	105	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	101	%
4-Bromofluorobenzene	110	%
1,2-Dichloroethane-d4	107	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

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Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Volatile Organics by GC/MS
Project: 088981

Category: VOA-MS-TL Volatile Organics - TCLP Leachate
Test: 8240CP-OTC-TL
Matrix: LEACHATE
QC Lot: 28 AUG 96-11 QC Run: 28 AUG 96-1B
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
1,1-Dichloroethene	0.250	0.230	92	52-150
Trichloroethene	0.250	0.240	96	76-129
Benzene	0.250	0.230	92	80-130
Toluene	0.250	0.230	92	77-127
Chlorobenzene	0.250	0.230	92	84-128

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results

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Environmental Services

QC LOT ASSIGNMENT REPORT
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
088981-0002-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B
088981-0003-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B
088981-0004-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B
088981-0005-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B

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Environmental Services

SINGLE CONTROL SAMPLE REPORT
Volatile Organics by GC/MS

Analyte	Concentration Spiked	Measured	Accuracy(%) SCS	Limits
Category: VOA-MS-TL				
Matrix: LEACHATE				
QC Lot: 28 AUG 96-11 QC Run: 28 AUG 96-1B				
Concentration Units: mg/L				
1,2-Dichloroethane-d4	0.250	0.253	101	76-114
Toluene-d8	0.250	0.246	98	86-115
4-Bromofluorobenzene	0.250	0.262	105	86-115

Calculations are performed before rounding to avoid round-off errors in calculated results

Quanterra
Environmental Services

METHOD BLANK REPORT
Volatile Organics by GC/MS

Test: 8240CP-OTC-TL
Matrix: SOIL
QC Lot: 28 AUG 96-11 QC Run: 28 AUG 96-1B

Analyte	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Volatile Organics by GC/MS
Project: 088981

Category: VOA-MS-TL Volatile Organics - TCLP Leachate
Test: 8240CP-OTC-TL Method: 8240
Matrix: LEACHATE
Sample: 088981-0002
MS Run: 28 AUG 96-1B
Units: mg/L

Analyte	Concentration: Sample Result	Concentration: MS Result	Concentration: MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
1,1-Dichloroethene	ND	0.240	0.250	0.250	96	100	65-135	4.1	35
Trichloroethene	ND	0.240	0.230	0.250	96	92	65-135	4.3	35
Benzene	ND	0.240	0.220	0.250	96	88	65-135	8.7	35
Toluene	ND	0.230	0.230	0.250	92	92	65-135	0.0	35
Chlorobenzene	ND	0.240	0.230	0.250	96	92	65-135	4.3	35

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B
088981-0003-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B
088981-0004-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B
088981-0005-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B

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Environmental
Services

Semivolatile Organics - Toxicity Characteristic List TCLP Leachate - Method 8270

Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	97	%
2-Fluorobiphenyl	84	%
Terphenyl-d14	109	%
Phenol-d5	40	%
2-Fluorophenol	66	%
2,4,6-Tribromophenol	97	%

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	94	%
2-Fluorobiphenyl	80	%
Terphenyl-d14	103	%
Phenol-d5	37	%
2-Fluorophenol	62	%
2,4,6-Tribromophenol	106	%

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	96	%
2-Fluorobiphenyl	83	%
Terphenyl-d14	105	%
Phenol-d5	38	%
2-Fluorophenol	64	%
2,4,6-Tribromophenol	109	%

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 30 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	84	%
2-Fluorobiphenyl	76	%
Terphenyl-d14	91	%
Phenol-d5	33	%
2-Fluorophenol	61	%
2,4,6-Tribromophenol	70	%

ND = Not detected
NA = Not applicable

Reported By: Donald Taylor

Approved By: Steve Rogers

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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Semivolatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0003-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0004-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0005-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0006-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0007-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0008-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0009-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0010-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0011-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0012-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0013-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0014-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0015-MS	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0015-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0015-SD	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0016-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A

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SINGLE CONTROL SAMPLE REPORT
Semivolatile Organics by GC/MS

Analyte	Concentration Spiked	Measured	Accuracy(%) SCS	Limits
Category: 8270-TL-A				
Matrix: AQUEOUS				
QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A				
Concentration Units: mg/L				
Nitrobenzene-d5	0.500	0.447	89	36-114
2-Fluorobiphenyl	0.500	0.395	79	43-116
Terphenyl-d14	0.500	0.524	105	33-141
2-Fluorophenol	0.750	0.461	61	21-100
Phenol-d5	0.750	0.273	36	10- 94
2,4,6-Tribromophenol	0.750	0.727	97	10-123

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Environmental Services

METHOD BLANK REPORT
Semivolatile Organics by GC/MS

Analyte	Result	Units	Reporting Limit
Test: 8270CP-OTC-TL			
Matrix: SOIL			
QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A			
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050
Test: 8270CP-OTC-TL			
Matrix: SOIL			
QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A			
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050

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Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Semivolatile Organics by GC/MS
Project: 088981

Category: 8270-TL-A Semivolatiles TCLP-full analyte list
Test: 8270CP-OTC-TL
Matrix: AQUEOUS
QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Pyridine	0.100	0.0474	47	17-101
1,4-Dichlorobenzene	0.100	0.0817	82	44-128
2-Methylphenol	0.100	0.0859	86	57-130
3/4-Methylphenol	0.200	0.153	76	37-129
Hexachloroethane	0.100	0.0857	86	30-130
Nitrobenzene	0.100	0.0969	97	57-145
Hexachlorobutadiene	0.100	0.0977	98	36-126
2,4,6-Trichlorophenol	0.100	0.0636	64	51-135
2,4,5-Trichlorophenol	0.100	0.0953	95	64-130
2,4-Dinitrotoluene	0.100	0.0856	86	32-137
Hexachlorobenzene	0.100	0.103	103	59-150
Pentachlorophenol	0.100	0.0792	79	9-103

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Semivolatile Organics by GC/MS
Project: 088981

Category: 8270-TL-A Semivolatiles TCLP-full analyte list
Test: 8270CP-OTC-TL Method: 8270
Matrix: LEACHATE
Sample: 088981-0015
MS Run: 27 AUG 96-11A
Units: mg/L

Analyte	Concentration: Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery: MS	MSD	Control Limits	%RPD	RPD Limit
Pyridine	ND	0.276	0.282	0.500	55	56	0-0	2.2	64
1,4-Dichlorobenzene	ND	0.375	0.373	0.500	75	75	0-0	0.53	32
2-Methylphenol	ND	0.414	0.422	0.500	83	84	0-0	1.9	21
3/4-Methylphenol	ND	0.737	0.742	1.00	74	74	0-0	0.68	25
Hexachloroethane	ND	0.377	0.377	0.500	75	75	0-0	0.0	39
Nitrobenzene	ND	0.481	0.483	0.500	96	97	0-0	0.41	22
Hexachlorobutadiene	ND	0.470	0.442	0.500	94	88	0-0	6.1	40
2,4,6-Trichlorophenol	ND	0.330	0.329	0.500	66	66	0-0	0.30	24
2,4,5-Trichlorophenol	ND	0.409	0.399	0.500	82	80	0-0	2.5	22
2,4-Dinitrotoluene	ND	0.416	0.419	0.500	83	84	0-0	0.72	27
Hexachlorobenzene	ND	0.476	0.466	0.500	95	93	0-0	2.1	20
2,3,4,6-Tetrachlorophenol	ND	ND	ND	NA	NC	NC	0-0	NC	12
Pentachlorophenol	ND	0.467	0.426	0.500	93	85	0-0	9.2	42
Naphthalene	ND	ND	ND	NA	NC	NC	0-0	NC	23

NA = Not Applicable
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Chlorinated Pesticides - Toxicity Characteristic List (TCLP) TCLP Leachate Method 8080

Quanterra
Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	103	%
Decachlorobiphenyl	119	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
Rev 230787

Quanterra Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	100	%
Decachlorobiphenyl	124	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	99	%
Decachlorobiphenyl	123	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	98	%
Decachlorobiphenyl	123	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett
Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A
088981-0003-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A
088981-0004-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A
088981-0005-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A

Quanterra
Environmental Services

METHOD BLANK REPORT
Semivolatile Organics by GC
Project: 088981

Test: 8080CP-OTC-TL — Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
Method: 8080
Matrix: LEACHATE
QC Lot: 21 AUG 96-11A — QC Run: 21 AUG 96-11A

Analyte	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

ND = Not Detected

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Semivolatile Organics by GC
Project: 088981

Category: OCP-TL Organochlorine Pesticides - TLCP Leachate
Test: 8080CP-OTC-TL
Matrix: LEACHATE
QC Lot: 21 AUG 96-11A QC Run: 21 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
gamma-BHC (Lindane)	0.000500	0.000428	86	56-103
Heptachlor	0.000500	0.000438	88	49-101
Aldrin	0.000500	0.000416	83	48-99
Dieldrin	0.00100	0.00107	107	60-106
Endrin	0.00100	0.00118	118	63-118
4,4'-DDT	0.00100	0.000993	99	55-112
Tetrachloro-m-xylene	0.00020	0.00020	99	30-150
Decachlorobiphenyl	0.00020	0.00023	116	30-150

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Semivolatile Organics by GC
Project: 088981

Category: OCP-TL Organochlorine Pesticides - TLCP Leachate
TestY 8080CP-OTC-TL Method: 8080
MatrixY LEACHATE
SampleY 088981-0005
MS RunY 21 AUG 96-11A
UnitsY mg/L

	Concentration								
Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
gamma-BHC (Lindane)	ND	0.00222	0.00222	0.00250	89	89	56-103	0.29	23
Heptachlor	ND	0.00232	0.00235	0.00250	93	94	49-101	1.5	24
Aldrin	ND	0.00212	0.00218	0.00250	85	87	48-99	2.9	31
Dieldrin	ND	0.00562	0.00584	0.00500	112	117	60-106	3.8	25
Endrin	ND	0.00673	0.00703	0.00500	135	141	63-118	4.3	24
4,4'-DDT	ND	0.00512	0.00560	0.00500	102	112	55-112	9.0	27

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental
Services

Chlorinated Herbicides - Toxicity Characteristic List TCLP Leachate - Method 8150

Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	78	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	86	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	80	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	84	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A
088981-0003-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A
088981-0004-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A
088981-0005-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A

Quanterra
Environmental Services

METHOD BLANK REPORT
Semivolatile Organics by GC
Project: 088981

Test: 8150CP-OTC-TL
Method: 8150
Matrix: LEACHATE
QC Lot: 20 AUG 96-11A

Chlorinated Herbicides - Toxicity Characteristic List

QC Run: 20 AUG 96-11A

Analyte	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010

ND = Not Detected

Quanterra
Environmental Services

SINGLE CONTROL SAMPLE REPORT
Semivolatile Organics by GC
Project: 088981

Category: HERB-TL OTC Herbicides
Matrix: LEACHATE
QC Lot: 20 AUG 96-11A QC Run: 20 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) SCS	Limits
2,4-DCAA	0.00500	0.0041	83	49-130

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Semivolatile Organics by GC
Project: 088981

Category: HERB-TL OTC Herbicides
Test: 8150CP-OTC-TL
Matrix: LEACHATE
QC Lot: 20 AUG 96-11A
QC Run: 20 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
2,4-D	0.00100	0.000786	79	40-122
2,4,5-TP (Silvex)	0.000200	0.000146	73	38-118
2,4,5-T	0.000200	0.000153	77	46-110

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Semivolatile Organics by GC
Project: 088981

Category: HERB-TL OTC Herbicides
Test: 8150CP-OTC-TL
Matrix: LEACHATE
Sample: 088981-0005
MS Run: 20 AUG 96-11A
Units: mg/L

Method: 8150

Analyte	Concentration Sample Result	Concentration MS Result	Concentration MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
2,4-D	ND	0.00436	0.00438	0.00500	87	88	0-0	0.33	30
2,4,5-TP (Silvex)	ND	0.000761	0.000757	0.00100	76	76	0-0	0.45	29
2,4,5-T	ND	0.000834	0.000842	0.00100	83	84	0-0	0.90	36

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental
Services

Toxicity characteristics (TCLP) List

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.18	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.20	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.17	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.18	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S10-960808 (MS)
Lab ID: 088981-0015-MS
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	5.0	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Barium	21.7	mg/L	20.0	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Chromium	2.1	mg/L	2.0	6010	16 AUG 96	19 AUG 96
Lead	5.0	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Mercury	0.0051	mg/L	0.0050	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.50	7740	16 AUG 96	17 AUG 96
Silver	0.50	mg/L	0.50	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S10-960808 (MSD)
Lab ID: 088981-0015-SD
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Barium	21.4	mg/L	20.0	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Chromium	2.1	mg/L	2.0	6010	16 AUG 96	19 AUG 96
Lead	5.0	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Mercury	0.0051	mg/L	0.0050	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.50	7740	16 AUG 96	17 AUG 96
Silver	0.50	mg/L	0.50	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-MW02-S1-960805
Lab ID: 088981-0001-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 05 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Aluminum	3440	mg/kg	10.0	6010	13 AUG 96	13 AUG 96
Arsenic	0.87	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	40.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Beryllium	0.21	mg/kg	0.20	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	1.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	4.6	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0001-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0001-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0002-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0002-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0002-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0003-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0003-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0003-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0004-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0004-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0004-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0005-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0005-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0005-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0006-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0006-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0006-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0006-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0006-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0007-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0007-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0007-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0007-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0008-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0008-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0008-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0008-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0009-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0009-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0009-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

(cont.)

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0009-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0010-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0010-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0010-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0010-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0011-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0011-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0011-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0011-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0012-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0012-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0012-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0012-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0013-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0013-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0013-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0013-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0014-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0014-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0014-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0014-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-MS	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-MS	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-MS	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

(cont.)

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0015-MS	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0015-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SD	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SD	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-SD	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0015-SD	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	LEACHATE	ICP-TL	16 AUG 96-NX	16 AUG 96-N	16 AUG 96-N
088981-0016-SA	LEACHATE	GFAA-TL	16 AUG 96-NX	16 AUG 96-N	16 AUG 96-N
088981-0016-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-UX	19 AUG 96-U	19 AUG 96-U
088981-0016-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0016-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981

Test: ICPOCP-TCLP-TL TCLP Metals by ICP TCLP Leachate
Method: 6010
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/L	1.0	
Barium	ND	mg/L	0.10	
Cadmium	ND	mg/L	0.050	
Chromium	ND	mg/L	0.10	
Lead	ND	mg/L	0.50	
Silver	ND	mg/L	0.10	

Test: ICPOCP-TCLP-TL TCLP Metals by ICP TCLP Leachate
Method: 6010
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/L	1.0	
Barium	ND	mg/L	0.10	
Cadmium	ND	mg/L	0.050	
Chromium	ND	mg/L	0.10	
Lead	ND	mg/L	0.50	
Silver	ND	mg/L	0.10	

Test: ICPOCP-TCLP-TL TCLP Metals by ICP TCLP Leachate
Method: 6010
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/L	1.0	
Barium	ND	mg/L	0.10	
Cadmium	ND	mg/L	0.050	
Chromium	ND	mg/L	0.10	
Lead	ND	mg/L	0.50	
Silver	ND	mg/L	0.10	

ND = Not Detected

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Test: GF-SECP-TCLP-TL Selenium by Graphite Furnace AA TCLP Leachate
Method: 7740
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/L	0.050	

Test: GF-SECP-TCLP-TL Selenium by Graphite Furnace AA TCLP Leachate
Method: 7740
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/L	0.050	

Test: GF-SECP-TCLP-TL Selenium by Graphite Furnace AA TCLP Leachate
Method: 7740
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/L	0.050	

Test: CV-HGCP-TCLP-TL Mercury by Cold Vapor AA TCLP Leachate
Method: 7470
Matrix: LEACHATE
QC Lot: 19 AUG 96-VX QC Run: 19 AUG 96-V

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/L	0.0020	

ND = Not Detected

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Test: CV-HGCP-TCLP-TL Mercury by Cold Vapor AA TCLP Leachate
Method: 7470
Matrix: LEACHATE
QC Lot: 19 AUG 96-TX QC Run: 19 AUG 96-T

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/L	0.0020	

Test: CV-HGCP-TCLP-TL Mercury by Cold Vapor AA TCLP Leachate
Method: 7470
Matrix: LEACHATE
QC Lot: 19 AUG 96-UX QC Run: 19 AUG 96-U

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/L	0.0020	

Test: AS-FAA-COE-S Arsenic, Furnace AA
Method: 7060
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/kg	0.50	

Test: PB-FAA-COE-S Lead, Furnace AA
Method: 7421
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Lead	ND	mg/kg	0.5	

ND = Not Detected

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Test: SE-FAA-COE-S Selenium, Furnace AA
Method: 7740
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/kg	0.5	

Test: HG-CVAA-COE-S Mercury, Cold Vapor AA
Method: 7471
Matrix: SOIL
QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/kg	0.1	

Test: ICP-COE-S ICP Quantitative Scan (27 Metals)
Method: 6010
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Aluminum	ND	mg/kg	10	
Barium	ND	mg/kg	1.0	
Beryllium	ND	mg/kg	0.2	
Cadmium	ND	mg/kg	0.5	
Chromium	ND	mg/kg	1.0	
Silver	ND	mg/kg	1.0	

ND = Not Detected

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Testcode: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX
Analyzed Date: 20 AUG 96 Time: 11:43

Method: 6010
Concentration Units: mg/L
QC Run: 19 AUG 96-A

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	5.21	104	75-125
Barium	20.0	21.1	105	75-125
Cadmium	0.500	0.498	100	75-125
Chromium	2.00	2.14	107	75-125
Lead	5.00	5.14	103	75-125
Silver	0.500	0.503	101	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Testcode: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX
Analyzed Date: 19 AUG 96 Time: 18:50

Method: 6010
Concentration Units: mg/L
QC Run: 16 AUG 96-M

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	5.05	101	75-125
Barium	20.0	21.8	109	75-125
Cadmium	0.500	0.486	97	75-125
Chromium	2.00	2.10	105	75-125
Lead	5.00	5.01	100	75-125
Silver	0.500	0.551	110	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Testcode: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX
Analyzed Date: 19 AUG 96 Time: 16:35

Method: 6010
Concentration Units: mg/L
QC Run: 16 AUG 96-N

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	4.82	96	75-125
Barium	20.0	20.2	101	75-125
Cadmium	0.500	0.482	96	75-125
Chromium	2.00	2.03	101	75-125
Lead	5.00	4.92	98	75-125
Silver	0.500	0.487	97	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Testcode: GF-SECP-TCLP-TL Method: 7740
Matrix: LEACHATE Concentration Units: mg/L
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A
Analyzed Date: 22 AUG 96 Time: 14:27

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.509	102	79-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Testcode: GF-SECP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX
Analyzed Date: 17 AUG 96 Time: 17:26

Method: 7740
Concentration Units: mg/L
QC Run: 16 AUG 96-M

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Selenium	0.500	0.498	100	79-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Testcode: GF-SECP-TCLP-TL Method: 7740
Matrix: LEACHATE Concentration Units: mg/L
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N
Analyzed Date: 17 AUG 96 Time: 17:31

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.501	100	79-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Testcode: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-VX
Analyzed Date: 20 AUG 96 Time: 01:03

Method: 7470
Concentration Units: mg/L
QC Run: 19 AUG 96-V

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Mercury	0.00500	0.00497	99	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Testcode: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-TX
Analyzed Date: 20 AUG 96 Time: 00:10

Method: 7470
Concentration Units: mg/L
QC Run: 19 AUG 96-T

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Mercury	0.00500	0.00504	101	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Testcode: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-UX
Analyzed Date: 20 AUG 96 Time: 01:13

Method: 7470
Concentration Units: mg/L
QC Run: 19 AUG 96-U

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Mercury	0.00500	0.00506	101	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7060-IRP-S Arsenic, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Testcode: AS-FAA-COE-S Method: 7060
Matrix: SOIL Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Analyzed Date: 14 AUG 96 Time: 11:11

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	75.4	72.3	96	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7421-IRP-S Lead, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Testcode: PB-FAA-COE-S
Method: 7421
Matrix: SOIL
Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX
QC Run: 13 AUG 96-A
Analyzed Date: 15 AUG 96 Time: 09:36

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Lead	53.5	53.5	100	65-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7740-IRP-S Selenium, Furnace AA
STATIC QC LIMITS - DO NOT UPDATE
Testcode: SE-FAA-COE-S Method: 7740
Matrix: SOIL Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Analyzed Date: 14 AUG 96 Time: 10:20

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	72.3	71.3	99	70-130

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7471-IRP-S Mercury by CVAA
STATIC QC LIMITS - DO NOT UPDATE
Test: HG-CVAA-COE-S
Matrix: SOIL
QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	1.50	1.89	126	26-157

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-IRP-S ICP Metals
STATIC QC LIMITS - DO NOT UPDATE (Lot 224)
Testcode: ICP-COE-S
Method: 6010
Matrix: SOIL
Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX
QC Run: 13 AUG 96-A
Analyzed Date: 13 AUG 96 Time: 19:42

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Aluminum	4590	2690	59	45-155
Antimony	39.8	30.2	76	30-166
Arsenic	75.4	82.9	110	49-149
Barium	106	139	131	58-131
Beryllium	51.0	70.5	138	64-140
Boron	94.1	103	110	50-200
Calcium	1290	1240	96	52-141
Cadmium	45.4	55.9	123	57-144
Chromium	71.0	92.1	130	54-141
Copper	112	135	121	57-145
Cobalt	49.6	65.3	132	60-142
Iron	9160	5240	57	49-151
Magnesium	1160	917	79	75-125
Manganese	154	187	122	67-135
Molybdenum	47.4	52.5	111	57-158
Potassium	1420	1110	78	62-132
Lead	53.5	58.9	110	53-142
Nickel	39.4	50.3	128	55-146
Selenium	72.3	75.6	105	52-149
Silver	116	123	106	45-146
Sodium	198	212	107	23-176
Thallium	40.0	41.7	104	50-150
Tin	102	107	105	50-200
Vanadium	65.9	71.6	109	61-131
Zinc	134	144	107	52-149

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-AX MS Run: 19 AUG 96-A

Analyte	Concentration: Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limi
Arsenic	ND	5.18	5.34	5.00	104	107	75-125	3.0	20
Barium	0.177	21.8	22.4	20.0	108	111	75-125	2.6	20
Cadmium	ND	0.490	0.501	0.500	98	100	75-125	2.1	20
Chromium	ND	2.16	2.20	2.00	108	110	75-125	1.7	20
Lead	ND	5.29	5.30	5.00	106	106	75-125	0.09	20
Silver	ND	0.505	0.512	0.500	101	102	75-125	1.3	20

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-MX MS Run: 16 AUG 96-M

Analyte	Concentration: Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limi
Arsenic	ND	4.97	4.81	5.00	99	96	75-125	3.4	20
Barium	0.204	21.7	21.4	20.0	108	106	75-125	1.6	20
Cadmium	ND	0.492	0.492	0.500	98	98	75-125	0.10	20
Chromium	ND	2.11	2.06	2.00	105	103	75-125	2.1	20
Lead	ND	5.04	4.99	5.00	101	100	75-125	1.1	20
Silver	ND	0.504	0.497	0.500	101	99	75-125	1.4	20

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-NX MS Run: 16 AUG 96-N

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Arsenic	ND	4.89	4.87	5.00	98	97	75-125	0.47	20
Barium	0.155	21.1	21.1	20.0	105	105	75-125	0.0	20
Cadmium	ND	0.480	0.485	0.500	96	97	75-125	1.0	20
Chromium	ND	2.05	2.06	2.00	103	103	75-125	0.58	20
Lead	ND	4.96	5.02	5.00	99	100	75-125	1.2	20
Silver	ND	0.488	0.492	0.500	98	98	75-125	0.82	20

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-AX MS Run: 19 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Selenium	ND	0.505	0.500	0.500	101	100	75-125	1.0	35

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-MX MS Run: 16 AUG 96-M

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Selenium	ND	0.488	0.483	0.500	98	97	75-125	1.0	35

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L
QC Lot : 16 AUG 96-NX

Method: 7740

Units Qualifier: Wet Weight
MS Run: 16 AUG 96-N

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Selenium	ND	0.498	0.499	0.500	100	100	75-125	0.20	35

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L
QC Lot : 19 AUG 96-VX

Method: 7470

Units Qualifier: Wet Weight
MS Run: 19 AUG 96-V

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Mercury	ND	0.00420	0.00436	0.00500	84	87	75-125	3.9	20

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L
QC Lot : 19 AUG 96-TX

Method: 7470

Units Qualifier: Wet Weight
MS Run: 19 AUG 96-T

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Mercury	ND	0.00507	0.00507	0.00500	101	101	75-125	0.0	20

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-UX MS Run: 19 AUG 96-U

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	ND	0.00504	0.00511	0.00500	101	102	75-125	1.4	20

Category: 7060-IRP-S Arsenic, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test : AS-FAA-COE-S Method: 7060
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	1.02	4.65	4.84	4.00	91	95	75-125	4.0	35

Category: 7421-IRP-S Lead, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test : PB-FAA-COE-S Method: 7421
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet Weight
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Lead	20.7	23	24	2.0	NC	NC	75-125	3.0	35

NC = Not Calculated, calculation not applicable.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: 7740-IRP-S Selenium, Furnace AA
STATIC QC LIMITS - DO NOT UPDATE
Test : SE-FAA-COE-S Method: 7740
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Concentration Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Selenium	ND	1.9	1.9	2.0	93	93	75-125	0.81	35

Category: 7471-IRP-S Mercury by CVAA
STATIC QC LIMITS - DO NOT UPDATE
Test : HG-CVAA-COE-S Method: 7471
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 16 AUG 96-BX MS Run: 16 AUG 96-B

Analyte	Concentration Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	0.0925 J	0.42	0.35	0.25	132	104	75-125	18	35

J = Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: ICP-IRP-S ICP Metals
STATIC QC LIMITS - DO NOT UPDATE (Lot 224)
Test : ICP-COE-S Method: 6010
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Concentration Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Aluminum	4130	5100	5200	100	NC	NC	45-155	3.0	25
Antimony	NA	NA	NA	49	NC	NC	30-166	0.0	25
Arsenic	NA	NA	NA	82	NC	NC	49-149	0.0	25
Barium	62.3	260	260	200	101	97	58-131	2.5	25
Beryllium	ND	5.0	4.9	5.0	100	98	64-140	1.6	25
Cadmium	ND	4.5	4.6	5.0	91	92	57-144	1.1	25
Calcium	NA	NA	NA	2400	NC	NC	52-141	0.0	25
Chromium	4.15	22	22	20	92	91	54-141	0.57	25
Cobalt	NA	NA	NA	100	NC	NC	60-142	0.0	25
Copper	NA	NA	NA	200	NC	NC	57-145	0.0	25
Iron	NA	NA	NA	7100	NC	NC	49-151	0.0	25
Lead	NA	NA	NA	160	NC	NC	53-142	0.0	25
Magnesium	NA	NA	NA	2400	NC	NC	60-144	0.0	25
Manganese	NA	NA	NA	370	NC	NC	67-135	0.0	25
Molybdenum	NA	NA	NA	94	NC	NC	57-158	0.0	25
Nickel	NA	NA	NA	140	NC	NC	55-146	0.0	25
Potassium	NA	NA	NA	2300	NC	NC	62-132	0.0	25
Selenium	NA	NA	NA	110	NC	NC	52-149	0.0	25
Silver	ND	4.6	4.6	5.0	92	92	45-146	0.35	25
Sodium	NA	NA	NA	500	NC	NC	23-176	0.0	25
Thallium	NA	NA	NA	130	NC	NC	50-150	0.0	25
Vanadium	NA	NA	NA	94	NC	NC	61-131	0.0	25
Zinc	NA	NA	NA	200	NC	NC	52-149	0.0	25

NA = Not Applicable
NC = Not Calculated, calculation not applicable.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

APPENDIX E
MONITORING WELL ABANDONMENT NOTIFICATION

INTERNATIONAL TECHNOLOGY CORPORATION

October 11, 1996

Project No. 761041

Mr. George G. Jackson, PE
Nevada Department of Conservation and Natural Resources
Division of Water Resources
Capitol Complex
123 West Nye Lane
Carson City, NV 89710

Hawthorne Army Depot
Monitoring Well Abandonment
Waiver No. M/O-1057

Dear Mr. Jackson:

As per our phone conversation on Tuesday, October 1, 1996, this letter will serve as IT Corporation's (IT) notification of abandonment for the groundwater monitoring well installed at the Hawthorne Army Depot (HWAD) New Bomb Underground Detonation Area. The waiver number for this notification is referenced above.

The monitoring well was drilled on August 5 and 6, 1996 to a total depth of 200 feet and no groundwater was encountered. During auger withdrawal, a problem was encountered by the drillers and approximately 40 feet of auger was left in the borehole, and the well was subsequently abandoned. Abandonment was completed by filling the well polyvinyl chloride (PVC) casing with cement bentonite grout as well as the remaining annular space.

Should you require any further information on this matter, please feel free to contact Mr. William Stanhope or Mr. Mark Weisberg at (412) 372-7701.

Respectfully submitted,

IT CORPORATION

William Stanhope
Project Geologist

Mark Weisberg, CHMM
Project Manager

WS:MW:jar

cc: G. Lovato, NDEP
H. Millsap, HWAD
P. Seday, HAZWRAP

APPENDIX H

H.3 HAWTHORN WATER QUALITY DATA

Water Quality Data Table

The table below lists all of the drinking water contaminants that we detected during the calendar year of this report. The presence of contaminants in the water does not necessarily indicate that the water poses a health risk. Unless otherwise noted, the data presented in this table is from testing done in the calendar year of the report. The EPA or the State requires us to monitor for certain contaminants less than once per year because the concentrations of these contaminants do not change frequently.

Contaminants	MCLG or MRDLG	MCL, TT, or MRDL	Your Water	Range Low	Range High	Sample Date	Violation	Typical Source
Disinfectants & Disinfectant By-Products								
(There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants)								
TTHMs [Total Trihalomethanes] (ppb)	NA	80	3.2	NA		2007	No	By-product of drinking water disinfection
Inorganic Contaminants								
Arsenic (ppb)	0	10	1	ND	1	2009	No	Erosion of natural deposits; Runoff from orchards; Runoff from glass and electronics production wastes
Barium (ppm)	2	2	0.023	NA		2009	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Chromium (ppb)	100	100	3	NA		2009	No	Discharge from steel and pulp mills; Erosion of natural deposits
Copper - source water (ppm)		1.3	0.004(MPL)	NA		2008	No	Corrosion of household plumbing systems; Erosion of natural deposits
Fluoride (ppm)	4	4	0.3	0.3	0.3	2009	No	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories
Nitrate [measured as Nitrogen] (ppm)	10	10	1.2	0.09	1.2	2009	No	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Radioactive Contaminants								
Radium (combined 226/228) (pCi/L)	0	5	0.457	0.08	0.914	2006	No	Erosion of natural deposits
Uranium (ug/L)	0	30	27	NA		2008	No	Erosion of natural deposits

Contaminants	MCLG	AL	Your Water	Sample Date	# Samples Exceeding AL	Exceeds AL	Typical Source
Inorganic Contaminants							
Copper - action level at consumer taps (ppm)	1.3	1.3	0.003	2006	0	No	Corrosion of household plumbing systems; Erosion of natural deposits

Unit Descriptions	
Term	**Definition**
ug/L	ug/L : Number of micrograms of substance in one liter of water
ppm	ppm: parts per million, or milligrams per liter (mg/L)
ppb	ppb: parts per billion, or micrograms per liter (µg/L)
pCi/L	pCi/L: picocuries per liter (a measure of radioactivity)
NA	NA: not applicable
ND	ND: Not detected
NR	NR: Monitoring not required, but recommended.

Important Drinking Water Definitions	
Term	**Definition**
MCLG	MCLG: Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
MCL	MCL: Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
TT	TT: Treatment Technique: A required process intended to reduce the level of a contaminant in drinking water.
AL	AL: Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
Variances and Exemptions	Variances and Exemptions: State or EPA permission not to meet an MCL or a treatment technique under certain conditions.
MRDLG	MRDLG: Maximum residual disinfection level goal. The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
MRDL	MRDL: Maximum residual disinfectant level. The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
MNR	MNR: Monitored Not Regulated
MPL	MPL: State Assigned Maximum Permissible Level

For more information please contact:

Contact Name: Stephen Gustafson
Address:
P. O. Box 1448
Hawthorne,, NV 89415
Phone: (775) 945-2486

APPENDIX H

H.4 SURFACE WATER RUN-OFF DATA

HAZWRAP

HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM

761041-6

Regulatory Support for Hawthorne Army Depot, Nevada

Surface Runoff Drainage Area Sampling Results, New Bomb Area

October 1996

Prepared by
IT Corporation
Monroeville, Pennsylvania

HAZWRAP SUPPORT CONTRACTOR OFFICE
Oak Ridge, Tennessee 37831
operated by
Lockheed Martin Energy Systems, Inc.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

INTERNATIONAL TECHNOLOGY CORPORATION

October 2, 1996

Project No. 761041

Mr. Paul Seday, Project Manager
HAZWRAP West Coast Office
151 North Sunrise Avenue, Suite 1202
Roseville, California 95661

General Order No. 93B-99204C, Work Release No. K-05
Regulatory Support for Hawthorne Army Depot, Hawthorne, Nevada
Final Report
Surface Runoff Drainage Area, Sampling Results for the New Bomb Area

Dear Mr. Seday:

The subject report enclosed has been finalized based on comments received from you on September 25, 1996. Hawthorne Army Depot (HWAD) had no comments on the draft.

Copies have been sent to Mr. Greg Lovato of the Nevada Division of Environmental Protection (NDEP) and to Mr. Herman Millsap at HWAD. Information presented in this report, excluding Attachment material, will be included with the revised New Bomb Part B Permit Application.

If you have any comments on this report please do not hesitate to call me at (412) 858-3996.

Sincerely,

IT CORPORATION

Mark Weisberg, CHMM
Project Manager

enclosure

cc: Herman Millsap - HWAD
Greg Lovato - NDEP

Table of Contents

List of Tables/List of Figures ii
1.0 Introduction 1
2.0 Sampling Activities 1
3.0 Presentation of Analytical Results 1
4.0 Results 2
Attachment A - Sampling and Analysis Plan, Surface Runoff Drainage Areas
Attachment B - Analysis Request and Chain-of-Custody Record; Chemical Analytical Data
Attachment C - Sample Collection Logs

List of Tables

Table	Title
1	Summary of Analytical Results ~~New Bomb Runoff Surface Soil Sampling Event~~
2	Comparison of Concentrations of Detected Constituents Found Above Site-Specific Background with Proposed Closure Goal Concentrations

List of Figures

Figure	Title
1	Surface Water Runoff Sampling Locations

1.0 Introduction

This report summarizes the analytical results for the Surface Water Runoff Soil Sampling Event conducted on August 8, 1996 at the Hawthorne Army Depot (HWAD) New Bomb underground detonation (UD) site near Hawthorne, Nevada. This sampling event was performed in accordance with the NDEP approved Sampling and Analysis Plan (SAP) Surface Runoff Drainage Areas, dated August 1996. A copy of this SAP is provided in Attachment A.

2.0 Sampling Activities

On August 8, 1996, IT Corporation (IT) personnel met with the NDEP representative and HWAD personnel to select the sampling locations. The IT field supervisor then returned to each site to collect the samples. Eleven discrete samples were collected from ten sampling locations, including a field duplicate. Sample NB-S11 was collected as a field duplicate for sample NB-S9. Each sample was collected using a dedicated stainless steel spoon or scoop. Then each sample was containerized, labeled, and placed in an iced cooler to ensure proper chilling requirements. The chain of custody and request for analysis form were completed and the samples were shipped on August 9, 1996 to Quanterra Analytical Services in West Sacramento, California for analyses. Each sample was analyzed for selected TCLP analytes, explosives by HPLC, Method 8330, and total metals, as indicated in Table 1 of the SAP (see Attachment A). Sample collection logs for these samples are provided in Attachment B.

3.0 Presentation of Analytical Results

The results of the analyses are summarized in Table 1 and a complete copy of the analytical report is presented in Attachment C. To expedite review of the analytical results, the samples were grouped according to their relative location in reference to UD operations. The first group is identified as background samples and include samples NB-S1 through NB-S3. These samples were collected in the unnamed spring canyon located approximately one-half of a mile west of the UD operations. They are considered to be unaffected by the UD operations, and represent background values at the New Bomb site.

The second grouping presents the samples collected in the immediate vicinity of UD operations, upgradient of the UD pits. These sampling locations are considered to be within

the zone of potential contamination from fallout and represent control samples for the runoff study. Samples in this group include samples NB-S4 through NB-S6.

The next two groups of samples are those which are downgradient of the UD pits. One sample group (NB-S7 and NB-S8) is located downgradient inside of the canyon and the other group (NB-S9 through NB-11) is located downgradient on the alluvial fan (see Table 1). These are the areas where deposition of potential contaminants associated with surface water runoff would occur.

The last column of Table 1 presents the 95 percent Upper Tolerance Limits (UTL) for naturally occurring constituents in soil for the Hawthorne Valley. For metals, this column represents an additional screening value for background concentrations in soils. Concentrations above the UTL would be considered above Hawthorne Valley background levels.

4.0 Results

When comparing the analytical results of the downgradient samples (NB-S7 through NB-S11) to the New Bomb site-specific background samples (NB-S1 through NB-S3), the following constituents generally exceeded site-specific background concentrations:

TCLP Metals	Total Explosives	Total Metals
Barium	HMX	Aluminum
	RDX	Arsenic
	2,4,6-TNT	Beryllium
		Cadmium
		Chromium
		Lead
		Mercury

It should be noted that some of these excursions above site-specific background are based on only one sample out of four being elevated (e.g., HMX; RDX; TNT; aluminum; beryllium; mercury).

It should also be noted that only the concentrations of two metals, cadmium and lead, exceeded the 95% UTL background concentrations for the Hawthorne Valley. The explosive compounds were not compared to the 95% UTL concentrations because UTLs do not exist for these constituents.

When comparing the results of the downgradient samples, however, with the "control" results (i.e., samples collected upgradient inside the canyon; NB-S4 through NB-S6), only the following constituents exceeded control concentrations:

TCLP Metals	Total Explosives	Total Metals
None	HMX	Aluminum
	RDX	Beryllium
	2,4,6-TNT	Chromium

It should be noted that all of these excursions above control results are based on only one sample out of four being elevated.

This demonstrates that concentrations of the TCLP metal barium, and total arsenic, cadmium, lead, and mercury are similar upgradient inside the canyon and in downgradient locations, suggesting no significant off-site migration for these constituents.

Those constituents that exceeded site-specific background levels were compared with human health risk-based concentrations for soil. The risk-based values were taken from HWAD's proposed closure goals as defined in the Investigation-derived Waste Management Plan (Tetra Tech, 1996). As shown in Table 2, none of the constituent concentrations exceeded HWAD's proposed risk-based closure goals for soil.

Based on these results, soils downgradient from the New Bomb area are expected to pose an insignificant risk to human health and additional actions to control off-site migration of chemical constituents are not necessary.

References

Tetra Tech, 1996, "Final Investigation-Derived Waste Management Plan," Hawthorne Army Depot, Hawthorne, Nevada, prepared for the U.S. Army Corps of Engineers by TetraTech, Inc., San Francisco, CA, March.

TABLES

Table 1
Summary of Analytical Results
New Bomb Runoff Surface Soil Sampling Event
Hawthorne Army Depot
August 1996

	Background Samples			Upgradient Inside Canyon			Downgradient Inside Canyon		Downgradient - Alluvial Fan		
Parameters/Units	**NB-S1**	**NB-S2**	**NB-S3**	**NB-S4**	**NB-S5**	**NB-S6**	**NB-S7**	**NB-S8**	**NB-S9/ NB-S11[a]**	**NB-S10**	***Background Values[b]***
TCLP[c] (mg/L)											
2,4-DNT	ND[d]	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*[e]
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
TCLP Metals (mg/L)											
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Barium	0.15	0.14	ND	0.22	0.21	0.24	0.19	0.24	0.14/0.16	0.20	*NA*
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Chromium	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Explosives[f] (total) (mg/kg)											
HMX	ND	ND	ND	ND	ND	ND	0.33	ND	ND/ND	ND	*NA*
1,3,5-TNB	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
RDX	ND	ND	ND	ND	0.64	ND	0.72	ND	ND/ND	ND	*NA*
1,3-DNT	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
2,4,6-TNT	ND	ND	ND	ND	ND	ND	0.63	ND	ND/ND	ND	*NA*
Tetryl	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
2,4-DNT	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
2,6-DNT	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
2-Am-DNT	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
4-Am-DNT	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
2-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
4-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
3-Nitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*

Ta 1
(Co ed)

Parameters/Units	Background Samples			Upgradient Inside Canyon			Downgradient Inside Canyon		Downgradient - Alluvial Fan		
	NB-S1	NB-S2	NB-S3	NB-S4	NB-S5	NB-S6	NB-S7	NB-S8	NB-S9/ NB-S11[a]	NB-S10	*Background Values*[b]
Metals[g] (total) (mg/kg)											
Aluminum	4,480	4,760	2,810	5,060	4,870	4,150	3,610	6,580	4,100/4,190	4,130	*12,558*
Arsenic	0.90	0.62	0.90	1.5	1.1	0.90	0.77	1.2	1.1/1.0	1.0	*15.2*
Barium	97.2	90.2	32.9	99.2	68.2	57.7	57.5	90.6	80.0/74.3	62.3	*141.0*
Beryllium	ND	0.21	ND	0.30	0.25	0.23	ND	0.32	0.20/0.20	ND	*0.51*
Cadmium	ND	ND	ND	0.58	1.9	0.60	0.73	1.2	ND/ND	ND	*1.12*
Chromium	3.1	4.7	2.4	5.9	3.1	5.3	4.6	7.9	2.6/3.2	4.1	*10.7*
Lead	3.4	3.1	4.9	37.8	41.7	19.8	22.9	37.7	14.8/15.2	20.7	*21.2*
Mercury	ND	ND	ND	0.10	ND	ND	ND	0.10	ND/ND	ND	*0.22*
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	*NA*

[a] Sample NB-S11 was collected as the field duplicate for sample NB-S9.

[b] Background values listed represent the 95% Upper Tolerance limits for naturally occurring constituents in Hawthorne Valley soils. These values are based on the samples collected in the Hawthorne Valley as reported by Tetra Tech, 1996.

[c] TCLP - Toxicity Characteristics Leaching Procedure

[d] Indicates that the parameter was not detected.

[e] NA indicates that the value is not available.

[f] Explosive analytes were analyzed by High Performance Liquid Chromatography (HPLC), Method 8330.

[g] Metals were analyzed by ICP (Method 6010), except for arsenic (Method 7060), lead (Method 7421), Mercury (Method 7471), and selenium (Method 7740).

Note: Chemical abbreviations are as follows:

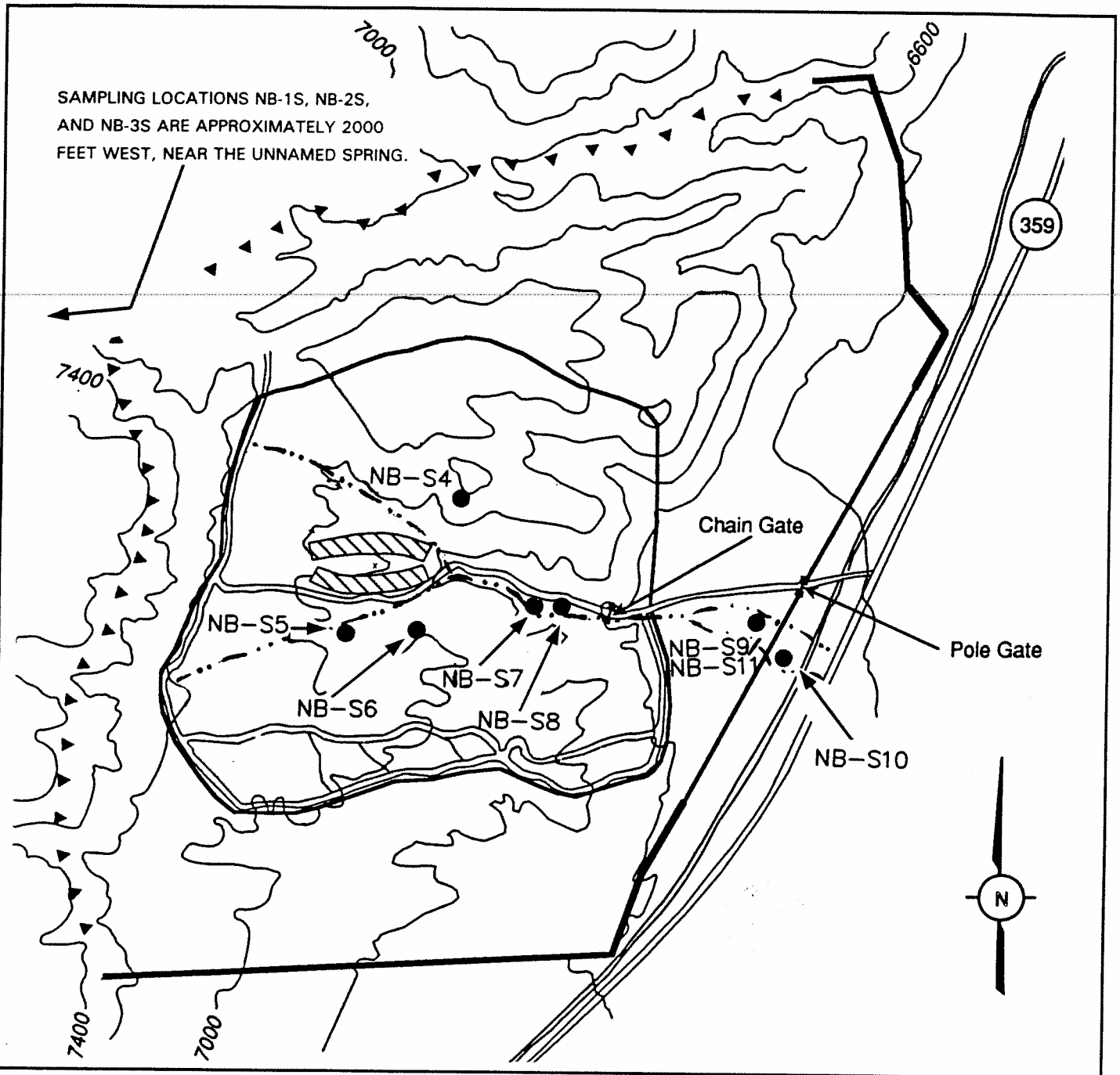
HMX - Cyclotetramethylene tetranitramine
1,3,5-TNB - 1,3,5-Trinitrobenzene
RDX - Cyclo-1,3,5-trimethylene-2,4,6-trinitramine
1,3-DNT - 1,3-Dinitrotoluene
2,4,6-TNT - 2,4,6-Trinitrotoluene
Tetryl - Trinitro-2,4,6-phenylmethylnitramine
2,4- and 2,6-DNT - 2,4- and 2,6-Dinitrotoluene
2-Am- and 4-Am-DNT - 2-Amino and 4-Amino-dinitrotoluene

Table 2
Comparison of Concentrations of Detected Constituents Found Above Site-Specific Background with Proposed Closure Goal Concentrations Hawthorne Army Depot New Bomb Area Hawthorne, Nevada

Constituent of Concern	HWAD Proposed Closure Goals for Soil (mg/kg)	Range of Detections in Downgradient Runoff Surface Soil Samples (mg/kg)
Explosives		
HMX	4,000	ND - 0.33
RDX	64	ND - 0.72
2,4,6-Trinitrotoluene	233	ND - 0.63
Metals		
Aluminum	80,000	3,610 - 6,580
Arsenic	100	0.77 - 1.2
Beryllium	1	ND - 0.32
Cadmium	20	ND - 1.2
Chromium	20	2.6 - 7.9
Lead	100	14.8 - 37.7
Mercury	24	ND - 0.10

Note: HWAD proposed closure goals for soils were obtained from Table 4-2 of the Investigation-Derived Waste Management Plan (TetraTech, 1996).

FIGURE



LEGEND

- Underground Detonation Unit
- Gates
- Existing Fence
- Proposed Fence, (recently constructed)
- Warning Signs
- Improved Roads
- Topographic Contours, (200 foot interval)
- NB-S3 Sampling Locations
- Intermittent Stream

FIGURE 1

SURFACE WATER RUNOFF
SAMPLING LOCATIONS

SCALE IN FEET

0 2000 4000

INTERNATIONAL
TECHNOLOGY
CORPORATION

ATTACHMENT A

SAMPLING AND ANALYSIS PLAN
SURFACE RUNOFF DRAINAGE AREAS

NEW BOMB AREA UNDERGROUND DETONATION UNIT
HAWTHORNE ARMY DEPOT
HAWTHORNE, NEVADA

PREPARED BY:

IT CORPORATION
2790 MOSSIDE BOULEVARD
MONROEVILLE, PENNSYLVANIA 15146

AUGUST 1996

Table of Contents

1.0 Introduction 1
1.1 Site Description 1
1.2 Objectives of Sampling and Analysis Plan 2
1.3 Work Organization and Responsibilities 2

2.0 Sampling Activities 3
2.1 Sampling Areas and Locations 3
2.2 List of Analytical Parameters 3
2.3 Safety and Health Considerations 4
2.4 Sampling Methods 4
2.4.1 Sampling Protocols 4
2.4.2 Sample Documentation 5
2.4.3 Sampling QA/QC Objectives and Procedures 6

3.0 Laboratory Analysis 7
3.1 Laboratory Analysis Protocols 7
3.2 Laboratory QA/QC Procedures 8
3.3 Data Validation Procedures 9

4.0 Evaluation of Characterization Data 11
Table 1 - List of Analytical Parameters
Attachment A - Forms

1.0 Introduction

This Sampling and Analysis Plan (SAP) presents the sampling and analytical requirements for characterization of the surface soil in the surface runoff drainage areas in the New Bomb Area. The objective of the sampling is to determine if significant levels of hazardous constituents are transported from the treatment area by stormwater runoff. Included in the SAP are objectives, scope of work, technical approach, methodologies, procedures, and quality assurance/quality control (QA/QC) protocols that are to be utilized in the characterization.

The SAP has been prepared by IT Corporation (IT) in response to a request from the Hawthorne Army Depot (HWAD) under an agreement with the Nevada Division of Environmental Protection (NDEP). Results from this SAP will be utilized to address NDEP comments on the "RCRA Part B Permit Application for Underground Detonation at Hawthorne Army Ammunition Plant, Nevada" (Part B Permit, July 1993).

1.1 Site Description

The New Bomb Area of HWAD is utilized by the U.S. Army to conduct thermal treatment for demilitarization of unserviceable explosive items, which primarily consist of cartridges, projectiles, bombs, rockets, small arms, artillery, mortar, and powders. Treatment is accomplished by underground detonation (UD) and open burning (OB) in the UD unit located at the base of a 185-foot-high ridge within the New Bomb Area. Underground detonation and open burning are conducted by the HWAD contractor under the direction of the government staff assigned to quality assurance surveillance.

A typical UD operation takes place in a 20-foot-long by 6-foot-wide by 4-foot-deep earthen cell located at the base of the ridge. A total of 20 cells are available for UD with 10 cells located in the northern canyon and another 10 cells located in the southern canyon. Location of the UD cells and approximate extent of the affected areas are shown in Figure II-10 in Section II.F of Part B Permit. OB is performed at the UD unit as well, until such time the Old Bomb Area located at the main base is permitted. OB is performed in metal pans approximately 16 feet long, 6 feet wide, and 1 foot deep in size.

1.2 Objectives of Sampling and Analysis Plan

The objectives for the sampling and analysis at the UD unit include:

- Characterize the conditions of soil media (1) in surface runoff drainage channel(s) downgradient from the UD unit, (2) in the vicinity and upgradient of the UD unit, and (3) near the spring located approximately one mile northwest of the site to establish background levels

  Note that the above-mentioned Area (2) will be located in the expected zone of plume deposition from treatment operations. Results from this location will be important if sampled areas downgradient (i.e., Area 1) are also within the zone of plume deposition.

- Compare the characterization results with background levels and upgradient levels to determine if any contaminant is transported by surface runoff to locations downgradient from the UD unit.

1.3 Work Organization and Responsibilities

Field sample collection will be performed by IT personnel trained in sampling at hazardous waste (including explosives) sites. A sampling task manager will be assigned to be responsible for sample collection, field analysis, labeling, documentation, packaging, and shipment or transfer of the samples to the designated laboratory for analysis. The sampling task manager and/or project manager will be responsible for sample data management, which involves tracking of samples from the time of collection through the reporting of analytical results, including knowing the status of each sample at all times. The project manager, with support from other project personnel at the home office, also will evaluate the characterization results with appropriate background levels and upgradient levels to determine if any impact by surface runoff exists.

2.0 Sampling Activities

The sampling activities that are to be performed under this SAP at the UD unit are described in the following sections.

2.1 Sampling Areas and Locations

The areas to be sampled include:

- Surface runoff drainage channel(s) downgradient from the UD unit - four (4) sampling locations, two on each side of the canyon or further downgradient along the road, to be selected in the field based on field observation and judgement
- Area(s) upgradient and in the vicinity of the UD unit, which show deposition from UD operations - two (2) sampling locations to be selected in the field based on field observation and judgement
- The spring area - three (3) sampling locations to be selected in the spring area which appears to be unaffected by UD operations

Sampling locations will first be identified in the field based on judgement of the IT's sampling task manager with the concurrence of an NDEP representative prior to sampling. Justification for the selected locations will be described in the Field Activity Daily Log (FADL) and Sample Collection Logs. Actual sampling locations will be clearly marked on a scale map of the New Bomb Area and attached the Sample Collection Logs. While the total number of samples will be made in the field, at least four (4) more sets of sample containers and equipment than as described above will be available for sampling.

2.2 List of Analytical Parameters

The list of parameters to be analyzed is presented in Table 1 - List of Analytical Parameters. The list of analytical parameters has been adapted from the Waste Analysis Plan for the New Bomb Area.

In addition, total concentrations of selected metals in the background samples will be analyzed to assist in the preparation of the New Bomb health risk assessment. These metals include

aluminum, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, selenium, and silver.

2.3 Safety and Health Considerations

Field screening for unexploded ordnance (UXO) and other materials (such as shrapnel), resulting from New Bomb operations, is performed after each treatment event. Field screening for UXO will be performed prior to any field sampling activities. Procedures for the field screening (cleanup) are described in the Standing Operating Procedures (SOP) for New Bomb.

The list of potential COCs is compiled based on historical activities at HWAD, residues detected at other U.S. Department of Defense (DoD) OB/OD sites, and potential transformation products of explosives. The chemicals in the representative munitions items have been evaluated and representative constituents have been included as analytical parameters in Table 1 (attached). Also, data collected according to the Waste Analysis Plan for the New Bomb Area were examined to ensure detected constituents were included as analytical parameters.

Safety and health precautions for field sampling activities are described in the Standing Operating Procedures (SOP) for New Bomb and the revised Health and Safety Plan (IT, July 1996).

2.4 Sampling Methods

Sampling methods, including sampling procedures, equipment, containers, preservation techniques, chain-of-custody, decontamination, and QA/QC procedures and objectives, are presented below.

2.4.1 Sampling Protocols

Sampling protocols, including sampling procedures, equipment, containers, preservation techniques, labeling, and decontamination, are described herein.

Surface soil samples will be collected from the areas and locations as described in Section 2.1. Prior to sampling, the areas will be inspected by the sampling task manager to determine the sampling locations. These locations will be photographed and recorded on a sample collection log with distance to distinguishable landmarks.

Surface soil samples will be collected from 0 to 6 inches below grade at each location using a fresh or decontaminated small hand tool, such as stainless steel spoons or gardening trowels. Depending on analytical requirements, a sufficient quantity of soils (e.g., 100 grams) will be collected in precleaned containers (e.g., laboratory-supplied sample jars for various analyses). At a minimum, all samples will be placed on ice immediately after collection to chill the samples to 4 degrees Celsius (°C).

Sample labels will be placed on all containers at the time the sample is collected. Sample labels will be filled out with waterproof ink and will include the following information: sample identification, sampling date, sample location, and analyses to be performed. In addition, upon completion of sample collection activities, a combined Request for Analysis and Chain-of-Custody Record form will be completed by the sampling team members as a part of sample documentation described in Section 2.4.2.

Note that extra amount of soils may be needed for QA/QC samples. At least one duplicate sample will be collected per sampling event. Field QA/QC procedures are outlined in Section 2.4.3.

2.4.2 Sample Documentation

An integral part of the field sampling activities will be maintaining a complete field documentation. A FADL will be completed each day when work is performed. Site observations and a description of sampling activities will be documented on the FADL by the sampling task manager or his/her designee (such as the other sampling team member). Each sample collected will be recorded on a Sample Collection Log that includes the date and time of sample collection, sample method, bottle requirements, and analytical parameters. A sketch of the sampling location will be shown on the Sample Collection Log.

Sampling activities involving off-site testing and analysis will be documented by a combined Request for Analysis/Chain-of-Custody Record form. This form will serve as the official record of sample custody. Chemical analytical results will be filed with the Request for Analysis/Chain-of-Custody Record forms. Examples of these field documentation forms are provided in Attachment A.

2.4.3 Sampling QA/QC Objectives and Procedures

The objectives of sampling QA/QC procedures are to generate field samples that can provide scientifically valid and legally defensible data. Several types of QA/QC samples are incorporated into the field sampling program. At least one field duplicate sample will be collected for each day of sampling or every 20 samples, whichever comes first, to ensure that the field sampling crew is obtaining samples that are representative of conditions at the site. All samples will be thoroughly mixed during sampling. This is critical because inadequate mixing of the samples could yield inaccurate analytical results. If the sampling equipment utilized to collect the samples is decontaminated between uses, a rinsate sample will be collected after decontamination to ensure that proper decontamination procedures are followed.

3.0 Laboratory Analysis

Analytical methods, including laboratory methods, detection limits, quantitation limits, QA/QC procedures, and data validation procedures, are described below.

3.1 Laboratory Analysis Protocols

Unless otherwise noted, the soil samples collected from the New Bomb UD unit will be analyzed in the laboratory by analytical protocols as contained in "Test Methods for Evaluating Solid Waste" (SW-846, Third Edition, 1986) and Appendix I in Appendix D of "RCRA Part B Permit Application for Underground Detonation at Hawthorne Army Ammunition Plant, Nevada" (Part B Permit, July 1993, as revised). The chemical groups are presented in Table 1 and their analytical methods are summarized below:

- Toxicity Characteristic Leaching Procedure (TCLP), Method 1311 of SW-846.
- Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC), Method 8330 of SW-846.
- Analysis for Explosives, HPLC, Method 1 of Appendix I, or equivalent method.
- Analysis for Metals, Method 6010 and/or 7000-series methods of SW-846 to achieve required reporting limits.
- Analysis for Semivolatile Organics, Method 8270 of SW-846 or latest update.

Method detection limits and quantitation limits for the above analytical methods will achieve levels that can be compared to regulatory TCLP levels listed in 40 CFR 261.24 and U.S. EPA Region IX Preliminary Remediation Goals (PRGs). These limits are based on several factors, and will be supplied by the laboratory at the time of analysis. A comparison of the estimated quantitation limits (in SW-846) with TCLP levels and PRGs indicates that the quantitation limits are typically several orders of magnitude less than the regulatory levels or PRGs.

3.2 Laboratory QA/QC Procedures

The laboratory QA/QC procedures outlined below are designed to provide scientifically valid and legally defensible data. Several types of quality control indicators are incorporated into the QA/QC program. These indicators are introduced into the sample testing process to provide a mechanism for the assessment of the analytical data.

Several quality control samples are included in each QC batch and are processed identically to the other environmental samples. These QC samples include a Method Blank (MB), a Laboratory Control Sample (LCS), and a Matrix Spike/Matrix Spike Duplicate (MS/MSD). An additional pair of samples will be collected to ensure enough samples are obtained to perform the MS/MSD analyses.

The LCS is a QC sample that is created by adding known concentrations of a full or partial set of target analytes to a matrix similar to that of the environmental samples in the QC batch. The LCS analyte recovery results are used to monitor the analytical process and provide evidence that the laboratory is performing the method within acceptable guidelines. Failure to meet the established recovery guidelines requires repreparation and reanalysis of all samples in the QC batch.

At times, a Laboratory Control Sample Duplicate (LCSD) is also included in the QC batch. An LCSD is a QC sample that is created and handled identically to the LCS. Analyte recovery data from the LCSD are assessed in the same way as those of the LCS. The LCSD recoveries, together with the LCS recoveries, are used to determine the reproducibility (precision) of the analytical system. Precision data are expressed as relative percent differences (RPD). Failure of the RPDs to fall within the laboratory-generated acceptance windows requires the repreparation and reanalysis of all samples in the QC batch.

The MB is a QC sample consisting of all the reagents used in analyzing the environmental samples contained in the QC batch. Method Blank results are used to determine if interference or contamination in the analytical system could lead to the reporting of false positive data or elevated analyte concentrations. All target analytes must be below the reporting limits except for the common laboratory contaminants indicated as follows:

Volatile (GC or GC/MS)	Semivolatile (GC/MS)	Metals
Methylene chloride	Phthalate Esters	Copper
Acetone		Iron
2-Butanone		Zinc
		Lead

The listed volatile and semivolatile compounds may be present in concentrations up to 5 times the reporting limits. All other organic analyte concentrations must be below the reporting limits. The listed metals may be present in concentrations up to 2 times the reporting limit, or must be twenty-fold less than the results of the environmental samples. Failure to meet these MB criteria requires the repreparation and reanalysis of all samples in the QC batch.

A MS/MSD are a pair of environmental samples to which known concentrations of a full or partial set of target analytes are added. The MS/MSD results are determined in the same manner as the results of the environmental sample used to prepare the MS/MSD. The analyte recoveries and the RPD of the recoveries are calculated and used to evaluate the effect of the sample matrix on the analytical results. When evaluating the MS/MSD data, special attention is given to the RPD values. When these values fail to meet acceptance criteria, the data are reviewed to determine the cause. If, in the analyst's judgment, sample matrix effects are indicated, no corrective action is performed. Otherwise, the MS/MSD and the environmental sample used to prepare them are reprepared and reanalyzed.

In addition to these batch-related QC indicators, each organic environmental and QC sample is spiked with surrogate compounds. Surrogates are organic chemicals that behave similarly to the analytes of interest and that are rarely present in the environment. Surrogate recoveries are used to monitor the individual performance of a sample in the analytical system.

3.3 Data Validation Procedures

Each sample result collected as a part of the sampling and analysis program will be verified and validated in accordance with the procedures provided in the U.S. Environmental Protection Agency (USEPA) guidance developed for the USEPA Contract Laboratory

Program (CLP) (USEPA, February 1988, updated February 1994; USEPA, July 1988, updated February 1994). Verification of laboratory chemical data will be the responsibility of the laboratories performing the analysis. Validation of all data will be the responsibility of the HWAD and/or its contractor.

Typically, the data validation process includes an assessment of the following QC requirements:

- Sample holding time and preservation (verification of sampling, extraction, and analysis dates from a review of chain-of-custody records, extraction logs, and run logs)
- Gas chromatography/mass spectrometry (GC/MS) tuning and GC instrument performance for organics
- Initial and continuing calibration
- Method, preparation, and calibration (inorganics) blank contamination (including trip blanks for volatile organic compounds [VOC])
- Surrogate spike recoveries (organics)
- LCS spike recoveries
- MS/MSD spike recoveries and precision between results
- Internal standards performance (organics)
- Inductively Coupled Plasma (ICP) interference check sample (ICS) results (inorganics)
- ICP serial dilution results (inorganics)

In addition, for detected analytes, the data validation process includes an evaluation of the reliability of the quantitation, with consideration of several other factors, such as retention time, spectral match, calibration range, matrix interference, and internal standards.

4.0 Evaluation of Characterization Data

Characterization data of soil media in surface runoff drainage channel(s) downgradient from the UD unit are to be compared to the levels found in the upgradient samples to determine if any contaminant is transported by surface runoff to locations downgradient from the UD unit. The background levels established in the samples collected from the spring area will be utilized to determine if sample collected near the site are above background.

A characterization report summarizing the sampling and analysis results will be submitted to NDEP upon completion. The report will include at a minimum the following elements:

- Narrative description of sampling and analysis activities, including rationale for sampling locations
- Map showing sampling locations
- Table showing analytical results
- Discussion comparing downgradient levels of detected compounds to background levels, regulatory TCLP levels, and health-based levels (e.g., PRGs)
- Narrative description of results of data validation process
- Copies of field daily activity logs, sample collection logs, chain-of-custody forms, and non-conformance reports.

TABLE 1
LIST OF ANALYTICAL PARAMETERS

Constituent	Analyzed for TCLP Conc. in mg/L	Analyzed for Total Conc. in mg/kg
Metals		
Aluminum		✓
Arsenic	✓	✓
Barium	✓	✓
Beryllium		✓
Cadmium	✓	✓
Chromium	✓	✓
Lead	✓	✓
Mercury	✓	✓
Selenium	✓	✓
Silver	✓	✓
Organics		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)		✓
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)		✓
1,3,5-Trinitrobenzene (1,3,5-TNB)		✓
1,3-Dinitrobenzene (1,3-DNB)		✓
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)		✓
Nitrobenzene (NB)	✓	✓
2,4,6-Trinitrotoluene (2,4,6-TNT)		✓
4-Amino-2,6-dinitrotoluene (4-Am-DNT)		✓
2-Amino-4,6-dinitrotoluene (2-Am-DNT)		✓
2,4-Dinitrotoluene (2,4-DNT)	✓	✓
2,6-Dinitrotoluene (2,6-DNT)		✓
2-Nitrotoluene (2-NT)		✓
3-Nitrotoluene (3-NT)		✓
4-Nitrotoluene (4-NT)		✓

Footnotes:

In accordance with NDEP comments, soil samples will be analyzed for metals and organics (in U.S. EPA Method 8330) for total concentrations.

ATTACHMENT A
FORMS

INTERNATIONAL TECHNOLOGY CORPORATION

FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	
	NO.	
	SHEET	OF

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SIGNATURE	DATE:

327A-7-8

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

SAMPLE COLLECTION LOG

PROJECT NAME _____

SAMPLE NO. _____

SAMPLE LOCATION _____

SAMPLE TYPE _____

COMPOSITE ____ YES ____ NO

COMPOSITE TYPE _____

DEPTH OF SAMPLE _____

WEATHER _____

CONTAINERS USED	AMOUNT COLLECTED

COMMENTS:

PREPARED BY: _____

COMMENTS: (Continued)

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

PREPARED BY: _____

LEGEND

1. A SAMPLE COLLECTION LOG IS TO BE COMPLETED FOR EACH SAMPLE.
2. ALWAYS COMPLETE BOTH SIDES. IF SECOND SIDE IS NOT USED, DRAW A LINE THROUGH IT AND MARK N/A. FILL IN CONTROL BLOCK AND PREPARED BY.
3. ALL ENTRIES ON LOG ARE TO BE COMPLETED, IF NOT APPLICABLE MARK N/A.
4. DATE: USE MONTH/DAY/YEAR; I.E., 10/30/85
5. TIME: USE 24-HOUR CLOCK; I.E., 1835 FOR 6:35 P.M.
6. PAGE: EACH SAMPLE TEAM SHOULD NUMBER PAGE _____ OF _____ FOR THE DAY'S ACTIVITIES FOR ALL SHEETS PREPARED ON A SINGLE DAY, I.E., IF THERE ARE A TOTAL OF 24 PAGES (INCLUDING FRONT AND BACK) NUMBER 1 OF 24, 2 OF 24, ETC.
7. SAMPLE LOCATION: USE BORING OR MONITORING WELL NUMBER, GRID LOCATION (TRANSECT), SAMPLING STATION I.D., OR COORDINATE TO PHYSICAL FEATURES WITH DISTANCES. INCLUDE SKETCH IN COMMENT SECTION IF NECESSARY.
8. SAMPLE TYPE: USE THE FOLLOWING - SOIL, WATER (SURFACE OR GROUND), AIR (FILTERS, TUBES, AMBIENT, PERSONNEL), SLUDGE, DRUM CONTENTS, OIL, VEGETATION, WIPE, SEDIMENT.
9. COMPOSITE TYPE: I.E., 24-HOUR, LIST SAMPLE NUMBERS IN COMPOSITE, SPATIAL COMPOSITE.
10. DEPTH OF SAMPLE: GIVE UNITS, WRITE OUT UNITS SUCH AS INCHES, FEET. DON'T USE ' OR ".
11. WEATHER: APPROXIMATE TEMPERATURE, SUN AND MOISTURE CONDITIONS.
12. CONTAINERS USED: LIST EACH CONTAINER TYPE AS NUMBER, VOLUME, MATERIAL (E.G., 2 - 1L GLASS; 4 - 40 ML GLASS VIAL; 1 - 400 ML PLASTIC; 1 - 3 INCH STEEL TUBE; 1 - 8 OZ. GLASS JAR).
13. AMOUNT COLLECTED: VOLUME IN CONTAINERS (E.G. 1/2 FULL).

IT INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 5042
Page 1 of ____

Project Name/No. 1
Sample Team Members 2
Profit Center No. 3
Project Manager 4
Purchase Order No. 6
Required Report Date 11

Samples Shipment Date 7
Lab Destination 8
Lab Contact 9
Project Contact/Phone 12
Carrier/Waybill No. 13

Bill to: 5

Report to: 10

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Pre-servative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☐ Archive (mos.)

Turnaround Time Required: 26
Normal ☐ Rush ☐

QC Level: 27
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation)	Date: Time:	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

White to accompany samples Yellow Field copy

*See back of form for special instructions

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] _____
Page____of ____

Project Name

Project No.

Samples Shipment Date

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.

White To accompany samples Yellow Field copy

*See back of form for special instructions

Non-Conformance Report

1	PROJECT NAME:	2	JOB NO.
3	LOCATION:	4 DATE:	5 NCR NO.

6 DESCRIPTION OF NON-CONFORMANCES:

PREPARED BY: _____ DATE: _____
Quality Control Representative

REVIEWED BY: _____ DATE: _____
Quality Control Manager

7 DISPOSITION:

RECOMMENDED BY: _____ DATE: _____

REVIEWED BY: _____ DATE: _____
Quality Control Representative

8 ACTION VERIFICATION:

IMPLEMENTED BY: _____ DATE: _____

VERIFIED BY: _____ DATE: _____
Quality Control Representative

9 NCR CLOSE-OUT _____ DATE: _____
Quality Control Manager

ATTACHMENT B

IT CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 23531
Page 1 of 2

Project Name/No.[1] Hawthorne Army Depot 761041
Sample Team Members[2] B. Stanhope
Profit Center No.[3] 3211210
Project Manager[4] M. Weisberg
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 08-09-96
Lab Destination[8] Quanterra - W. Sacramento
Lab Contact[9] V. Herd
Project Contact/Phone[12] B. Stanhope / 412 372 7701
Carrier/Waybill No.[13] 2349392555 FEDERAL EXPRESS

Bill to:[5] IT-Corp / AP
2790 Mosside Blvd.
Monroeville, PA 15146

Report to:[10] B. Stanhope
IT Corp.
2790 Mosside Blvd.
Monroeville, PA 15146

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
[illegible]W02-S1-960807	Soil	8-5-96 (1015)	1X 8oz glass	8oz	None	Al, As, Ba, Be, Cd, Cr, Pb, Hg, Se, Ag	FOR LAB USE ONLY	
[illegible]-MW02-S2-960807		8-7-96 @ 1610	1x 16oz glass	16oz		Full TCLP		
[illegible]W02-S3-960807		8-7-96 @ 1635						
[illegible]W02-S4-960807		8-7-96 @ 1655						
[illegible]W02-S5-960807		8-7-96 @ 1610						
[illegible]-S1-960808		8-8-96 @ 1110				TCLP*, Metals, Total 8330	FOR LAB USE ONLY	
[illegible]-S2-960808		8-8-96 @ 1115						
[illegible]-S3-960808		8-8-96 @ 1125						

COPY

Special Instructions:[23]

Possible Hazard Identification:[24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal:[25]
Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required:[26]
Normal ☒ Rush ☐

QC Level:[27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) illegible Stanhope	Date: 8-9-96 Time: 1400	1. Received by[28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29] * TCLP analytes for samples are As, Ba, Cd, Cr, Pb, Hg, Se, Ag, Nitrobenzene, and 2,4-Dinitrotoluene.

(US)

MCA 3/15/91

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 531

Page 2 of 2

Project Name Hawthorne Army Depot Project No. 761041 Samples Shipment Date 8-9-96

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
7-960808	Soil	8-8-96 @ 1145	1 x 160z glass	160z	None	TCLP*, Total Metals, 8330		
5-960808		8-8-96 @ 1205					FOR LAB USE ONLY	
6-960808		8-8-96 @ 1220						
7-960808		8-8-96 @ 1240					FOR LAB USE ONLY	
8-960808		8-8-96 @ 1250						
9-960808		8-8-96 @ 1335					FOR LAB USE ONLY	
10-960808		(WS) 1405 → 8-8-96 @ ~~1250~~ WS						
11-960808		8-8-96 @ 1335					FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

COPY

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

MCA 3/15/91

Quanterra Environmental Services

Quanterra Incorporated
880 Riverside Parkway
West Sacramento, California 95605

916 373-5600 Telephone
916 372-1059 Fax

September 5, 1996

QUANTERRA PROJECT NUMBER: 088981
PO/CONTRACT: NA

Bill Stanhope
IT Corporation
2790 Mosside Blvd.
Monroeville, Pennsylvania 15145-2792

Dear Mr. Stanhope:

This report contains the analytical results for the sixteen soil samples which were received under chain of custody by Quanterra Environmental Services on 10 August 1996. This sample set is associated with your Hawthorne Army Depot project.

The case narrative is an integral part of this report.

If you have any questions, please call me at (916)374-4362.

Sincerely,

Diana L. Brooks
Project Manager

DB/myg

Enclosures

Quanterra
Environmental Services

TABLE OF CONTENTS

QUANTERRA PROJECT NUMBER 088981

Case Narrative

Quanterra's Quality Assurance Program

Sample Description Information

Chain of Custody Documentation

Volatile Organics - Toxicity Characteristic List TCLP Leachate - Method 8240
Includes Samples: 2 - 5
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Semivolatile Organics - Toxicity Characteristic List TCLP Leachate - Method 8270
Includes Samples: 2 - 16
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Chlorinated Pesticeds - Toxicity Characteristic List (TCLP) TCLP Leachate Method 8080
Includes Samples: 2 - 5
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Chlorinated Herbicides - Toxicity Characteristic List TCLP Leachate - Method 8150
Includes Samples: 2 - 5
- Sample Data Sheets
- Method Blank Report
- Laboratory QC Reports

Quanterra
Environmental Services

TABLE OF CONTENTS
(Continued)
QUANTERRA PROJECT NUMBER 088981

Nitroaromatic and Nitramines by HPLC - Method 8330
Includes Samples: 6 - 16
Sample Data Sheets
Method Blank Report
Laboratory QC Reports

Toxicity characteristics (TCLP) List
Includes Samples: 1 - 16
Sample Data Sheets
Method Blank Report
Laboratory QC Reports

Quanterra
Environmental Services

CASE NARRATIVE

QUANTERRA PROJECT NUMBER 088981

TCLP Organochlorine Pesticides - Method 8080

The recovery of dieldrin and/or endrin in the laboratory control sample and matrix spike/matrix spike duplicate exceeded the control limits reported. This is attributed to differences in standard preparation methods from the suppliers of these standards. As this compound was not detected in any of the samples, this anomaly does not have an adverse affect on the sample data.

TCLP Semivolatile Organics - Method 8270

2,3,4,6-Tetrachlorophenol and Naphthalene are no longer part of the matrix spike/matrix spike duplicate spike mix for this test and thus recoveries are not available.

TCLP Volatile Organics - Method 8240

The duplicate control sample surrogate recovery for 1,2-Dichloroethane-d4 was above control limits. There were no positive hits found in the samples, thus this will not impact your sample data.

Selected Metals - Various Methods

The matrix spike for Mercury has a percent recovery outside of control limits. Re-analysis of the sample confirmed the recovery.

The matrix spike/matrix spike duplicate for Aluminum had recoveries outside of control limits due to the sample concentration being four time or greater than the spike concentration.

The matrix spike duplicate for Lead had recoveries outside of control limits due to the sample concentration being four time or greater than the spike concentration.

No other anomalies were associated with this report.

Quanterra
Environmental Services

QUANTERRA'S QUALITY ASSURANCE PROGRAM

Quanterra has implemented an extensive Quality Assurance (QA) program to ensure the production of scientifically sound, legally defensible data of known documentable quality. A key element of this program is Quanterra's Laboratory Control Sample (LCS) system. Controlling lab operations with LCS (as opposed to matrix spike/matrix spike duplicate samples), allows the lab to differentiate between bias as a result of procedural errors versus bias due to matrix effects. The analyst can then identify and implement the appropriate corrective actions at the bench level, without waiting for extensive senior level review or costly and time-consuming sample re-analyses. The LCS program also provides our client with information to assess batch, and overall laboratory performance.

Laboratory Control Samples - (LCS)

Laboratory Control Samples (LCS) are well-characterized, laboratory generated samples used to monitor the laboratory's day-to-day performance of routine analytical methods. The results of the LCS are compared to well-defined laboratory acceptance criteria to determine whether the laboratory system is "in control". Three types of LCS are routinely analyzed: Duplicate Control Samples (DCS), Single Control Samples (SCS), and method blanks. Each of these LCS are described below.

Duplicate Control Samples. A DCS is a well-characterized matrix (blank water, sand, sodium sulfate or celite) which is spiked with certain target parameters and analyzed at approximately 10% of the sample load in order to establish method-specific control limits.

Single Control Samples. An SCS consists of a control matrix that is spiked with surrogate compounds appropriate to the method being used. In cases where no surrogate is available, (e.g. metals or conventional analyses) a single control sample identical to the DCS serves as the control sample. An SCS is prepared for each sample lot. Accuracy is calculated identically to the DCS.

Method Blank Results. A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples.

Quanterra
Environmental Services

SAMPLE DESCRIPTION INFORMATION
for
IT Corporation

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
088981-0001-SA	NB-MW02-S1-960805	SOIL	05 AUG 96	10:15	10 AUG 96
088981-0002-SA	NB-MW02-S2-960807	SOIL	07 AUG 96	16:10	10 AUG 96
088981-0003-SA	NB-MW02-S3-960807	SOIL	07 AUG 96	16:25	10 AUG 96
088981-0004-SA	NB-MW02-S4-960807	SOIL	07 AUG 96	16:35	10 AUG 96
088981-0005-SA	NB-MW02-S5-960807	SOIL	07 AUG 96	16:10	10 AUG 96
088981-0006-SA	NB-S1-960808	SOIL	08 AUG 96	11:10	10 AUG 96
088981-0007-SA	NB-S2-960808	SOIL	08 AUG 96	11:15	10 AUG 96
088981-0008-SA	NB-S3-960808	SOIL	08 AUG 96	11:25	10 AUG 96
088981-0009-SA	NB-S4-960808	SOIL	08 AUG 96	11:45	10 AUG 96
088981-0010-SA	NB-S5-960808	SOIL	08 AUG 96	12:05	10 AUG 96
088981-0011-SA	NB-S6-960808	SOIL	08 AUG 96	12:20	10 AUG 96
088981-0012-SA	NB-S7-960808	SOIL	08 AUG 96	12:40	10 AUG 96
088981-0013-SA	NB-S8-960808	SOIL	08 AUG 96	12:50	10 AUG 96
088981-0014-SA	NB-S9-960808	SOIL	08 AUG 96	13:35	10 AUG 96
088981-0015-SA	NB-S10-960808	SOIL	08 AUG 96	14:05	10 AUG 96
088981-0015-MS	NB-S10-960808 (MS)	SOIL	08 AUG 96	14:05	10 AUG 96
088981-0015-SD	NB-S10-960808 (MSD)	SOIL	08 AUG 96	14:05	10 AUG 96
088981-0016-SA	NB-S11-960808	SOIL	08 AUG 96	13:35	10 AUG 96

IT NATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 23531
Page 1 of 2

Project Name/No. 1 761041 Hawthorne Army Depot
Sample Team Members 2 B. Stanhope
Profit Center No. 3 3211210
Project Manager 4 M. Weisberg
Purchase Order No. 6
Required Report Date 11

Samples Shipment Date 7 08-09-96
Lab Destination 8 Quanterra - W. Sacramento
Lab Contact 9 V. Herd
Project Contact/Phone 12 B. Stanhope / 412 372 7701
Carrier/Waybill No. 13 2349392555 FEDERAL EXPRESS

Bill to: 5 IT-Corp / AP
2790 Mosside Blvd.
Monroeville, PA 15146

Report to: 10 B. Stanhope
IT Corp.
2790 Mosside Blvd.
Monroeville, PA 15146

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Pre-servative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
NB-MW02-S1-960805	Soil	8-5-96 (1015)	1x 8oz glass	8oz.	None	Al, As, Ba, Be, Cd, Cr, Pb, Hg, Se, Ag	Good.	
NB-MW02-S2-960807	↓	8-7-96 @ 1610	1x 16oz glass	16oz	↓	Full TCLP	↓	
NB-MW02-S3-960807	↓	8-7-96 @ 1625	↓	↓	↓	↓	↓	
NB-MW02-S4-960807	↓	8-7-96 @ 1635	↓	↓	↓	↓	↓	
NB-MW02-S5-960807	↓	8-7-96 @ 1610	↓	↓	↓	↓	↓	
NB-S1-960808	↓	8-8-96 @ 1110	↓	↓	↓	TCLP*, Total Metals, 8330	↓	
NB-S2-960808	↓	8-8-96 @ 1115	↓	↓	↓	↓	↓	
NB-S3-960808	↓	8-8-96 @ 1125	↓	↓	↓	↓	↓	

FOR LAB USE ONLY

KAF 081096

FOR LAB USE ONLY

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required: 26
Normal ☒ Rush ☐

QC Level: 27
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation) William Stanhope	Date: 8-9-96 Time: 1400	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation) Julia Des Brouer	Date: 8-10-96 Time: 0911

Comments: 29 * TCLP analytes for samples are As, Ba, Cd, Cr, Pb, Hg, Se, Ag, Nitrobenzene, and 2,4-Dinitrotoluene.

(WS)

MCA 3/15/91

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 523531
Page 2 of 2

Project Name Hawthorne Army Depot Project No. 761041 Samples Shipment Date 8-9-96

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
NB-S4-960808	Soil	8-8-96 @ 1145	1 x 16oz glass	16oz	None	TCLP*, Total Metals, 8330	Good	
NB-S5-960808		8-8-96 @ 1205						
NB-S6-960808		8-8-96 @ 1220						
NB-S7-960808		8-8-96 @ 1240						
NB-S8-960808		8-8-96 @ 1250						
NB-S9-960808		8-8-96 @ 1335						
NB-S10-960808	WS 1405	8-8-96 @ ~~1250~~ WS						
NB-S11-960808		8-8-96 @ 1335						

FOR LAB USE ONLY

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

MCA 3/15/91

Quanterra
Environmental
Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate - Method 8240

Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	101	%
4-Bromofluorobenzene	110	%
1,2-Dichloroethane-d4	103	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	98	%
4-Bromofluorobenzene	108	%
1,2-Dichloroethane-d4	101	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050
Surrogate	**Recovery**		
Toluene-d8	102	%	
4-Bromofluorobenzene	108	%	
1,2-Dichloroethane-d4	105	%	

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Volatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8240

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 17 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Surrogate	Recovery	
Toluene-d8	101	%
4-Bromofluorobenzene	110	%
1,2-Dichloroethane-d4	107	%

ND = Not detected
NA = Not applicable

Reported By: Karin Yee

Approved By: Mike Orbanosky

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Volatile Organics by GC/MS
Project: 088981

Category: VOA-MS-TL Volatile Organics - TCLP Leachate
Test: 8240CP-OTC-TL
Matrix: LEACHATE
QC Lot: 28 AUG 96-11 QC Run: 28 AUG 96-1B
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
1,1-Dichloroethene	0.250	0.230	92	52-150
Trichloroethene	0.250	0.240	96	76-129
Benzene	0.250	0.230	92	80-130
Toluene	0.250	0.230	92	77-127
Chlorobenzene	0.250	0.230	92	84-128

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
088981-0002-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B
088981-0003-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B
088981-0004-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B
088981-0005-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B

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SINGLE CONTROL SAMPLE REPORT
olatile Organics by GC/MS

Analyte	Concentration Spiked	Measured	Accuracy(%) SCS	Limits
Category: VOA-MS-TL				
Matrix: LEACHATE				
QC Lot: 28 AUG 96-11 QC Run: 28 AUG 96-1B				
Concentration Units: mg/L				
1,2-Dichloroethane-d4	0.250	0.253	101	76-114
Toluene-d8	0.250	0.246	98	86-115
4-Bromofluorobenzene	0.250	0.262	105	86-115

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Environmental Services

METHOD BLANK REPORT
Volatile Organics by GC/MS

Analyte	Result	Units	Reporting Limit
Test: 8240CP-OTC-TL			
Matrix: SOIL			
QC Lot: 28 AUG 96-11 QC Run: 28 AUG 96-1B			
Benzene	ND	mg/L	0.025
2-Butanone (MEK)	ND	mg/L	0.050
Carbon tetrachloride	ND	mg/L	0.025
Chlorobenzene	ND	mg/L	0.025
Chloroform	ND	mg/L	0.025
1,2-Dichloroethane	ND	mg/L	0.025
1,1-Dichloroethene	ND	mg/L	0.025
Tetrachloroethene	ND	mg/L	0.025
Trichloroethene	ND	mg/L	0.025
Vinyl chloride	ND	mg/L	0.050

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Volatile Organics by GC/MS
Project: 088981

Category: VOA-MS-TL Volatile Organics - TCLP Leachate
Test: 8240CP-OTC-TL Method: 8240
Matrix: LEACHATE
Sample: 088981-0002
MS Run: 28 AUG 96-1B
Units: mg/L

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
,1-Dichloroethene	ND	0.240	0.250	0.250	96	100	65-135	4.1	35
richloroethene	ND	0.240	0.230	0.250	96	92	65-135	4.3	35
Benzene	ND	0.240	0.220	0.250	96	88	65-135	8.7	35
oluene	ND	0.230	0.230	0.250	92	92	65-135	0.0	35
hlorobenzene	ND	0.240	0.230	0.250	96	92	65-135	4.3	35

ND = Not Detected

alculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental
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QC LOT ASSIGNMENT REPORT - MS QC
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B
088981-0003-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B
088981-0004-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B
088981-0005-SA	LEACHATE	VOA-MS-TL	28 AUG 96-11	28 AUG 96-1B	28 AUG 96-1B

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Semivolatile Organics - Toxicity Characteristic List TCLP Leachate - Method 8270

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Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	97	%
2-Fluorobiphenyl	84	%
Terphenyl-d14	109	%
Phenol-d5	40	%
2-Fluorophenol	66	%
2,4,6-Tribromophenol	97	%

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	94	%
2-Fluorobiphenyl	80	%
Terphenyl-d14	103	%
Phenol-d5	37	%
2-Fluorophenol	62	%
2,4,6-Tribromophenol	106	%

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

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Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	96	%
2-Fluorobiphenyl	83	%
Terphenyl-d14	105	%
Phenol-d5	38	%
2-Fluorophenol	64	%
2,4,6-Tribromophenol	109	%

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 30 AUG 96

Parameter	Result	Units	Reporting Limit
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	84	%
2-Fluorobiphenyl	76	%
Terphenyl-d14	91	%
Phenol-d5	33	%
2-Fluorophenol	61	%
2,4,6-Tribromophenol	70	%

ND = Not detected
NA = Not applicable

Reported By: Donald Taylor
Approved By: Steve Rogers

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Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S1-960808
Lab ID: 088981-0006-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 30 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	82	%
2-Fluorobiphenyl	76	%
Terphenyl-d14	89	%
Phenol-d5	25	%
2-Fluorophenol	59	%
2,4,6-Tribromophenol	67	%

ND = Not detected
NA = Not applicable

Reported By: Donald Taylor
Approved By: Steve Rogers

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Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S2-960808
Lab ID: 088981-0007-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 30 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050

Surrogate	Recovery	
Nitrobenzene-d5	82	%
2-Fluorobiphenyl	75	%
Terphenyl-d14	96	%
Phenol-d5	30	%
2-Fluorophenol	60	%
2,4,6-Tribromophenol	71	%

ND = Not detected
NA = Not applicable

Reported By: Donald Taylor
Approved By: Steve Rogers

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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S3-960808
Lab ID: 088981-0008-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	94	%	
2-Fluorobiphenyl	55	%	
Terphenyl-d14	110	%	
Phenol-d5	38	%	
2-Fluorophenol	61	%	
2,4,6-Tribromophenol	86	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

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Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S4-960808
Lab ID: 088981-0009-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	92	%	
2-Fluorobiphenyl	56	%	
Terphenyl-d14	99	%	
Phenol-d5	39	%	
2-Fluorophenol	61	%	
2,4,6-Tribromophenol	86	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S5-960808
Lab ID: 088981-0010-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	97	%	
2-Fluorobiphenyl	58	%	
Terphenyl-d14	108	%	
Phenol-d5	31	%	
2-Fluorophenol	63	%	
2,4,6-Tribromophenol	84	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

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Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S6-960808
Lab ID: 088981-0011-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	92	%	
2-Fluorobiphenyl	56	%	
Terphenyl-d14	102	%	
Phenol-d5	38	%	
2-Fluorophenol	62	%	
2,4,6-Tribromophenol	82	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

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Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S7-960808
Lab ID: 088981-0012-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	95	%	
2-Fluorobiphenyl	58	%	
Terphenyl-d14	104	%	
Phenol-d5	69	%	
2-Fluorophenol	61	%	
2,4,6-Tribromophenol	82	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S8-960808
Lab ID: 088981-0013-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	93	%	
2-Fluorobiphenyl	57	%	
Terphenyl-d14	93	%	
Phenol-d5	38	%	
2-Fluorophenol	59	%	
2,4,6-Tribromophenol	84	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer

Approved By: Steve Rogers

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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S9-960808
Lab ID: 088981-0014-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	96	%	
2-Fluorobiphenyl	58	%	
Terphenyl-d14	99	%	
Phenol-d5	38	%	
2-Fluorophenol	58	%	
2,4,6-Tribromophenol	80	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S10-960808
Lab ID: 088981-0015-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	97	%	
2-Fluorobiphenyl	58	%	
Terphenyl-d14	109	%	
Phenol-d5	40	%	
2-Fluorophenol	61	%	
2,4,6-Tribromophenol	80	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Semivolatile Organics - Toxicity Characteristic List
TCLP Leachate
Method 8270

Client Name: IT Corporation
Client ID: NB-S11-960808
Lab ID: 088981-0016-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Surrogate	**Recovery**		
Nitrobenzene-d5	94	%	
2-Fluorobiphenyl	55	%	
Terphenyl-d14	103	%	
Phenol-d5	39	%	
2-Fluorophenol	61	%	
2,4,6-Tribromophenol	81	%	

ND = Not detected
NA = Not applicable

Reported By: Emily Uebelhoer
Approved By: Steve Rogers

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Semivolatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0003-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0004-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0005-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0006-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0007-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0008-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0009-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0010-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0011-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0012-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0013-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0014-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0015-MS	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0015-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0015-SD	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A
088981-0016-SA	AQUEOUS	8270-TL-A	27 AUG 96-11A	27 AUG 96-11A	27 AUG 96-11A

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Environmental Services

SINGLE CONTROL SAMPLE REPORT
Semivolatile Organics by GC/MS

Analyte	Concentration Spiked	Measured	Accuracy(%) SCS	Limits
Category: 8270-TL-A				
Matrix: AQUEOUS				
QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A				
Concentration Units: mg/L				
Nitrobenzene-d5	0.500	0.447	89	36-114
2-Fluorobiphenyl	0.500	0.395	79	43-116
Terphenyl-d14	0.500	0.524	105	33-141
2-Fluorophenol	0.750	0.461	61	21-100
Phenol-d5	0.750	0.273	36	10- 94
2,4,6-Tribromophenol	0.750	0.727	97	10-123

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Environmental Services

METHOD BLANK REPORT
Semivolatile Organics by GC/MS

Analyte	Result	Units	Reporting Limit
Test: 8270CP-OTC-TL Matrix: SOIL QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A			
1,4-Dichlorobenzene	ND	mg/L	0.050
2,4-Dinitrotoluene	ND	mg/L	0.050
Hexachlorobenzene	ND	mg/L	0.050
Hexachlorobutadiene	ND	mg/L	0.050
Hexachloroethane	ND	mg/L	0.050
2-Methylphenol	ND	mg/L	0.050
3/4-Methylphenol	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050
Pentachlorophenol	ND	mg/L	0.25
Pyridine	ND	mg/L	0.10
2,4,5-Trichlorophenol	ND	mg/L	0.050
2,4,6-Trichlorophenol	ND	mg/L	0.050
Test: 8270CP-OTC-TL Matrix: SOIL QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A			
2,4-Dinitrotoluene	ND	mg/L	0.050
Nitrobenzene	ND	mg/L	0.050

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Semivolatile Organics by GC/MS
Project: 088981

Category: 8270-TL-A Semivolatiles TCLP-full analyte list
Test: 8270CP-OTC-TL
Matrix: AQUEOUS
QC Lot: 27 AUG 96-11A QC Run: 27 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Pyridine	0.100	0.0474	47	17-101
1,4-Dichlorobenzene	0.100	0.0817	82	44-128
2-Methylphenol	0.100	0.0859	86	57-130
3/4-Methylphenol	0.200	0.153	76	37-129
Hexachloroethane	0.100	0.0857	86	30-130
Nitrobenzene	0.100	0.0969	97	57-145
Hexachlorobutadiene	0.100	0.0977	98	36-126
2,4,6-Trichlorophenol	0.100	0.0636	64	51-135
2,4,5-Trichlorophenol	0.100	0.0953	95	64-130
2,4-Dinitrotoluene	0.100	0.0856	86	32-137
Hexachlorobenzene	0.100	0.103	103	59-150
Pentachlorophenol	0.100	0.0792	79	9-103

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Semivolatile Organics by GC/MS
Project: 088981

Category: 8270-TL-A Semivolatiles TCLP-full analyte list
Test: 8270CP-OTC-TL Method: 8270
Matrix: LEACHATE
Sample: 088981-0015
MS Run: 27 AUG 96-11A
Units: mg/L

Analyte	Concentration: Sample Result	Concentration: MS Result	Concentration: MSD Result	Spiked MS/MSD	%Recovery: MS	%Recovery: MSD	Control Limits	%RPD	RPD Limit
Pyridine	ND	0.276	0.282	0.500	55	56	0-0	2.2	64
1,4-Dichlorobenzene	ND	0.375	0.373	0.500	75	75	0-0	0.53	32
2-Methylphenol	ND	0.414	0.422	0.500	83	84	0-0	1.9	21
3/4-Methylphenol	ND	0.737	0.742	1.00	74	74	0-0	0.68	25
Hexachloroethane	ND	0.377	0.377	0.500	75	75	0-0	0.0	39
Nitrobenzene	ND	0.481	0.483	0.500	96	97	0-0	0.41	22
Hexachlorobutadiene	ND	0.470	0.442	0.500	94	88	0-0	6.1	40
2,4,6-Trichlorophenol	ND	0.330	0.329	0.500	66	66	0-0	0.30	24
[illegible]chlorophenol	ND	0.409	0.399	0.500	82	80	0-0	2.5	22
2,4-Dinitrotoluene	ND	0.416	0.419	0.500	83	84	0-0	0.72	27
Hexachlorobenzene	ND	0.476	0.466	0.500	95	93	0-0	2.1	20
2,3,4,6-Tetrachlorophenol	ND	ND	ND	NA	NC	NC	0-0	NC	125
Pentachlorophenol	ND	0.467	0.426	0.500	93	85	0-0	9.2	42
Naphthalene	ND	ND	ND	NA	NC	NC	0-0	NC	23

NA = Not Applicable
NC = Not Calculated, calculation not applicable.
ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Chlorinated Pesticides - Toxicity Characteristic List (TCLP) TCLP Leachate Method 8080

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Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	103	%
Decachlorobiphenyl	119	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	100	%
Decachlorobiphenyl	124	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

Surrogate	Recovery	
Tetrachloro-m-xylene	99	%
Decachlorobiphenyl	123	%

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett
Approved By: Karla Buechler

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Quanterra Environmental Services

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)
TCLP Leachate
Method 8080

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 21 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050
Surrogate	**Recovery**		
Tetrachloro-m-xylene	98	%	
Decachlorobiphenyl	123	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A
088981-0003-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A
088981-0004-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A
088981-0005-SA	LEACHATE	OCP-TL	21 AUG 96-11A	21 AUG 96-11A	21 AUG 96-11A

Quanterra
Environmental Services

METHOD BLANK REPORT
Semivolatile Organics by GC
Project: 088981

Test: 8080CP-OTC-TL
Method: 8080
Matrix: LEACHATE
QC Lot: 21 AUG 96-11A

Chlorinated Pesticides - Toxicity Characteristic List (TCLP)

QC Run: 21 AUG 96-11A

Analyte	Result	Units	Reporting Limit
gamma-BHC (Lindane)	ND	mg/L	0.00050
Chlordane	ND	mg/L	0.0050
Endrin	ND	mg/L	0.0010
Heptachlor (and its epoxide)	ND	mg/L	0.00050
Methoxychlor	ND	mg/L	0.0050
Toxaphene	ND	mg/L	0.050

ND = Not Detected

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Semivolatile Organics by GC
Project: 088981

Category: OCP-TL Organochlorine Pesticides - TLCP Leachate
Test: 8080CP-OTC-TL
Matrix: LEACHATE
QC Lot: 21 AUG 96-11A QC Run: 21 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
gamma-BHC (Lindane)	0.000500	0.000428	86	56-103
Heptachlor	0.000500	0.000438	88	49-101
Aldrin	0.000500	0.000416	83	48-99
Dieldrin	0.00100	0.00107	107	60-106
Endrin	0.00100	0.00118	118	63-118
4,4'-DDT	0.00100	0.000993	99	55-112
Tetrachloro-m-xylene	0.00020	0.00020	99	30-150
Decachlorobiphenyl	0.00020	0.00023	116	30-150

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Semivolatile Organics by GC
Project: 088981

Category: OCP-TL Organochlorine Pesticides - TLCP Leachate
TestY 8080CP-OTC-TL Method: 8080
MatrixY LEACHATE
SampleY 088981-0005
MS RunY 21 AUG 96-11A
UnitsY mg/L

	Concentration								
Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Gamma-BHC (Lindane)	ND	0.00222	0.00222	0.00250	89	89	56-103	0.29	23
Heptachlor	ND	0.00232	0.00235	0.00250	93	94	49-101	1.5	24
Aldrin	ND	0.00212	0.00218	0.00250	85	87	48-99	2.9	31
Dieldrin	ND	0.00562	0.00584	0.00500	112	117	60-106	3.8	25
Endrin	ND	0.00673	0.00703	0.00500	135	141	63-118	4.3	24
4,4'-DDT	ND	0.00512	0.00560	0.00500	102	112	55-112	9.0	27

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Chlorinated Herbicides - Toxicity Characteristic List TCLP Leachate - Method 8150

Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	78	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

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Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	86	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	80	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett
Approved By: Karla Buechler

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Quanterra
Environmental Services

Chlorinated Herbicides - Toxicity Characteristic List
TCLP Leachate
Method 8150

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: 20 AUG 96
Analyzed: 28 AUG 96

Parameter	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010
Surrogate	**Recovery**		
2,4-DCAA	84	%	

ND = Not detected
NA = Not applicable

Reported By: Kirby Garrett
Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0002-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A
088981-0003-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A
088981-0004-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A
088981-0005-SA	LEACHATE	HERB-TL	20 AUG 96-11A	20 AUG 96-11A	20 AUG 96-11A

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Environmental Services

METHOD BLANK REPORT
Semivolatile Organics by GC
Project: 088981

Test: 8150CP-OTC-TL
Method: 8150
Matrix: LEACHATE
QC Lot: 20 AUG 96-11A

Chlorinated Herbicides - Toxicity Characteristic List

QC Run: 20 AUG 96-11A

Analyte	Result	Units	Reporting Limit
2,4-D	ND	mg/L	0.0050
2,4,5-TP (Silvex)	ND	mg/L	0.0010

ND = Not Detected

Quanterra
Environmental Services

SINGLE CONTROL SAMPLE REPORT
Semivolatile Organics by GC
Project: 088981

Category: HERB-TL OTC Herbicides
Matrix: LEACHATE
QC Lot: 20 AUG 96-11A QC Run: 20 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) SCS	Limits
2,4-DCAA	0.00500	0.0041	83	49-130

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Semivolatile Organics by GC
Project: 088981

Category: HERB-TL OTC Herbicides
Test: 8150CP-OTC-TL
Matrix: LEACHATE
QC Lot: 20 AUG 96-11A QC Run: 20 AUG 96-11A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
2,4-D	0.00100	0.000786	79	40-122
2,4,5-TP (Silvex)	0.000200	0.000146	73	38-118
2,4,5-T	0.000200	0.000153	77	46-110

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Semivolatile Organics by GC
Project: 088981

Category: HERB-TL OTC Herbicides
Test: 8150CP-OTC-TL Method: 8150
Matrix: LEACHATE
Sample: 088981-0005
GS Run: 20 AUG 96-11A
Units: mg/L

Analyte	Concentration Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
2,4-D	ND	0.00436	0.00438	0.00500	87	88	0-0	0.33	30
2,4,5-TP (Silvex)	ND	0.000761	0.000757	0.00100	76	76	0-0	0.45	29
2,4,5-T	ND	0.000834	0.000842	0.00100	83	84	0-0	0.90	36

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental
Services

Nitroaromatic and Nitramines by HPLC - Method 8330

Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S1-960808
LAB ID: 088981-0006-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	99 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S2-960808
LAB ID: 088981-0007-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	100 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S3-960808
LAB ID: 088981-0008-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	93 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

The cover letter is an integral part of this report.
Rev 230787

Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S4-960808
LAB ID: 088981-0009-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	97 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

The cover letter is an integral part of this report.
Rev 230787

Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S5-960808
LAB ID: 088981-0010-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	0.64	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	96 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S6-960808
LAB ID: 088981-0011-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	97 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S7-960808
LAB ID: 088981-0012-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	0.33	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	0.72	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	0.63	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	97 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S8-960808
LAB ID: 088981-0013-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	95 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S9-960808
LAB ID: 088981-0014-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	96 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

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Quanterra
Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S10-960808
LAB ID: 088981-0015-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 26 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	93 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

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Quanterra Environmental Services

Nitroaromatics and Nitramines by HPLC
Method 8330

Client Name: IT Corporation
Client ID: NB-S11-960808
LAB ID: 088981-0016-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: 22 AUG 96

Received: 10 AUG 96
Analyzed: 27 AUG 96

Dilution Factor: 1.0

Parameter	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	

Surrogate	Recovery	Acceptable Range
2,4-Dinitrofluorobenzene	94 %	65 - 135

ND = Not Detected

Reported By: Dennis Gall

Approved By: Karla Buechler

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Special Services - LC Mass Spectrometry

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0006-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0007-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0008-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0009-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0010-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0011-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0012-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0013-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0014-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0015-MS	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0015-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0015-SD	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A
088981-0016-SA	SOIL	8330-COE-S	22 AUG 96-7A	22 AUG 96-7A	22 AUG 96-7A

METHOD BLANK REPORT
Special Services - LC Mass Spectrometry
Project: 088981

Quanterra Environmental Services

Test: 8330-S Nitroaromatics and Nitramines by HPLC
Method: 8330
Matrix: SOLID
QC Lot: 22 AUG 96-7A QC Run: 22 AUG 96-7A
Analyzed Date: 26 AUG 96 Time: 21:22

Analyte	Result	Units	Reporting Limit	Qualifier
HMX	ND	mg/kg	0.25	
1,3,5-Trinitrobenzene	ND	mg/kg	0.25	
RDX	ND	mg/kg	0.25	
1,3-Dinitrobenzene	ND	mg/kg	0.25	
Nitrobenzene	ND	mg/kg	0.25	
2,4,6-Trinitrotoluene	ND	mg/kg	0.25	
Tetryl	ND	mg/kg	0.25	
2,4-Dinitrotoluene	ND	mg/kg	0.25	
2,6-Dinitrotoluene	ND	mg/kg	0.25	
2-Am-DNT	ND	mg/kg	0.25	
4-Am-DNT	ND	mg/kg	0.25	
2-Nitrotoluene	ND	mg/kg	0.25	
4-Nitrotoluene	ND	mg/kg	0.25	
3-Nitrotoluene	ND	mg/kg	0.25	
2,4-Dinitrofluorobenzene	96 %		65-135	

ND = Not Detected

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Special Services - LC Mass Spectrometry
Project: 088981

Category: 8330-COE-S Explosives by HPLC
Testcode: 8330-S Method: 8330
Matrix: SOIL Concentration Units: mg/kg
QC Lot: 22 AUG 96-7A QC Run: 22 AUG 96-7A
Analyzed Date: 26 AUG 96 Time: 22:20

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
HMX	1.00	0.955	95	65-135
1,3,5-Trinitrobenzene	1.00	0.952	95	65-135
RDX	1.00	0.928	93	65-135
1,3-Dinitrobenzene	1.00	0.946	95	65-135
Nitrobenzene	1.00	0.973	97	65-135
2,4,6-Trinitrotoluene	1.00	0.977	98	65-135
Tetryl	1.00	1.02	102	65-135
2,4-Dinitrotoluene	1.00	0.949	95	65-135
2,6-Dinitrotoluene	1.00	0.925	93	65-135
2-Am-DNT	1.00	0.978	98	65-135
4-Am-DNT	1.00	1.00	100	65-135
2-Nitrotoluene	1.00	1.00	100	65-135
4-Nitrotoluene	1.00	1.02	102	65-135
[illegible]-Nitrotoluene	1.00	0.912	91	65-135

Surrogate	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
2,4-Dinitrofluorobenzene	2.0	1.9	96	65-135

ND = Not Detected

[illegible]ote #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

SPIKE/MATRIX SPIKE DUPLICATE QC REPORT
Special Services - LC Mass Spectrometry
Project: 088981

Category: 8330-COE-S Explosives by HPLC
Test : 8330-S Method: 8330
Sample : 088981-0015
Matrix : SOLID
Units : mg/kg
HPLC Run : 22 AUG 96-7A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
HMX	ND	0.915	0.960	1.00	91	96	65-135	4.8	35
1,3,5-Trinitrobenzene	ND	0.911	0.967	1.00	91	97	65-135	6.0	35
RDX	ND	0.927	0.986	1.00	93	99	65-135	6.1	35
1,3-Dinitrobenzene	ND	0.861	0.955	1.00	86	95	65-135	10	35
Nitrobenzene	ND	0.843	0.951	1.00	84	95	65-135	12	35
2,4,6-Trinitrotoluene	ND	0.957	0.993	1.00	96	99	65-135	3.7	35
Tetryl	ND	0.911	0.946	1.00	91	95	65-135	3.7	35
2,4-Dinitrotoluene	ND	0.877	0.954	1.00	88	95	65-135	8.4	35
2,6-Dinitrotoluene	ND	0.853	0.942	1.00	85	94	65-135	9.9	35
2A-DNT	ND	0.932	0.999	1.00	93	100	65-135	6.9	35
4A-DNT	ND	0.935	0.978	1.00	93	98	65-135	4.5	35
2-Nitrotoluene	ND	0.865	0.953	1.00	86	95	65-135	9.7	35
4-Nitrotoluene	ND	0.887	0.989	1.00	89	99	65-135	11	35
3-Nitrotoluene	ND	0.816	0.921	1.00	82	92	65-135	12	35

Surrogates	%Recovery Sample	%Recovery MS	%Recovery MSD	Control Limits
2,4-Dinitrofluorobenzene	93	97	93	65-135

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental
Services

Toxicity characteristics (TCLP) List

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S2-960807
Lab ID: 088981-0002-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.18	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S3-960807
Lab ID: 088981-0003-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.20	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S4-960807
Lab ID: 088981-0004-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.17	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-MW02-S5-960807
Lab ID: 088981-0005-SA
Matrix: SOIL

Sampled: 07 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 17 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	19 AUG 96	20 AUG 96
Barium	0.18	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Cadmium	ND	mg/L	0.050	6010	19 AUG 96	20 AUG 96
Chromium	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96
Lead	ND	mg/L	0.50	6010	19 AUG 96	20 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	19 AUG 96	22 AUG 96
Silver	ND	mg/L	0.10	6010	19 AUG 96	20 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Lee Mao

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Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S1-960808
Lab ID: 088981-0006-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.15	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S2-960808
Lab ID: 088981-0007-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.14	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S3-960808
Lab ID: 088981-0008-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S4-960808
Lab ID: 088981-0009-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.22	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S5-960808
Lab ID: 088981-0010-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.21	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S6-960808
Lab ID: 088981-0011-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.24	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S7-960808
Lab ID: 088981-0012-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.19	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S8-960808
Lab ID: 088981-0013-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.24	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S9-960808
Lab ID: 088981-0014-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.14	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S10-960808
Lab ID: 088981-0015-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.20	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S10-960808 (MS)
Lab ID: 088981-0015-MS
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	5.0	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Barium	21.7	mg/L	20.0	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Chromium	2.1	mg/L	2.0	6010	16 AUG 96	19 AUG 96
Lead	5.0	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Mercury	0.0051	mg/L	0.0050	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.50	7740	16 AUG 96	17 AUG 96
Silver	0.50	mg/L	0.50	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S10-960808 (MSD)
Lab ID: 088981-0015-SD
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Barium	21.4	mg/L	20.0	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Chromium	2.1	mg/L	2.0	6010	16 AUG 96	19 AUG 96
Lead	5.0	mg/L	5.0	6010	16 AUG 96	19 AUG 96
Mercury	0.0051	mg/L	0.0050	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.50	7740	16 AUG 96	17 AUG 96
Silver	0.50	mg/L	0.50	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

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Quanterra
Environmental Services

Toxicity Characteristic (TCLP) List

Client Name: IT Corporation
Client ID: NB-S11-960808
Lab ID: 088981-0016-SA
Matrix: SOIL

Sampled: 08 AUG 96
Received: 10 AUG 96
Authorized: 10 AUG 96

Leached: 15 AUG 96
Prepared: See Below
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	ND	mg/L	1.0	6010	16 AUG 96	19 AUG 96
Barium	0.16	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Cadmium	ND	mg/L	0.050	6010	16 AUG 96	19 AUG 96
Chromium	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96
Lead	ND	mg/L	0.50	6010	16 AUG 96	19 AUG 96
Mercury	ND	mg/L	0.0020	7470	19 AUG 96	20 AUG 96
Selenium	ND	mg/L	0.050	7740	16 AUG 96	17 AUG 96
Silver	ND	mg/L	0.10	6010	16 AUG 96	19 AUG 96

ND = Not detected
NA = Not applicable

Reported By: John Disney

Approved By: Lee Mao

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-MW02-S1-960805
Lab ID: 088981-0001-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 05 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Aluminum	3440	mg/kg	10.0	6010	13 AUG 96	13 AUG 96
Arsenic	0.87	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	40.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Beryllium	0.21	mg/kg	0.20	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	1.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	4.6	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S2-960808
Lab ID: 088981-0007-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	0.62	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	90.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	4.7	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	3.1	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S3-960808
Lab ID: 088981-0008-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	0.90	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	32.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	2.4	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	4.9	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S4-960808
Lab ID: 088981-0009-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below
Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	1.5	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	99.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	0.58	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	5.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	37.8	mg/kg	5.0	7421	13 AUG 96	15 AUG 96	R
Mercury	0.10	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	q
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

Note q : Post-digestion spike recovery fell between 40% and 85% due to matrix interference.

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw
Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S5-960808
Lab ID: 088981-0010-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	1.1	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	68.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	1.9	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	3.1	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	41.7	mg/kg	10.0	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	q
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

Note q : Post-digestion spike recovery fell between 40% and 85% due to matrix interference.

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S6-960808
Lab ID: 088981-0011-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below
Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	0.90	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	57.7	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	0.60	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	5.3	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	19.8	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw
Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S7-960808
Lab ID: 088981-0012-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	0.77	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	57.5	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Cadmium	0.73	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	4.6	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	22.9	mg/kg	2.5	7421	13 AUG 96	15 AUG 96 R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S8-960808
Lab ID: 088981-0013-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	1.2	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	90.6	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	1.2	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	7.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	37.7	mg/kg	5.0	7421	13 AUG 96	15 AUG 96	R
Mercury	0.10	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S9-960808
Lab ID: 088981-0014-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	1.1	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	80.0	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	2.6	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	14.8	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	q
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

Note q : Post-digestion spike recovery fell between 40% and 85% due to matrix interference.

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S10-960808
Lab ID: 088981-0015-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	1.0	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	62.3	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	4.1	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	20.7	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S10-960808 (MS)
Lab ID: 088981-0015-MS
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	4.6	mg/kg	4.0	7060	13 AUG 96	14 AUG 96
Barium	264	mg/kg	200	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	5.0	6010	13 AUG 96	13 AUG 96
Chromium	22.5	mg/kg	20.0	6010	13 AUG 96	13 AUG 96
Lead	22.8	mg/kg	2.0	7421	13 AUG 96	15 AUG 96
Mercury	0.42	mg/kg	0.25	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	2.0	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	5.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S10-960808 (MSD)
Lab ID: 088981-0015-SD
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	4.8	mg/kg	4.0	7060	13 AUG 96	14 AUG 96
Barium	257	mg/kg	200	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	5.0	6010	13 AUG 96	13 AUG 96
Chromium	22.4	mg/kg	20.0	6010	13 AUG 96	13 AUG 96
Lead	23.5	mg/kg	2.0	7421	13 AUG 96	15 AUG 96
Mercury	0.35	mg/kg	0.25	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	2.0	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	5.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S11-960808
Lab ID: 088981-0016-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Arsenic	1.0	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	74.3	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	3.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	15.2	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
Rev 230787

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0001-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0001-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0002-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0002-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0002-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0003-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0003-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0003-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0004-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0004-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0004-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0005-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0005-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0005-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0006-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0006-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0006-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0006-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0006-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0007-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0007-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0007-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0007-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0008-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0008-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0008-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0008-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0009-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0009-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0009-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

(cont.)

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0009-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0010-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0010-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0010-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0010-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0011-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0011-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0011-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0011-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0012-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0012-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0012-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0012-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0013-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0013-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0013-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0013-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0014-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0014-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0014-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0014-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-MS	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-MS	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-MS	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation (cont.)

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0015-MS	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0015-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SD	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SD	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-SD	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0015-SD	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	LEACHATE	ICP-TL	16 AUG 96-NX	16 AUG 96-N	16 AUG 96-N
088981-0016-SA	LEACHATE	GFAA-TL	16 AUG 96-NX	16 AUG 96-N	16 AUG 96-N
088981-0016-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-UX	19 AUG 96-U	19 AUG 96-U
088981-0016-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0016-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981

Test: ICPOCP-TCLP-TL TCLP Metals by ICP TCLP Leachate
Method: 6010
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/L	1.0	
Barium	ND	mg/L	0.10	
Cadmium	ND	mg/L	0.050	
Chromium	ND	mg/L	0.10	
Lead	ND	mg/L	0.50	
Silver	ND	mg/L	0.10	

Test: ICPOCP-TCLP-TL TCLP Metals by ICP TCLP Leachate
Method: 6010
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/L	1.0	
Barium	ND	mg/L	0.10	
Cadmium	ND	mg/L	0.050	
Chromium	ND	mg/L	0.10	
Lead	ND	mg/L	0.50	
Silver	ND	mg/L	0.10	

Test: ICPOCP-TCLP-TL TCLP Metals by ICP TCLP Leachate
Method: 6010
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/L	1.0	
Barium	ND	mg/L	0.10	
Cadmium	ND	mg/L	0.050	
Chromium	ND	mg/L	0.10	
Lead	ND	mg/L	0.50	
Silver	ND	mg/L	0.10	

ND = Not Detected

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Test: GF-SECP-TCLP-TL Selenium by Graphite Furnace AA TCLP Leachate
Method: 7740
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/L	0.050	

Test: GF-SECP-TCLP-TL Selenium by Graphite Furnace AA TCLP Leachate
Method: 7740
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/L	0.050	

Test: GF-SECP-TCLP-TL Selenium by Graphite Furnace AA TCLP Leachate
Method: 7740
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/L	0.050	

Test: CV-HGCP-TCLP-TL Mercury by Cold Vapor AA TCLP Leachate
Method: 7470
Matrix: LEACHATE
QC Lot: 19 AUG 96-VX QC Run: 19 AUG 96-V

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/L	0.0020	

ND = Not Detected

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Test: CV-HGCP-TCLP-TL Mercury by Cold Vapor AA TCLP Leachate
Method: 7470
Matrix: LEACHATE
QC Lot: 19 AUG 96-TX QC Run: 19 AUG 96-T

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/L	0.0020	

Test: CV-HGCP-TCLP-TL Mercury by Cold Vapor AA TCLP Leachate
Method: 7470
Matrix: LEACHATE
QC Lot: 19 AUG 96-UX QC Run: 19 AUG 96-U

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/L	0.0020	

Test: AS-FAA-COE-S Arsenic, Furnace AA
Method: 7060
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Arsenic	ND	mg/kg	0.50	

Test: PB-FAA-COE-S Lead, Furnace AA
Method: 7421
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Lead	ND	mg/kg	0.5	

ND = Not Detected

Quanterra
Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Test: SE-FAA-COE-S Selenium, Furnace AA
Method: 7740
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Selenium	ND	mg/kg	0.5	

Test: HG-CVAA-COE-S Mercury, Cold Vapor AA
Method: 7471
Matrix: SOIL
QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B

Analyte	Result	Units	Reporting Limit	Qualifier
Mercury	ND	mg/kg	0.1	

Test: ICP-COE-S ICP Quantitative Scan (27 Metals)
Method: 6010
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A

Analyte	Result	Units	Reporting Limit	Qualifier
Aluminum	ND	mg/kg	10	
Barium	ND	mg/kg	1.0	
Beryllium	ND	mg/kg	0.2	
Cadmium	ND	mg/kg	0.5	
Chromium	ND	mg/kg	1.0	
Silver	ND	mg/kg	1.0	

ND = Not Detected

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Testcode: ICPOCP-TCLP-TL Method: 6010
Matrix: LEACHATE Concentration Units: mg/L
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A
Analyzed Date: 20 AUG 96 Time: 11:43

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	5.21	104	75-125
Barium	20.0	21.1	105	75-125
Cadmium	0.500	0.498	100	75-125
Chromium	2.00	2.14	107	75-125
Lead	5.00	5.14	103	75-125
Silver	0.500	0.503	101	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

ABORATORY CONTROL SAMPLE REPORT
etals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Testcode: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX
Analyzed Date: 19 AUG 96 Time: 18:50

Method: 6010
Concentration Units: mg/L
QC Run: 16 AUG 96-M

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	5.05	101	75-125
Barium	20.0	21.8	109	75-125
Cadmium	0.500	0.486	97	75-125
Chromium	2.00	2.10	105	75-125
Lead	5.00	5.01	100	75-125
Silver	0.500	0.551	110	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Testcode: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX
Analyzed Date: 19 AUG 96 Time: 16:35

Method: 6010
Concentration Units: mg/L
QC Run: 16 AUG 96-N

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	4.82	96	75-125
Barium	20.0	20.2	101	75-125
Cadmium	0.500	0.482	96	75-125
Chromium	2.00	2.03	101	75-125
Lead	5.00	4.92	98	75-125
Silver	0.500	0.487	97	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Testcode: GF-SECP-TCLP-TL Method: 7740
Matrix: LEACHATE Concentration Units: mg/L
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A
Analyzed Date: 22 AUG 96 Time: 14:27

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.509	102	79-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Testcode: GF-SECP-TCLP-TL Method: 7740
Matrix: LEACHATE Concentration Units: mg/L
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M
Analyzed Date: 17 AUG 96 Time: 17:26

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.498	100	79-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Testcode: GF-SECP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX
Analyzed Date: 17 AUG 96 Time: 17:31

Method: 7740
Concentration Units: mg/L
QC Run: 16 AUG 96-N

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Selenium	0.500	0.501	100	79-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

ABORATORY CONTROL SAMPLE REPORT
etals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Testcode: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-VX
Analyzed Date: 20 AUG 96 Time: 01:03

Method: 7470
Concentration Units: mg/L
QC Run: 19 AUG 96-V

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	0.00500	0.00497	99	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Testcode: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-TX
Analyzed Date: 20 AUG 96 Time: 00:10

Method: 7470
Concentration Units: mg/L
QC Run: 19 AUG 96-T

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Mercury	0.00500	0.00504	101	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Testcode: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-UX
Analyzed Date: 20 AUG 96 Time: 01:13

Method: 7470
Concentration Units: mg/L
QC Run: 19 AUG 96-U

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Mercury	0.00500	0.00506	101	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7060-IRP-S Arsenic, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Testcode: AS-FAA-COE-S
Method: 7060
Matrix: SOIL
Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX
QC Run: 13 AUG 96-A
Analyzed Date: 14 AUG 96 Time: 11:11

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	75.4	72.3	96	75-125

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7421-IRP-S Lead, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Testcode: PB-FAA-COE-S Method: 7421
Matrix: SOIL Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Analyzed Date: 15 AUG 96 Time: 09:36

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Lead	53.5	53.5	100	65-135

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7740-IRP-S Selenium, Furnace AA
STATIC QC LIMITS - DO NOT UPDATE
Testcode: SE-FAA-COE-S Method: 7740
Matrix: SOIL Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Analyzed Date: 14 AUG 96 Time: 10:20

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) LCS	Accuracy(%) Limits
Selenium	72.3	71.3	99	70-130

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: 7471-IRP-S Mercury by CVAA
STATIC QC LIMITS - DO NOT UPDATE
Test: HG-CVAA-COE-S
Matrix: SOIL
QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	1.50	1.89	126	26-157

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT
Metals Analysis and Preparation
Project: 088981

Category: ICP-IRP-S ICP Metals
STATIC QC LIMITS - DO NOT UPDATE (Lot 224)
Testcode: ICP-COE-S Method: 6010
Matrix: SOIL Concentration Units: mg/kg
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Analyzed Date: 13 AUG 96 Time: 19:42

Analyte	-----Concentration----- Spiked	Measured	Accuracy(%) LCS	Limits
Aluminum	4590	2690	59	45-155
Antimony	39.8	30.2	76	30-166
Arsenic	75.4	82.9	110	49-149
Barium	106	139	131	58-131
Beryllium	51.0	70.5	138	64-140
Boron	94.1	103	110	50-200
Calcium	1290	1240	96	52-141
Cadmium	45.4	55.9	123	57-144
Chromium	71.0	92.1	130	54-141
Copper	112	135	121	57-145
Cobalt	49.6	65.3	132	60-142
Iron	9160	5240	57	49-151
Magnesium	1160	917	79	75-125
Manganese	154	187	122	67-135
Molybdenum	47.4	52.5	111	57-158
Potassium	1420	1110	78	62-132
Lead	53.5	58.9	110	53-142
Nickel	39.4	50.3	128	55-146
Selenium	72.3	75.6	105	52-149
Silver	116	123	106	45-146
Sodium	198	212	107	23-176
Thallium	40.0	41.7	104	50-150
Tin	102	107	105	50-200
Vanadium	65.9	71.6	109	61-131
Zinc	134	144	107	52-149

ND = Not Detected

Note #: Outside of Control Limits
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-AX MS Run: 19 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	ND	5.18	5.34	5.00	104	107	75-125	3.0	20
Barium	0.177	21.8	22.4	20.0	108	111	75-125	2.6	20
Cadmium	ND	0.490	0.501	0.500	98	100	75-125	2.1	20
Chromium	ND	2.16	2.20	2.00	108	110	75-125	1.7	20
Lead	ND	5.29	5.30	5.00	106	106	75-125	0.09	20
Silver	ND	0.505	0.512	0.500	101	102	75-125	1.3	20

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-MX MS Run: 16 AUG 96-M

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	ND	4.97	4.81	5.00	99	96	75-125	3.4	20
Barium	0.204	21.7	21.4	20.0	108	106	75-125	1.6	20
Cadmium	ND	0.492	0.492	0.500	98	98	75-125	0.10	20
Chromium	ND	2.11	2.06	2.00	105	103	75-125	2.1	20
Lead	ND	5.04	4.99	5.00	101	100	75-125	1.1	20
Silver	ND	0.504	0.497	0.500	101	99	75-125	1.4	20

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

MATRIX SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-NX MS Run: 16 AUG 96-N

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	RPD %RPD	RPD Limit
Arsenic	ND	4.89	4.87	5.00	98	97	75-125	0.47	20
Barium	0.155	21.1	21.1	20.0	105	105	75-125	0.0	20
Cadmium	ND	0.480	0.485	0.500	96	97	75-125	1.0	20
Chromium	ND	2.05	2.06	2.00	103	103	75-125	0.58	20
Lead	ND	4.96	5.02	5.00	99	100	75-125	1.2	20
Silver	ND	0.488	0.492	0.500	98	98	75-125	0.82	20

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-AX MS Run: 19 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	RPD %RPD	RPD Limit
Selenium	ND	0.505	0.500	0.500	101	100	75-125	1.0	35

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-MX MS Run: 16 AUG 96-M

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	RPD %RPD	RPD Limit
Selenium	ND	0.488	0.483	0.500	98	97	75-125	1.0	35

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Analysis and Preparation
Project: 088981 (cont.)

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-NX MS Run: 16 AUG 96-N

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Selenium	ND	0.498	0.499	0.500	100	100	75-125	0.20	35

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-VX MS Run: 19 AUG 96-V

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	ND	0.00420	0.00436	0.00500	84	87	75-125	3.9	20

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-TX MS Run: 19 AUG 96-T

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	ND	0.00507	0.00507	0.00500	101	101	75-125	0.0	20

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Analysis and Preparation
Project: 088981 (cont.)

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-UX MS Run: 19 AUG 96-U

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	ND	0.00504	0.00511	0.00500	101	102	75-125	1.4	20

Category: 7060-IRP-S Arsenic, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test : AS-FAA-COE-S Method: 7060
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	1.02	4.65	4.84	4.00	91	95	75-125	4.0	35

Category: 7421-IRP-S Lead, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test : PB-FAA-COE-S Method: 7421
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet Weight
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Lead	20.7	23	24	2.0	NC	NC	75-125	3.0	35

NC = Not Calculated, calculation not applicable.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981 (cont.)

Category: 7740-IRP-S Selenium, Furnace AA
STATIC QC LIMITS - DO NOT UPDATE
Test : SE-FAA-COE-S Method: 7740
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Selenium	ND	1.9	1.9	2.0	93	93	75-125	0.81	35

Category: 7471-IRP-S Mercury by CVAA
STATIC QC LIMITS - DO NOT UPDATE
Test : HG-CVAA-COE-S Method: 7471
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 16 AUG 96-BX MS Run: 16 AUG 96-B

Analyte	Sample Result		MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	0.0925	J	0.42	0.35	0.25	132	104	75-125	18	35

Result is detected below the reporting limit or is an estimated concentration.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT

Analysis and Preparation
Project: 088981 (cont.)

Category: ICP-IRP-S ICP Metals
STATIC QC LIMITS - DO NOT UPDATE (Lot 224)
Test : ICP-COE-S Method: 6010
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Concentration: Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Aluminum	4130	5100	5200	100	NC	NC	45-155	3.0	25
Antimony	NA	NA	NA	49	NC	NC	30-166	0.0	25
Arsenic	NA	NA	NA	82	NC	NC	49-149	0.0	25
Barium	62.3	260	260	200	101	97	58-131	2.5	25
Beryllium	ND	5.0	4.9	5.0	100	98	64-140	1.6	25
Cadmium	ND	4.5	4.6	5.0	91	92	57-144	1.1	25
Calcium	NA	NA	NA	2400	NC	NC	52-141	0.0	25
Chromium	4.15	22	22	20	92	91	54-141	0.57	25
Cobalt	NA	NA	NA	100	NC	NC	60-142	0.0	25
Copper	NA	NA	NA	200	NC	NC	57-145	0.0	25
Iron	NA	NA	NA	7100	NC	NC	49-151	0.0	25
Lead	NA	NA	NA	160	NC	NC	53-142	0.0	25
Magnesium	NA	NA	NA	2400	NC	NC	60-144	0.0	25
Manganese	NA	NA	NA	370	NC	NC	67-135	0.0	25
Molybdenum	NA	NA	NA	94	NC	NC	57-158	0.0	25
Nickel	NA	NA	NA	140	NC	NC	55-146	0.0	25
Potassium	NA	NA	NA	2300	NC	NC	62-132	0.0	25
Selenium	NA	NA	NA	110	NC	NC	52-149	0.0	25
Silver	ND	4.6	4.6	5.0	92	92	45-146	0.35	25
Sodium	NA	NA	NA	500	NC	NC	23-176	0.0	25
Thallium	NA	NA	NA	130	NC	NC	50-150	0.0	25
Vanadium	NA	NA	NA	94	NC	NC	61-131	0.0	25
Zinc	NA	NA	NA	200	NC	NC	52-149	0.0	25

NA = Not Applicable
NC = Not Calculated, calculation not applicable.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-MW02-S1-960805
Lab ID: 088981-0001-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 05 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Aluminum	3440	mg/kg	10.0	6010	13 AUG 96	13 AUG 96
Arsenic	0.87	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	40.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Beryllium	0.21	mg/kg	0.20	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	1.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	4.6	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S1-960808
Lab ID: 088981-0006-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Aluminum	4480	mg/kg	10.0	6010	13 AUG 96	13 AUG 96
Arsenic	0.90	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	97.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Beryllium	ND	mg/kg	0.20	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	3.1	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	3.4	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S2-960808
Lab ID: 088981-0007-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Aluminum	4760	mg/kg	10.0	6010	13 AUG 96	13 AUG 96
Arsenic	0.62	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	90.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Beryllium	0.21	mg/kg	0.20	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	4.7	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	3.1	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S3-960808
Lab ID: 088981-0008-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Aluminum	2810	mg/kg	10.0	6010	13 AUG 96	13 AUG 96
Arsenic	0.90	mg/kg	0.50	7060	13 AUG 96	14 AUG 96
Barium	32.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Beryllium	ND	mg/kg	0.20	6010	13 AUG 96	13 AUG 96
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96
Chromium	2.4	mg/kg	1.0	6010	13 AUG 96	13 AUG 96
Lead	4.9	mg/kg	0.50	7421	13 AUG 96	15 AUG 96
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S4-960808
Lab ID: 088981-0009-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	5060	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	1.5	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	99.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	0.30	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	0.58	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	5.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	37.8	mg/kg	5.0	7421	13 AUG 96	15 AUG 96	R
Mercury	0.10	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	q
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

Note q : Post-digestion spike recovery fell between 40% and 85% due to matrix interference.

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S5-960808
Lab ID: 088981-0010-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	4870	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	1.1	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	68.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	0.25	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	1.9	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	3.1	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	41.7	mg/kg	10.0	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	q
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

Note q : Post-digestion spike recovery fell between 40% and 85% due to matrix interference.

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S6-960808
Lab ID: 088981-0011-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	4150	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	0.90	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	57.7	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	0.23	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	0.60	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	5.3	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	19.8	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S7-960808
Lab ID: 088981-0012-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	3610	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	0.77	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	57.5	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	ND	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	0.73	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	4.6	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	22.9	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S8-960808
Lab ID: 088981-0013-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	6580	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	1.2	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	90.6	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	0.32	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	1.2	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	7.9	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	37.7	mg/kg	5.0	7421	13 AUG 96	15 AUG 96	R
Mercury	0.10	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S9-960808
Lab ID: 088981-0014-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	4100	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	1.1	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	80.0	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	0.20	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	2.6	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	14.8	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	q
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

Note q : Post-digestion spike recovery fell between 40% and 85% due to matrix interference.

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

The cover letter is an integral part of this report.
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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S10-960808
Lab ID: 088981-0015-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	4130	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	1.0	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	62.3	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	ND	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	4.1	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	20.7	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

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Quanterra
Environmental Services

METALS

(Soil/Solid - Total)

Client Name: IT Corporation
Client ID: NB-S11-960808
Lab ID: 088981-0016-SA
Matrix: SOIL
Authorized: 10 AUG 96

Sampled: 08 AUG 96
Prepared: See Below

Received: 10 AUG 96
Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date	
Aluminum	4190	mg/kg	10.0	6010	13 AUG 96	13 AUG 96	
Arsenic	1.0	mg/kg	0.50	7060	13 AUG 96	14 AUG 96	
Barium	74.3	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Beryllium	0.20	mg/kg	0.20	6010	13 AUG 96	13 AUG 96	
Cadmium	ND	mg/kg	0.50	6010	13 AUG 96	13 AUG 96	
Chromium	3.2	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	
Lead	15.2	mg/kg	2.5	7421	13 AUG 96	15 AUG 96	R
Mercury	ND	mg/kg	0.10	7471	16 AUG 96	17 AUG 96	
Selenium	ND	mg/kg	0.50	7740	13 AUG 96	14 AUG 96	
Silver	ND	mg/kg	1.0	6010	13 AUG 96	13 AUG 96	

Note R : Raised reporting limit(s) due to high analyte level(s).

ND = Not detected
NA = Not applicable

Reported By: Barry Votaw

Approved By: Mei Lai

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0001-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0001-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0001-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0002-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0002-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0002-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0003-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0003-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0003-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0004-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0004-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0004-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0005-SA	LEACHATE	ICP-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0005-SA	LEACHATE	GFAA-TL	19 AUG 96-AX	19 AUG 96-A	19 AUG 96-A
088981-0005-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-VX	19 AUG 96-V	19 AUG 96-V
088981-0006-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0006-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0006-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0006-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0006-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0006-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0007-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0007-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0007-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0007-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0007-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0008-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0008-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0008-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0008-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0008-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0009-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0009-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0009-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0009-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

(cont.)

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0009-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0010-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0010-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0010-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0010-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0010-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0011-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0011-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0011-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0011-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0011-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0012-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0012-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0012-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0012-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0012-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0013-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0013-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0013-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0013-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0013-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0014-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0014-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0014-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0014-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0014-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-MS	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-MS	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-MS	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-MS	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B

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Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Metals Analysis and Preparation

(cont.)

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
088981-0015-MS	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SA	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0015-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	LEACHATE	ICP-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SD	LEACHATE	GFAA-TL	16 AUG 96-MX	16 AUG 96-M	16 AUG 96-M
088981-0015-SD	LEACHATE	HG-CVAA-TL	19 AUG 96-TX	19 AUG 96-T	19 AUG 96-T
088981-0015-SD	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0015-SD	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0015-SD	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	LEACHATE	ICP-TL	16 AUG 96-NX	16 AUG 96-N	16 AUG 96-N
088981-0016-SA	LEACHATE	GFAA-TL	16 AUG 96-NX	16 AUG 96-N	16 AUG 96-N
088981-0016-SA	LEACHATE	HG-CVAA-TL	19 AUG 96-UX	19 AUG 96-U	19 AUG 96-U
088981-0016-SA	SOIL	7060-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7421-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7740-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A
088981-0016-SA	SOIL	7471-IRP-S	16 AUG 96-BX	16 AUG 96-B	16 AUG 96-B
088981-0016-SA	SOIL	ICP-IRP-S	13 AUG 96-AX	13 AUG 96-A	13 AUG 96-A

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Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation

Analyte	Result	Units	Reporting Limit
Test: AS-FAA-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Arsenic	ND	mg/kg	0.50
Test: PB-FAA-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Lead	ND	mg/kg	0.50
Test: SE-FAA-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Selenium	ND	mg/kg	0.50
Test: HG-CVAA-COE-S			
Matrix: SOIL			
QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B			
Mercury	ND	mg/kg	0.10
Test: ICP-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Aluminum	ND	mg/kg	10.0
Barium	ND	mg/kg	1.0
Beryllium	ND	mg/kg	0.20
Cadmium	ND	mg/kg	0.50
Chromium	ND	mg/kg	1.0
Silver	ND	mg/kg	1.0

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Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation (cont.)

Analyte	Result	Units	Reporting Limit
Test: ICPOCP-TCLP-TL			
Matrix: SOIL			
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A			
Arsenic	ND	mg/L	1.0
Barium	ND	mg/L	0.10
Cadmium	ND	mg/L	0.050
Chromium	ND	mg/L	0.10
Lead	ND	mg/L	0.50
Silver	ND	mg/L	0.10
Test: GF-SECP-TCLP-TL			
Matrix: SOIL			
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A			
Selenium	ND	mg/L	0.050
Test: CV-HGCP-TCLP-TL			
Matrix: SOIL			
QC Lot: 19 AUG 96-VX QC Run: 19 AUG 96-V			
Mercury	ND	mg/L	0.0020
Test: AS-FAA-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Arsenic	ND	mg/kg	0.50
Test: PB-FAA-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Lead	ND	mg/kg	0.50

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Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation (cont.)

Analyte	Result	Units	Reporting Limit
Test: SE-FAA-COE-S Matrix: SOIL QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Selenium	ND	mg/kg	0.50
Test: HG-CVAA-COE-S Matrix: SOIL QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B			
Mercury	ND	mg/kg	0.10
Test: ICPOCP-TCLP-TL Matrix: SOIL QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M			
Arsenic	ND	mg/L	1.0
Barium	ND	mg/L	0.10
Cadmium	ND	mg/L	0.050
Chromium	ND	mg/L	0.10
Lead	ND	mg/L	0.50
Silver	ND	mg/L	0.10
Test: GF-SECP-TCLP-TL Matrix: SOIL QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M			
Selenium	ND	mg/L	0.050
Test: CV-HGCP-TCLP-TL Matrix: SOIL QC Lot: 19 AUG 96-TX QC Run: 19 AUG 96-T			
Mercury	ND	mg/L	0.0020

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Environmental Services

METHOD BLANK REPORT
Metals Analysis and Preparation (cont.)

Analyte	Result	Units	Reporting Limit
Test: ICP-COE-S			
Matrix: SOIL			
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A			
Aluminum	ND	mg/kg	10.0
Barium	ND	mg/kg	1.0
Beryllium	ND	mg/kg	0.20
Cadmium	ND	mg/kg	0.50
Chromium	ND	mg/kg	1.0
Silver	ND	mg/kg	1.0
Test: ICPOCP-TCLP-TL			
Matrix: SOIL			
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N			
Arsenic	ND	mg/L	1.0
Barium	ND	mg/L	0.10
Cadmium	ND	mg/L	0.050
Chromium	ND	mg/L	0.10
Lead	ND	mg/L	0.50
Silver	ND	mg/L	0.10
Test: GF-SECP-TCLP-TL			
Matrix: SOIL			
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N			
Selenium	ND	mg/L	0.050
Test: CV-HGCP-TCLP-TL			
Matrix: SOIL			
QC Lot: 19 AUG 96-UX QC Run: 19 AUG 96-U			
Mercury	ND	mg/L	0.0020

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Environmental Services

ABORATORY CONTROL SAMPLE REPORT
etals Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Test: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	5.21	104	75-125
Barium	20.0	21.1	105	75-125
Cadmium	0.500	0.498	100	75-125
Chromium	2.00	2.14	107	75-125
Lead	5.00	5.14	103	75-125
Silver	0.500	0.503	101	75-125

Category: ICP-TL Metals by ICP in Leachate
Test: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	5.05	101	75-125
Barium	20.0	21.8	109	75-125
Cadmium	0.500	0.486	97	75-125
Chromium	2.00	2.10	105	75-125
Lead	5.00	5.01	100	75-125
Silver	0.500	0.551	110	75-125

Category: ICP-TL Metals by ICP in Leachate
Test: ICPOCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	5.00	4.82	96	75-125
Barium	20.0	20.2	101	75-125
Cadmium	0.500	0.482	96	75-125
Chromium	2.00	2.03	101	75-125
Lead	5.00	4.92	98	75-125
Silver	0.500	0.487	97	75-125

ND = Not Detected

alculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT (cont.)
Metals Analysis and Preparation
Project: 088981

Category: GFAA-TL TCLP Metals by GFAA
Test: GF-SECP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-AX QC Run: 19 AUG 96-A
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.509	102	79-135

Category: GFAA-TL TCLP Metals by GFAA
Test: GF-SECP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-MX QC Run: 16 AUG 96-M
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.498	100	79-135

Category: GFAA-TL TCLP Metals by GFAA
Test: GF-SECP-TCLP-TL
Matrix: LEACHATE
QC Lot: 16 AUG 96-NX QC Run: 16 AUG 96-N
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	0.500	0.501	100	79-135

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-VX QC Run: 19 AUG 96-V
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	0.00500	0.00497	99	75-125

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT (cont.)
Metals Analysis and Preparation
Project: 088981

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-TX QC Run: 19 AUG 96-T
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	0.00500	0.00504	101	75-125

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test: CV-HGCP-TCLP-TL
Matrix: LEACHATE
QC Lot: 19 AUG 96-UX QC Run: 19 AUG 96-U
Concentration Units: mg/L

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	0.00500	0.00506	101	75-125

Category: 7060-IRP-S Arsenic, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test: AS-FAA-COE-S
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Arsenic	75.4	72.3	96	75-125

Category: 7421-IRP-S Lead, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test: PB-FAA-COE-S
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Lead	53.5	53.5	100	65-135

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

LABORATORY CONTROL SAMPLE REPORT (cont.)
Metals Analysis and Preparation
Project: 088981

Category: 7740-IRP-S Selenium, Furnace AA
STATIC QC LIMITS - DO NOT UPDATE
Test: SE-FAA-COE-S
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Selenium	72.3	71.3	99	70-130

Category: 7471-IRP-S Mercury by CVAA
STATIC QC LIMITS - DO NOT UPDATE
Test: HG-CVAA-COE-S
Matrix: SOIL
QC Lot: 16 AUG 96-BX QC Run: 16 AUG 96-B
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Mercury	1.50	1.89	126	75-125

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

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Environmental Services

LABORATORY CONTROL SAMPLE REPORT (cont.)
Metals Analysis and Preparation
Project: 088981

Category: ICP-IRP-S ICP Metals
STATIC QC LIMITS - DO NOT UPDATE (Lot 224)
Test: ICP-COE-S
Matrix: SOIL
QC Lot: 13 AUG 96-AX QC Run: 13 AUG 96-A
Concentration Units: mg/kg

Analyte	Concentration Spiked	Measured	Accuracy(%) LCS	Limits
Aluminum	4590	2690	59	45-155
Antimony	39.8	30.2	76	30-166
Arsenic	75.4	82.9	110	49-149
Barium	106	139	131	58-131
Beryllium	51.0	70.5	138	64-140
Boron	94.1	103	110	50-200
Calcium	1290	1240	96	52-141
Cadmium	45.4	55.9	123	57-144
Chromium	71.0	92.1	130	54-141
Copper	112	135	121	57-145
Cobalt	49.6	65.3	132	60-142
Iron	9160	5240	57	49-151
Magnesium	1160	917	79	75-125
Manganese	154	187	122	67-135
Molybdenum	47.4	52.5	111	57-158
Potassium	1420	1110	78	62-132
Lead	53.5	58.9	110	53-142
Nickel	39.4	50.3	128	55-146
Selenium	72.3	75.6	105	52-149
Silver	116	123	106	45-146
Sodium	198	212	107	23-176
Thallium	40.0	41.7	104	50-150
Tin	102	107	105	50-200
Vanadium	65.9	71.6	109	61-131
Zinc	134	144	107	52-149

ND = Not Detected

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-AX MS Run: 19 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	ND	5.18	5.34	5.00	104	107	75-125	3.0	20
Barium	0.177	21.8	22.4	20.0	108	111	75-125	2.6	20
Cadmium	ND	0.490	0.501	0.500	98	100	75-125	2.1	20
Chromium	ND	2.16	2.20	2.00	108	110	75-125	1.7	20
Lead	ND	5.29	5.30	5.00	106	106	75-125	0.09	20
Silver	ND	0.505	0.512	0.500	101	102	75-125	1.3	20

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-MX MS Run: 16 AUG 96-M

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	ND	4.97	4.81	5.00	99	96	75-125	3.4	20
Barium	0.204	21.7	21.4	20.0	108	106	75-125	1.6	20
Cadmium	ND	0.492	0.492	0.500	98	98	75-125	0.10	20
Chromium	ND	2.11	2.06	2.00	105	103	75-125	2.1	20
Lead	ND	5.04	4.99	5.00	101	100	75-125	1.1	20
Silver	ND	0.504	0.497	0.500	101	99	75-125	1.4	20

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981 (cont.)

Category: ICP-TL Metals by ICP in Leachate
Test : ICPOCP-TCLP-TL Method: 6010
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-NX MS Run: 16 AUG 96-N

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Arsenic	ND	4.89	4.87	5.00	98	97	75-125	0.47	20
Barium	0.155	21.1	21.1	20.0	105	105	75-125	0.0	20
Cadmium	ND	0.480	0.485	0.500	96	97	75-125	1.0	20
Chromium	ND	2.05	2.06	2.00	103	103	75-125	0.58	20
Lead	ND	4.96	5.02	5.00	99	100	75-125	1.2	20
Silver	ND	0.488	0.492	0.500	98	98	75-125	0.82	20

Category: GFAA-TL TCLP Metals by GFAA
T : GF-SECP-TCLP-TL Method: 7740
x : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-AX MS Run: 19 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Selenium	ND	0.505	0.500	0.500	101	100	75-125	1.0	35

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-MX MS Run: 16 AUG 96-M

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
	---------- Concentration ----------								
Selenium	ND	0.488	0.483	0.500	98	97	75-125	1.0	35

ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981 (cont.)

Category: GFAA-TL TCLP Metals by GFAA
Test : GF-SECP-TCLP-TL Method: 7740
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 16 AUG 96-NX MS Run: 16 AUG 96-N

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	RPD %RPD	RPD Limit
Selenium	ND	0.498	0.499	0.500	100	100	75-125	0.20	35

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0005
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-VX MS Run: 19 AUG 96-V

te	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	RPD %RPD	RPD Limit
Mercury	ND	0.00420	0.00436	0.00500	84	87	75-125	3.9	20

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0015
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-TX MS Run: 19 AUG 96-T

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	RPD %RPD	RPD Limit
Mercury	ND	0.00507	0.00507	0.00500	101	101	75-125	0.0	20

= Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
Metals Analysis and Preparation
Project: 088981 (cont.)

Category: HG-CVAA-TL TCLP Mercury by CVAA
Test : CV-HGCP-TCLP-TL Method: 7470
Matrix : LEACHATE
Sample : 088981-0016
Units : mg/L Units Qualifier: Wet Weight
QC Lot : 19 AUG 96-UX MS Run: 19 AUG 96-U

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	ND	0.00504	0.00511	0.00500	101	102	75-125	1.4	20

Category: 7060-IRP-S Arsenic, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test : AS-FAA-COE-S Method: 7060
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Arsenic	1.02	4.65	4.84	4.00	91	95	75-125	4.0	35

Category: 7421-IRP-S Lead, Furnace AA
STATIC QC LIMTS - DO NOT UPDATE
Test : PB-FAA-COE-S Method: 7421
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet Weight
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Lead	20.7	23	24	2.0	NC	NC	75-125	3.0	35

NC = Not Calculated, calculation not applicable.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981 (cont.)

Category: 7740-IRP-S Selenium, Furnace AA
STATIC QC LIMITS - DO NOT UPDATE
Test : SE-FAA-COE-S Method: 7740
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Selenium	ND	1.9	1.9	2.0	93	93	75-125	0.81	35

Category: 7471-IRP-S Mercury by CVAA
STATIC QC LIMITS - DO NOT UPDATE
Test : HG-CVAA-COE-S Method: 7471
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 16 AUG 96-BX MS Run: 16 AUG 96-B

Analyte	Sample Result		MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Mercury	0.0925	J	0.42	0.35	0.25	132	104	75-125	18	35

Result is detected below the reporting limit or is an estimated concentration.
D = Not Detected
alculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

X SPIKE/MATRIX SPIKE DUPLICATE MSQC REPORT
s Analysis and Preparation
Project: 088981 (cont.)

Category: ICP-IRP-S ICP Metals
STATIC QC LIMITS - DO NOT UPDATE (Lot 224)
Test : ICP-COE-S Method: 6010
Matrix : SOIL
Sample : 088981-0015
Units : mg/kg Units Qualifier: Wet wt.
QC Lot : 13 AUG 96-AX MS Run: 13 AUG 96-A

Analyte	Concentration: Sample Result	MS Result	MSD Result	Spiked MS/MSD	%Recovery MS	%Recovery MSD	Control Limits	%RPD	RPD Limit
Aluminum	4130	5100	5200	100	NC	NC	45-155	3.0	25
Antimony	NA	NA	NA	49	NC	NC	30-166	0.0	25
Arsenic	NA	NA	NA	82	NC	NC	49-149	0.0	25
Barium	62.3	260	260	200	101	97	58-131	2.5	25
Beryllium	ND	5.0	4.9	5.0	100	98	64-140	1.6	25
Cadmium	ND	4.5	4.6	5.0	91	92	57-144	1.1	25
Calcium	NA	NA	NA	2400	NC	NC	52-141	0.0	25
Chromium	4.15	22	22	20	92	91	54-141	0.57	25
Cobalt	NA	NA	NA	100	NC	NC	60-142	0.0	25
Copper	NA	NA	NA	200	NC	NC	57-145	0.0	25
[illegible]	NA	NA	NA	7100	NC	NC	49-151	0.0	25
[illegible]	NA	NA	NA	160	NC	NC	53-142	0.0	25
Magnesium	NA	NA	NA	2400	NC	NC	60-144	0.0	25
Manganese	NA	NA	NA	370	NC	NC	67-135	0.0	25
Molybdenum	NA	NA	NA	94	NC	NC	57-158	0.0	25
Nickel	NA	NA	NA	140	NC	NC	55-146	0.0	25
Potassium	NA	NA	NA	2300	NC	NC	62-132	0.0	25
Selenium	NA	NA	NA	110	NC	NC	52-149	0.0	25
Silver	ND	4.6	4.6	5.0	92	92	45-146	0.35	25
Sodium	NA	NA	NA	500	NC	NC	23-176	0.0	25
Thallium	NA	NA	NA	130	NC	NC	50-150	0.0	25
Vanadium	NA	NA	NA	94	NC	NC	61-131	0.0	25
Zinc	NA	NA	NA	200	NC	NC	52-149	0.0	25

Not Applicable
Not Calculated, calculation not applicable.
ND = Not Detected
Calculations are performed before rounding to avoid round-off errors in calculated results.

ATTACHMENT C

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1	1	0		
PAGE 1 OF 1						
PAGE	0	0	0	0	1	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Haw Thorne

SAMPLE NO. NB-SI - 960808

SAMPLE LOCATION Unnamed Spring Canyon

SAMPLE TYPE soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0 - 0.5 ft.

WEATHER Sunny - hot high 80s

CONTAINERS USED	AMOUNT COLLECTED
1x16oz glass jar	full

COMMENTS:

A soil sample was collected in the intermittent stream bed in the unnamed spring valley. This sample was collected to assess background concentrations of metals in soil at the New Bomb UD unit area. The sample was placed in an (was) 16oz glass jar. No preservatives were added. The sample was shipped to Quanterra, Inc., West Sacramento, California for the following analyses:

- TCLP - selected analytes
- Explosives by EPA Method 8330.
- Metals (total).

Sample Location: Unnamed Spring Canyon, immediately downstream of spring. Spring has dried up.

Sample description: light gray fine to coarse sand.

PREPARED BY: William Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9 6
TIME	1	1	1	5	
PAGE 1 OF 1					
PAGE	0	0	0	0	2
PROJECT NO. 761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S2-960808

SAMPLE LOCATION Unnamed Spring Canyon

SAMPLE TYPE soil

COMPOSITE ___ YES ✓ NO

COMPOSITE TYPE ~~0-0.5~~ NA

DEPTH OF SAMPLE ~~0~~-0.5

WEATHER Sunny - hot, highs 80's

CONTAINERS USED	AMOUNT COLLECTED
1 x 16 oz. glass jar	full

COMMENTS:

A soil sample was collected in the intermittent stream bed in the unnamed spring valley. This sample was collected to assess background concentrations of metals in soil at the New Bomb UD unit area. The sample was placed in a 16 oz. glass jar. No preservatives were added. The sample was shipped to ~~the~~ (WS) Quanterra, Inc. in West Sacramento, California for the following analyses:

- TCLP (selected analytes)
- Explosives by EPA Method 8330.
- Metals (total)

Sample location: Unnamed Spring canyon approximately 100 feet downstream of NB-S1

Sample description: light gray fine to coarse sand

PREPARED BY: W. Starhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1	2	5		
PAGE	1 OF 1					
PAGE	0	0	0	0	3	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S3-960808

SAMPLE LOCATION Unnamed Spring Canyon

SAMPLE TYPE soil

COMPOSITE ___ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft.

WEATHER Sunny - hot, high 80s

CONTAINERS USED	AMOUNT COLLECTED
1x16oz glass jar	full

COMMENTS:

A soil sample was collected in the intermittent stream bed in the unnamed spring valley. This sample was collected to assess background concentrations of metals in soil at the New Bomb area. The sample was shipped to Quanterra, Inc. in West Sacramento, California for the following analyses:

- TCLP (selected analytes)
- Explosives by EPA Method 8330
- Metals (total)

Sample Location: Unnamed Spring ~~Valley~~ Canyon, approximately 250 feet downstream of NB-S1.

Sample description: gray fine to coarse sand.

PREPARED BY: M. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1		4	5	
PAGE 1 OF 1						
PAGE	0	0	0	0	4	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S4-960808

SAMPLE LOCATION Upgradient - North side of canyon

SAMPLE TYPE Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE ~~o~~ (WS) NA

DEPTH OF SAMPLE 0 - 0.5 ft.

WEATHER Sunny, hot high 80's

CONTAINERS USED	AMOUNT COLLECTED
1 x 16 oz. glass jar	full

COMMENTS:

A soil sample was collected from the north side of the canyon, upgradient of the UD pits. This sample is considered to be within the zone of potential contamination from fallout, and represents a control sample. The sample was shipped to Quanterra, Inc. in West Sacramento, CA for the following analyses:

- TCLP (selected ~~metals~~ analytes) (WS)
- Explosives by EPA Method 8330
- Metals (total)

Sample Location: North side of UD canyon, approximately 50 feet from camera mount

Sample description: grayish brown silt, sand, and gravel.

PREPARED BY: Ken Stanhope

ATTACHMENT C

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1	1	0		
PAGE 1 OF 1						
PAGE	0	0	0	0	1	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Haw Thorne

SAMPLE NO. NB-S1 - 960808

SAMPLE LOCATION Unnamed Spring Canyon

SAMPLE TYPE Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0 - 0.5 ft.

WEATHER Sunny - hot high 80s

CONTAINERS USED	AMOUNT COLLECTED
1x16oz glass jar	full

COMMENTS:

A soil sample was collected in the intermittent stream bed in the unnamed spring valley. This sample was collected to assess background concentrations of metals in soil at the New Bomb UD unit area. The sample was placed in an (was) 16oz glass jar. No preservatives were added. The sample was shipped to Quanterra, Inc., West Sacramento, California for the following analyses:

- TCLP - selected analytes
- Explosives by EPA Method 8330.
- Metals (total).

Sample Location: Unnamed Spring Canyon, immediately downstream of spring. Spring has dried up.

Sample description: light gray fine to coarse sand.

PREPARED BY: William Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1	1		5	
PAGE 1 OF 1						
PAGE	0	0	0	0	2	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S2-960808

SAMPLE LOCATION Unnamed Spring Canyon

SAMPLE TYPE Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE ~~0 - 0.5~~ NA

DEPTH OF SAMPLE 0-0.5

WEATHER Sunny - hot, highs 80's

CONTAINERS USED	AMOUNT COLLECTED
1 x 16 oz. glass jar	full

COMMENTS:

A soil sample was collected in the intermittent stream bed in the unnamed spring valley. This sample was collected to assess background concentrations of metals in soil at The New Bomb UD unit area. The sample was placed in a 16 oz. glass jar. No preservatives were added. The sample was shipped to ~~the~~ us Quanterra, Inc. in West Sacramento, California for the following analyses:

- TCLP (selected analytes)
- Explosives by EPA Method 8330.
- Metals (total)

Sample location: Unnamed Spring canyon approximately 100 feet downstream of NB-S1

Sample description: light gray fine to coarse sand

PREPARED BY: W. Harlow

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1	2	5		
PAGE	1 OF 1					
PAGE	0	0	0	0	3	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S3-960808

SAMPLE LOCATION Unnamed Spring Canyon

SAMPLE TYPE soil

COMPOSITE ___ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft.

WEATHER Sunny - hot, high 80s

CONTAINERS USED	AMOUNT COLLECTED
1x16oz glass jar	full

COMMENTS:

A soil sample was collected in the intermittent stream bed in the unnamed spring valley. This sample was collected to assess background concentrations of metals in soil at the New Bomb area. The sample was shipped to Quanterra, Inc. in West Sacramento, California for the following analyses:

- TCLP (selected analytes)
- Explosives by EPA Method 8330
- Metals (total)

Sample Location: Unnamed Spring ~~Valley~~ Canyon, approximately 250 feet downstream of NB-S1.

Sample description: gray fine to coarse sand.

PREPARED BY: M. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	1	4	5		
PAGE	1	OF	1			
PAGE	0	0	0	0	4	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB - S4 - 960808

SAMPLE LOCATION Upgradient - North side of canyon

SAMPLE TYPE Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE ~~o~~ (WS) NA

DEPTH OF SAMPLE 0 - 0.5 ft.

WEATHER Sunny, hot high 80's

CONTAINERS USED	AMOUNT COLLECTED
1 x 16 oz. glass jar	full

COMMENTS:

A soil sample was collected from the north side of the canyon, upgradient of the UD pits. This sample is considered to be within the zone of potential contamination from fallout, and represents a control sample. The sample was shipped to Quanterra, Inc. in West Sacramento, CA for the following analyses:

- TCLP (selected ~~metals~~ analytes) (WS)
- Explosives by EPA Method 8330
- Metals (total)

Sample Location: North side of UD canyon, approximately 50 feet from camera mount

Sample description: grayish brown silt, sand, and gravel.

PREPARED BY: Wm Stinchcomb

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	2	0	5		
PAGE	1 OF 1					
PAGE	0	0	0	0	5	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S5-960808

SAMPLE LOCATION Upgradient - South side of UD Canyon. (west)

SAMPLE TYPE Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0 - 0.5 ft.

WEATHER Sunny, hot high 80's

CONTAINERS USED	AMOUNT COLLECTED
1 x 16 oz. glass jar	full

COMMENTS:

A soil sample was collected from the south side of the UD canyon, upgradient of the UD pits. This sample is considered to be within the zone of potential contamination from fall out and represents a control sample. The sample was shipped to Quanterra, Inc. in West Sacramento, CA for the following analyses:

- TCLP (selected analytes)
- Explosives by EPA Method 8330
- Metals (total)

Sample Location: South side of UD canyon, 50 feet North of the intersection of fire roads. (See figure.)

Sample description: grayish brown silt and sand.

PREPARED BY: Wm. Steinhaye

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	2	2	0		
PAGE	1 OF 1					
PAGE	0	0	0	0	6	
PROJECT NO.	76104					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-56-960808

SAMPLE LOCATION Up gradient - South side of UD canyon (east)

SAMPLE TYPE soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft.

WEATHER Sunny, hot high 80s

CONTAINERS USED	AMOUNT COLLECTED
1x 160g. glass jar	full

COMMENTS:

A soil sample was collected from the south side of the UD canyon, upgradient of the UD pits. This sample is considered to be within the zone of potential contamination from outfall and represents a control sample. The sample was shipped to Quanterra, Inc. in west Sacramento, CA for the following analyses:

- TCLP (selected analytes),
- Explosives by EPA Method 8330, and
- Metals (total).

Sample Location: 100 feet southwest of existing observation camara, south side of UD canyon. (See figure)

Sample description: gray silt sand and gravel.

PREPARED BY: Wm. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	2	4	0		
PAGE	1 OF 1					
PAGE	0	0	0	0	7	
PROJECT NO.	76104					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-57-960808

SAMPLE LOCATION Downgradient - in drainage ditch-undisturbed area.

SAMPLE TYPE soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft.

WEATHER Sunny, hot high 80's

CONTAINERS USED	AMOUNT COLLECTED
1x 16oz. glass jar	full (WS)

COMMENTS:

A soil sample was collected in the drainage ditch, downgradient of UD pits. This sample was also collected inside the canyon. This sampling location is an area where depositions of water carried sediments occurs and is therefore, an area where potential contamination could exist. The sample was shipped to Quanterra, Inc. in West Sacramento, CA for the following analyses:

- TCLP (selected analytes)
- Explosives by EPA Method 8330, and
- Metals (total).

Sample Location: Unworked area of drainage ditch on right side of existing roadway (looking east).

Sample description: grayish brown silt and sand.

PREPARED BY: Willie Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	2	5	0		
PAGE 1 OF 1						
PAGE	0	0	0	0	8	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-58-960808

SAMPLE LOCATION Downgradient - in drainage ditch - undisturbed area

SAMPLE TYPE Soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft.

WEATHER Sunny, hot, high 80s

CONTAINERS USED	AMOUNT COLLECTED
1 x 16oz. glass jar	full

COMMENTS:

A soil sample was collected in the drainage ditch, downgradient of the UD pits, inside the canyon. This sample was collected in an area where deposition of sediments occurs in the intermittent stream, and represents an area where potential contamination could exist. The sample was shipped to Quanterra, Inc. in West Sacramento, CA for the following analyses:

- TCLP (selected analytes),
- Explosives by EPA Method 8330, and
- Metals (total).

Sample Location: Unworked area of Drainage ditch inside canyon on the right side of the existing roadway (facing eastward). Drainage ditch is wide and low flow deposition is evident.

Sample description: gray silt and sand.

PREPARED BY: Will Strahze

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	3	3	5		
PAGE	1	OF	1			
PAGE	0	0	0	0	9	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot.
SAMPLE NO. NB-S9-960808
SAMPLE LOCATION Downgradient - in alluvial fan
SAMPLE TYPE Soil
COMPOSITE ____ YES ✓ NO
COMPOSITE TYPE NA
DEPTH OF SAMPLE 0-0.5 ft
WEATHER Sunny, hot, high 80s

CONTAINERS USED	AMOUNT COLLECTED
1x16 oz. glass jars	full

COMMENTS:

A soil sample was collected in the alluvial fan inside the drainage ditch. This sample was collected in an area where deposition of sediments occurs in the intermittent stream. The sampling location contained debris possibly associated with OD operations. The sample was shipped to Quanterra, Inc in West Sacramento, CA for the following analyses:

- TCLP (selected analytes),
- Explosives by EPA Method 8330, and
- Metals (total).

A field duplicate, sample NB-S11-960808 was collected for this sample

Sample Location: 100 feet west of electric poll # 500, inside restricted area fence.

Sample description: grayish brown silt and sand.

PREPARED BY: Willie Atterbye

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	4	0	5		
PAGE 1 OF 1						
PAGE	0	0	0	1	0	
PROJECT NO. 761041						

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S10-960808 (MS/MSD)

SAMPLE LOCATION Downgradient of UD pit in the alluvial Fan

SAMPLE TYPE soil

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft.

WEATHER Sunny, hot, high 80s

CONTAINERS USED	AMOUNT COLLECTED
2* x 16 oz glass jar	full

* extra quantity for MS/MSD samples

COMMENTS:

A soil sample was collected in the alluvial fan near the drainage ditch. This sample was collected in an area where deposition of ~~occurs~~ (WS) sediments occurs in the intermittent stream. The sampling location contained debris possibly associated with UD operations. The sample was shipped to Quanterra in West Sacramento, ~~Ore.~~ (WS) for the following analyses:

- TCLP (selected analytes),
- Explosives by EPA Method 8330, and
- Metals (Total).

Sampling Location: 50 feet North of Electric Poll # 502 outside of restricted area fense.

Sample description: grayish brown silt and sand.

PREPARED BY: W. Stanhope

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	0	8	0	8	9	6
TIME	1	3	3	5		
PAGE	1 OF 1					
PAGE	0	0	0	0	1	
PROJECT NO.	761041					

SAMPLE COLLECTION LOG

PROJECT NAME Hawthorne Army Depot

SAMPLE NO. NB-S11-960808

SAMPLE LOCATION Sampling location NB-59

SAMPLE TYPE Field duplicate

COMPOSITE ____ YES ✓ NO

COMPOSITE TYPE NA

DEPTH OF SAMPLE 0-0.5 ft

WEATHER sunny hot high 80s

CONTAINERS USED	AMOUNT COLLECTED
1 x 160z glass jar	full.

COMMENTS:

This sample was collected as a field duplicate for sample NB-59-960808. Refer to the collection log for this sample for details.

PREPARED BY: W. Stanhope.

APPENDIX H

H.5 GEOTECHNICAL DATA NEW BOMB

412 823-8999

Stor cation: BIN H-1

Geotechnics, Inc.
Laboratory Testing Program

geotechnics

Client IT CORP - AP
Project HAWTHORNE / 761041
Project No. 96071-01

Project Start Date 04-05-96
Report Due Date 04-19-96 or Before

Client Contact MARK WEISBERG

No. of Samples 3
Sheet 1 of 1

Boring	Depth	Sample	Lab I.D.	Container	Testing
NEW BOMB	EQ. SHED	A	96071-01.001	Bag	Sieve Hydro
NEW BOMB	NORTH	B	96071-01.002	Bag	Sieve Hydro
NEW BOMB	SOUTH	C	96071-01.003	Bag	Sieve Hydro

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Geotechnics

WASH SIEVE ANALYSIS

Client	IT CORPORATION	Tested By	VG	Date	04-09-96
Client Project	HAWTHORNE / 761041	Checked By	JCM	Date	4-18-96
Project No.	96071-01				
Boring No.	NEW BOMB				
Depth(ft.)	EQ. SHED				
Sample No.	A				
Soil Description	GRAY CLAYEY SAND				

Wt. of Total Sample(dry)	773.14 gm.
Wt. of +#200 Sample	615.82 gm.
Wt. of -#200 Sample	157.32 gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
12"	300.00	0.00	0.0	0.0	100.0
6"	150.00	0.00	0.0	0.0	100.0
3"	75.00	0.00	0.0	0.0	100.0
2"	50.00	0.00	0.0	0.0	100.0
1/2"	37.50	0.00	0.0	0.0	100.0
1"	25.00	0.00	0.0	0.0	100.0
3/4"	19.00	0.00	0.0	0.0	100.0
1/2"	12.50	52.50	6.8	6.8	93.2
3/8"	9.50	9.15	1.2	8.0	92.0
#4	4.75	39.00	5.0	13.0	87.0
#10	2.00	98.10	12.7	25.7	74.3
#20	0.85	103.07	13.3	39.0	61.0
#40	0.425	87.29	11.3	50.3	49.7
#60	0.250	70.78	9.2	59.5	40.5
#140	0.106	124.27	16.1	75.6	24.4
#200	0.075	31.66	4.1	79.7	20.3
Pan	-	157.32	20.3	100.0	-

Water Content	
Tare No.	1626
Wgt. Tare + WS.	895.00
Wgt. Tare + DS.	874.40
Wgt. Tare	101.26
Wgt. Of Water	20.60
Wgt. Of DS.	773.14
% Water	2.7

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Geotechnics

HYDROMETER ANALYSIS

Client	IT CORPORATION	Tested By	TO	Date	04-09-96
Client Project	HAWTHORNE / 761041	Checked By	JPM	Date	4-18-96
Project No.	96071-01				
Boring No.	NEW BOMB				
Depth(ft.)	EQ. SHED				
Sample No.	A				

Soil Sample Weight			
Container No.	1303		
Wt. Contain. & Dry Soil	125.95 gm.	K Factor	0.01321
Wt. Contain.	104.65 gm.	Composite Correction	7.02
Wt. Dispers.	5.00 gm.	a Factor	0.99
Wt. Dry Soil	16.30 gm.	% Finer Than No. 200	20.35
Temperature C	21.5		
Specific Gravity	2.70 Assumed		

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2	17.0	17.0	10.0	60.6	0.0343	12.3
5		15.5	8.5	51.5	0.0219	10.5
15		13.5	6.5	39.4	0.0128	8.0
30		12.5	5.5	33.3	0.0091	6.8
73		11.0	4.0	24.2	0.0059	4.9
250		9.5	2.5	15.1	0.0032	3.1
1440		8.5	1.5	9.0	0.0013	1.8

Geotechnics

lient	IT CORPORATION
Client Project	HAWTHORNE / 761041
Project No.	96071-01
Boring No.	NEW BOMB
Depth(ft.)	EQ. SHED
Sample No.	A

DIAMETER (mm)	PERCENT FINER
300.00	100.0
150.00	100.0
75.000	100.0
50.000	100.0
37.500	100.0
25.000	100.0
19.000	100.0
12.500	93.2
9.5000	92.0
4.7500	87.0
2.0000	74.3
0.8500	61.0
0.4250	49.7
0.2500	40.5
0.1060	24.4
0.0750	20.3
0.0343	12.3
0.0219	10.5
0.0128	8.0
0.0091	6.8
0.0059	4.9
0.0032	3.1
0.0013	1.8

SIEVE OPENING (mm)	PERCENT FINER
100.00	100.00
2.00	74.29
0.05	16.19
0.002	2.39

PERCENT OF EACH COMPONENT		CORRECTED PERCENT OF -2.0 mm MATERIAL FOR USDA DETERMINATION
GRAVEL	25.71	0.00
SAND	58.10	78.21
SILT	13.80	18.57
CLAY	2.39	3.22

USDA CLASSIFICATION: LOAMY SAND

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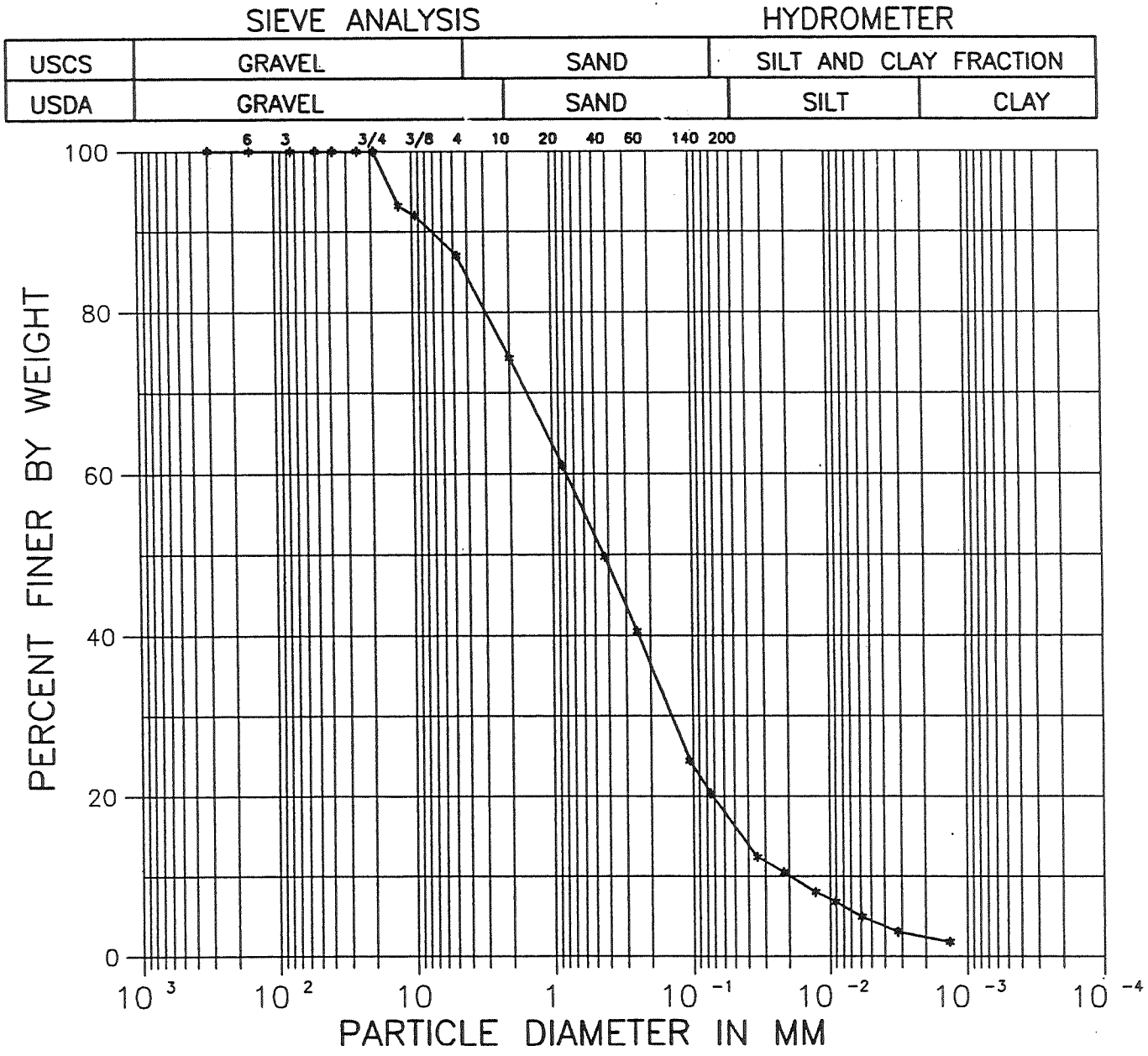
Client IT CORPORATION
Client Project HAWTHORNE / 761041
Project No. 96071-01
USCS Classification sc
Soil Description GRAY CLAYEY SAND

Boring No. NEW BOMB
Depth(ft) EQ. SHED
Sample No. A
USDA Classification LOAMY SAND



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Geotechnics

Geotechnics

WASH SIEVE ANALYSIS

Client	IT CORPORATION	Tested By	VG	Date	04-17-96
Client Project	HAWTHORNE \ 761041	Checked By	JCM	Date	4.19.96
Project No.	96071-01				
Boring No.	NEW BOMB				
Depth(ft.)	NORTH				
Sample No.	B				
Soil Description	GRAY CLAYEY SAND				

Wt. of Total Sample(dry)	326.50 gm.
Wt. of +#200 Sample	219.68 gm.
Wt. of -#200 Sample	106.82 gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
12"	300.00	0.00	0.0	0.0	100.0
6"	150.00	0.00	0.0	0.0	100.0
3"	75.00	0.00	0.0	0.0	100.0
2"	50.00	0.00	0.0	0.0	100.0
1 1/2"	37.50	0.00	0.0	0.0	100.0
1"	25.00	0.00	0.0	0.0	100.0
3/4"	19.00	0.00	0.0	0.0	100.0
1/2"	12.50	3.05	0.9	0.9	99.1
3/8"	9.50	3.17	1.0	1.9	98.1
#4	4.75	15.07	4.6	6.5	93.5
#10	2.00	35.13	10.8	17.3	82.7
#20	0.85	39.63	12.1	29.4	70.6
#40	0.425	35.30	10.8	40.2	59.8
#60	0.250	28.25	8.7	48.9	51.1
#140	0.106	44.11	13.5	62.4	37.6
#200	0.075	15.97	4.9	67.3	32.7
Pan	-	106.82	32.7	100.0	-

Water Content	
Tare No.	1620
Wgt. Tare + WS.	440.10
Wgt. Tare + DS.	425.60
Wgt. Tare	99.10
Wgt. Of Water	14.50
Wgt. Of DS.	326.50
% Water	4.4

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Geotechnics

HYDROMETER ANALYSIS

Client	IT CORPORATION	Tested By	TO	Date	04-17-96
Client Project	HAWTHORNE \ 761041	Checked By	jom	Date	4.19.96
Project No.	96071-01				
Boring No.	NEW BOMB				
Depth(ft.)	NORTH				
Sample No.	B				

Soil Sample Weight			
Container No.	1018		
Wt. Contain. & Dry Soil	133.89 gm.	K Factor	0.01321
Wt. Contain.	102.50 gm.	Composite Correction	7.02
Wt. Dispers.	5.00 gm.	a Factor	0.99
Wt. Dry Soil	26.39 gm.	% Finer Than No. 200	32.72
Temperature C	21.5		
Specific Gravity	2.70 Assumed		

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2	25.0	25.5	18.5	69.3	0.0325	22.7
5		22.5	15.5	58.1	0.0210	19.0
15		20.0	13.0	48.7	0.0123	15.9
30		17.5	10.5	39.3	0.0088	12.9
67		14.5	7.5	28.1	0.0060	9.2
250		12.5	5.5	20.6	0.0032	6.7
1440		10.0	3.0	11.2	0.0013	3.7

Geotechnics

ient	IT CORPORATION
Client Project	HAWTHORNE \ 761041
Project No.	96071-01
Boring No.	NEW BOMB
Depth(ft.)	NORTH
Sample No.	B

DIAMETER (mm)	PERCENT FINER
300.00	100.0
150.00	100.0
75.000	100.0
50.000	100.0
37.500	100.0
25.000	100.0
19.000	100.0
12.500	99.1
9.5000	98.1
4.7500	93.5
2.0000	82.7
0.8500	70.6
0.4250	59.8
0.2500	51.1
0.1060	37.6
0.0750	32.7
0.0325	22.7
0.0210	19.0
0.0123	15.9
0.0088	12.9
0.0060	9.2
0.0032	6.7
0.0013	3.7

SIEVE OPENING (mm)	PERCENT FINER
100.00	100.00
2.00	82.72
0.05	27.85
0.002	5.10

PERCENT OF EACH COMPONENT		CORRECTED PERCENT OF -2.0 mm MATERIAL FOR USDA DETERMINATION
GRAVEL	17.28	0.00
SAND	54.87	66.33
SILT	22.75	27.50
CLAY	5.10	6.17

USDA CLASSIFICATION: SANDY LOAM

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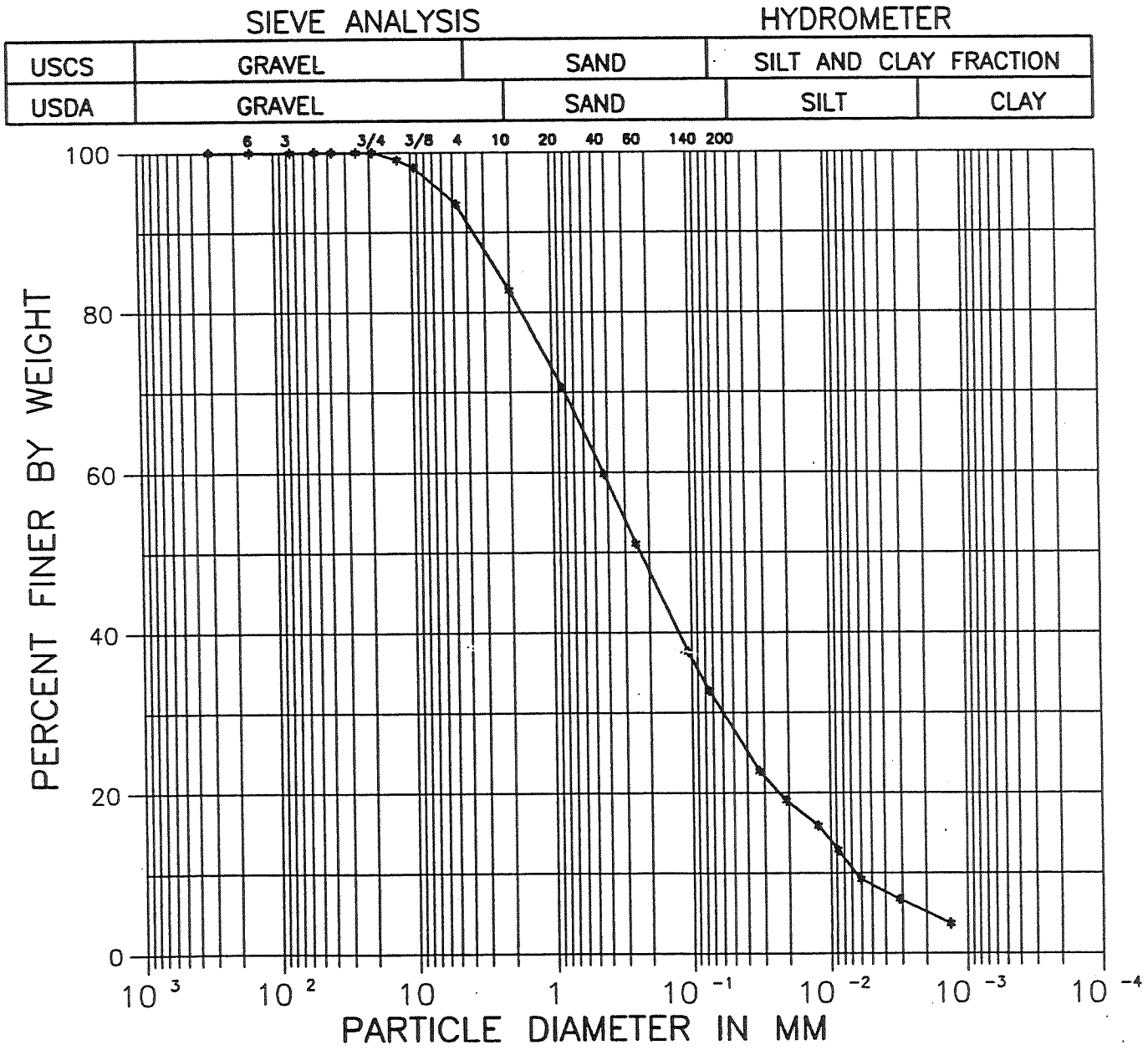
Client IT CORPORATION
Client Project HAWTHORNE 761041
Project No. 96071-01
USCS Classification sc
Soil Description GRAY CLAYEY SAND

Boring No. NEW BOMB
Depth(ft) NORTH
Sample No. B
USDA Classification SANDY LOAM



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Geotechnics

Geotechnics

WASH SIEVE ANALYSIS

Client	IT CORPORATION	Tested By	VG	Date	04-17-96
Client Project	HAWTHORNE \ 761041	Checked By	JCM	Date	4-18-96
Project No.	96071-01				
Boring No.	NEW BOMB				
Depth(ft.)	SOUTH				
Sample No.	C				
Soil Description	GRAY CLAYEY SAND				

Wt. of Total Sample(dry)	469.61 gm.
Wt. of +#200 Sample	339.72 gm.
Wt. of -#200 Sample	129.89 gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
12"	300.00	0.00	0.0	0.0	100.0
6"	150.00	0.00	0.0	0.0	100.0
3"	75.00	0.00	0.0	0.0	100.0
2"	50.00	0.00	0.0	0.0	100.0
1/2"	37.50	0.00	0.0	0.0	100.0
1"	25.00	0.00	0.0	0.0	100.0
3/4"	19.00	0.00	0.0	0.0	100.0
1/2"	12.50	9.89	2.1	2.1	97.9
3/8"	9.50	4.25	0.9	3.0	97.0
#4	4.75	23.58	5.0	8.0	92.0
#10	2.00	53.08	11.3	19.3	80.7
#20	0.85	63.65	13.6	32.9	67.1
#40	0.425	61.45	13.1	46.0	54.0
#60	0.250	43.67	9.3	55.3	44.7
#140	0.106	58.81	12.5	67.8	32.2
#200	0.075	21.34	4.5	72.3	27.7
Pan	-	129.89	27.7	100.0	-

Water Content	
Tare No.	1626
Wgt. Tare + WS.	604.30
Wgt. Tare + DS.	570.90
Wgt. Tare	101.29
Wgt. Of Water	33.40
Wgt. Of DS.	469.61
% Water	7.1

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Geotechnics

HYDROMETER ANALYSIS

Client	IT CORPORATION	Tested By	TO	Date	04-17-96
Client Project	HAWTHORNE \ 761041	Checked By	JCM	Date	4-19-96
Project No.	96071-01				
Boring No.	NEW BOMB				
Depth(ft.)	SOUTH				
Sample No.	C				

Soil Sample Weight			
Container No.	869		
Wt. Contain. & Dry Soil	135.44 gm.	K Factor	0.01321
Wt. Contain.	110.97 gm.	Composite Correction	7.02
Wt. Dispers.	5.00 gm.	a Factor	0.99
Wt. Dry Soil	19.47 gm.	% Finer Than No. 200	27.66
Temperature C	21.5		
Specific Gravity	2.70 Assumed		

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2	19.0	20.0	13.0	66.0	0.0337	18.3
5		18.0	11.0	55.8	0.0216	15.4
15		16.0	9.0	45.7	0.0126	12.6
30		13.5	6.5	32.9	0.0090	9.1
70		11.0	4.0	20.2	0.0060	5.6
250		9.5	2.5	12.6	0.0032	3.5
1440		8.0	1.0	5.0	0.0013	1.4

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ient	IT CORPORATION
lient Project	HAWTHORNE \ 761041
Project No.	96071-01
Boring No.	NEW BOMB
Depth(ft.)	SOUTH
Sample No.	C

DIAMETER (mm)	PERCENT FINER
300.00	100.0
150.00	100.0
75.000	100.0
50.000	100.0
37.500	100.0
25.000	100.0
19.000	100.0
12.500	97.9
9.5000	97.0
4.7500	92.0
2.0000	80.7
0.8500	67.1
0.4250	54.0
0.2500	44.7
0.1060	32.2
0.0750	27.7
0.0337	18.3
0.0216	15.4
0.0126	12.6
0.0090	9.1
0.0060	5.6
0.0032	3.5
0.0013	1.4

SIEVE OPENING (mm)	PERCENT FINER	PERCENT OF EACH COMPONENT		CORRECTED PERCENT OF -2.0 mm MATERIAL FOR USDA DETERMINATION
100.00	100.00			
		GRAVEL	19.34	0.00
2.00	80.66			
		SAND	57.77	71.62
0.05	22.89			
		SILT	20.56	25.48
0.002	2.34			
		CLAY	2.34	2.90

USDA CLASSIFICATION SANDY LOAM

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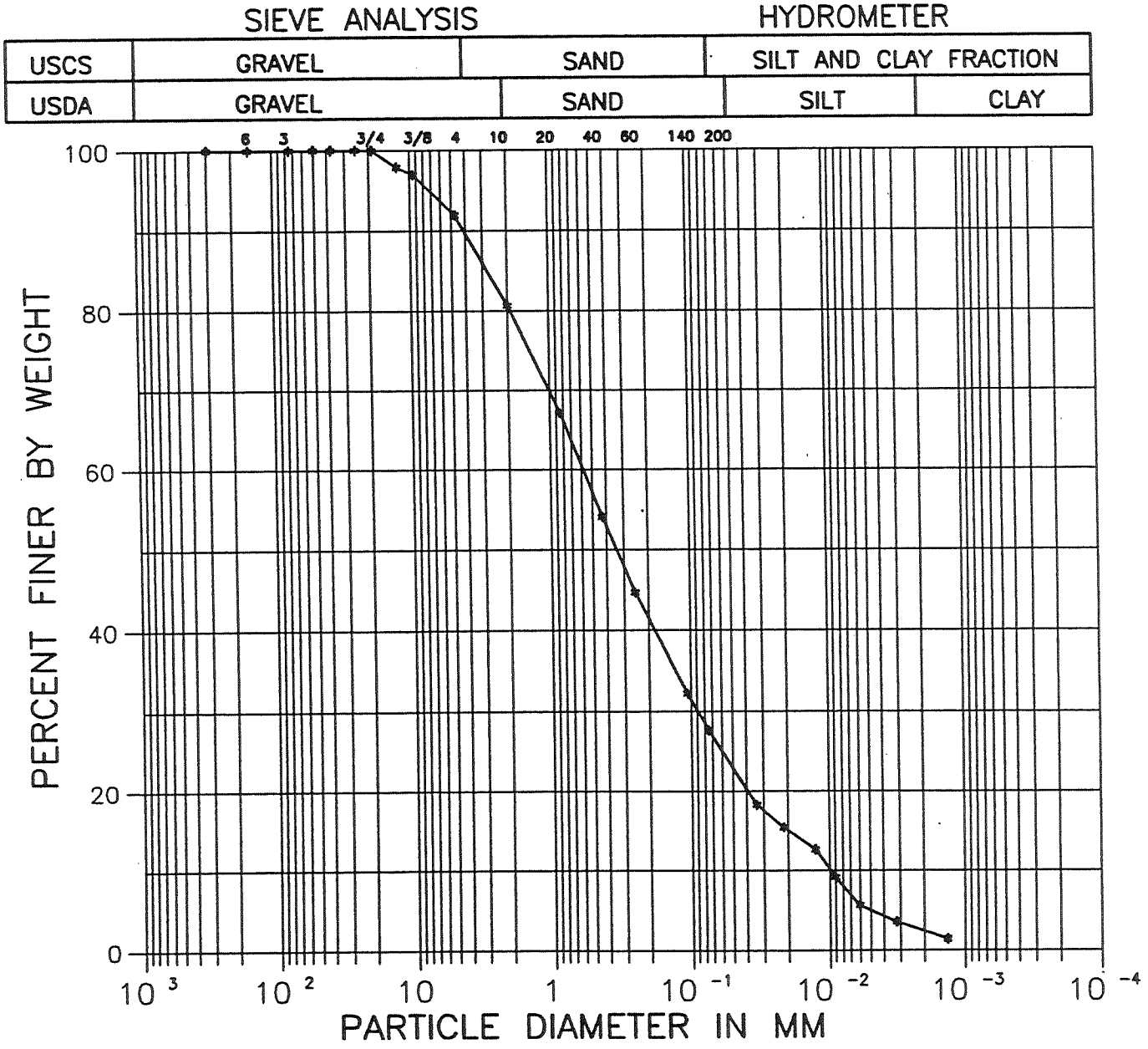
Client IT CORPORATION
Client Project HAWTHORNE 761041
Project No. 96071-01
USCS Classification sc
Soil Description GRAY CLAYEY SAND

Boring No. NEW BOMB
Depth(ft) SOUTH
Sample No. C
USDA Classification SANDY LOAM



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Geotechnics

APPENDIX H

H.6 WELL #2 ANALYTICAL DATA

APPENDIX E

ANALYTICAL WATER QUALITY RESULTS FOR WHISKEY FLATS WELL NO. 2

Source
EBASCO 1988 Permit App

IN TRIPLICATE
(PLEASE PRINT OR TYPE)

NEVADA STATE HEALTH LABORATORY
NEVADA DIVISION OF HEALTH
1660 N. Virginia Street
Reno, Nevada 89503
(702) 789-0335

73405

ER CHEMISTRY ANALYSIS:

.: Fees may apply to some types of samples.

All of the information below must be filled in or the analysis will not be performed.

State NV County MINERAL
Township 6 Range 31 Section 20
General Location WHISKEY FLATS
Source Address WELL #2

TYPE OF ANALYSIS:

☑ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debris as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by _____ Date 9/11/86
Owner HAWTHORNE UTILITIES Phone _____
Address PO BOX 1448
City HAWTHORNE State NV

REASON FOR ANALYSIS:

☐ Loan
☐ Personal health reasons
☐ Purchase of the property
☐ Rental or sale of property
☐ Subdivision approval
☑ Other PWS

USE OF WATER:

☑ Domestic drinking water
☐ Geothermal
☐ Industrial or mining
☐ Irrigation
☐ Other _____
Initials _____

REPORT TO:

Name BAY ABRAMS
Address PO BOX 1448
City HAWTHORNE
State NEVADA Zip 89415

SOURCE OF WATER:

Filter ☐ Yes ☑ No
Public ☑ Yes ☐ No
Spring _____
Well ✓ Depth _____ ft.
Hot _____ Cold ✓
IN USE ☑ Yes ☐ No

Type _____
Name HAWTHORNE UTIL
Surface _____
Casing diameter _____ in.
Casing depth _____ ft.

The results below are representative only of the sample submitted to this laboratory.

FOR LABORATORY USE ONLY

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.	PRINT OTHER DESIRED CONSTITUENTS BELOW Constituent	ppm
0445	218	0.61	10.0	4	-937	73406			
T.D.S. @ 103° C.	177	Chloride	14	Iron	0.05	Color	8	Be FURN	0.04
Hardness	90	Nitrate	5.0	Manganese	0.00	Turbidity	0.5	Cd	<0.001
Calcium	31	Alkalinity	88	Copper	0.00	pH	8.13	Cr	<0.005
Magnesium	3	Bicarbonate	107	Zinc	0.08	EC	292	Pb	<0.005
Sodium	22	Carbonate	0	Barium	0.02			Hg	<0.0005
Potassium	2	Fluoride	0.19	Boron	0.17			Se	<0.001
Sulfate	29	Arsenic	<0.003	Silica	21			Ag	<0.005
		MBAS	<0.1						

Fee _____
Collected by _____
PWS I.D. 073
WA—Pri. ✓ Sec. _____
2nd _____ 3rd _____
Date Rec'd 9.23 Init. MK

ppm = parts per million, milligrams per liter
S.U. = Standard Units

Remarks _____
9/25/86 YTL
Eng 10-6-86

RECEIVED
OCT 9 1986
CONSUMER HEALTH PROTECTION

Chemical quality meets the State of Nevada Drinking Water Standards.

Included December 2010

Appendix I

Final Package Section 4

From

Tetra Tech Document, 1996

4.0 BACKGROUND SAMPLING

The objective of background samples is to assess the natural or anthropogenic levels of metals and explosive compounds in the near-surface soils of the Hawthorne Valley at locations not likely to have been directly impacted by HWAD operations. The implication is that remedial attempts to reduce these metals and explosive compound levels at the SWMUs below the natural levels would not significantly decrease the threat to human health and the environment and, therefore, would have no cost benefit. The goal of the background sampling is to establish defensible background levels for these metals and explosive compounds to assist in establishing appropriate proposed closure goals (PCGs) that will be used to direct remedial actions at HWAD.

The Hawthorne and Mount Grant Mining Districts have been mined for a wide range of metal-bearing minerals, including economic deposits of aluminous minerals, iron, uranium and other radioactive minerals, gold and silver, and associated gangue minerals containing lead, antimony, arsenic, and zinc. Mercury has been produced in southern Mineral County in association with areas of faulting and has been used at mining sites to separate gold. It is likely that natural concentrations of these metals would be found in the near surface soils in the Hawthorne Valley. Explosive compounds would not naturally occur in the soils found in the Hawthorne Valley. However, explosive compounds might persist at anthropogenic levels, especially near the production facilities. These levels could be caused primarily by the distribution of wind blown particulates that contained these explosive compounds.

Previous background sampling was conducted by International Technology Corporation (IT) during the 1989 field investigations (IT, 1989). The SWMUs that were investigated during this investigation included I-02, A-05, and the Old Old Bomb area. Background samples were collected from within these specific SWMU boundaries and analyzed to investigate anthropogenic levels of various compounds. Only those background samples collected at SWMUs I-02 and the Old Old Bomb area were analyzed for metals; none of the background samples were analyzed for explosive compounds. The results of the metals analyses are included in this section.

In December 1994 Tt collected and analyzed 50 background soil samples. The following is a description of the sampling activities and the results and conclusions of the chemical analysis.

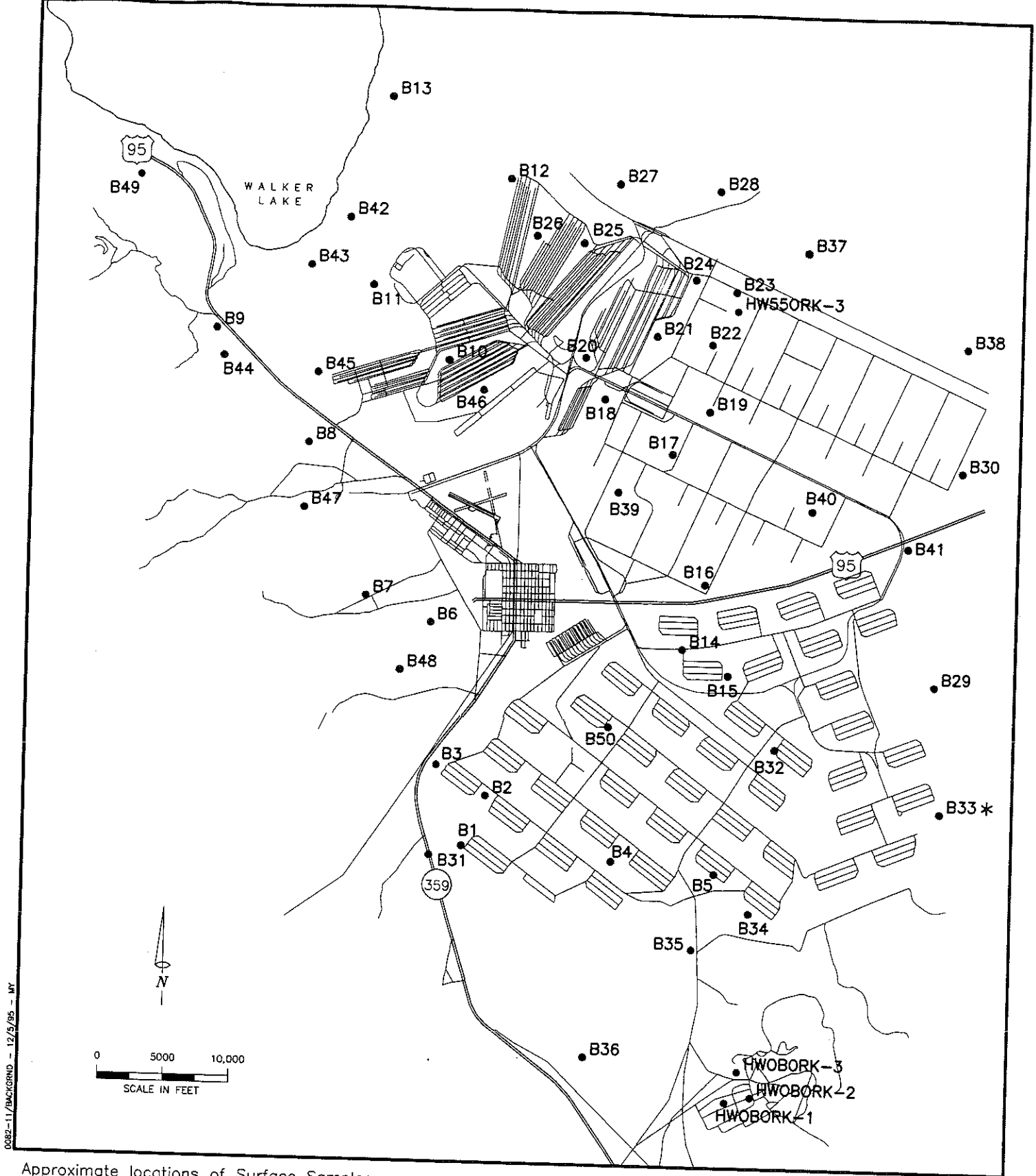
The scope of the background sampling activity for the base included:

- Collecting and analyzing composite near-surface soil samples for explosives and metals from 50 locations;
- Managing IDW from the sampling activity;
- Photo documentation of each sample location; and
- Identifying the natural background levels for metals and explosives within the Hawthorne Valley.

4.1. Sample Collection and Analyses

Locations of the 50 background composite samples were selected to represent the major indigenous soil types present within the project area as identified by the 1991 Hawthorne Army Ammunition Plant Soil Survey, and to represent areas not likely to have not been directly impacted by operations at HWAD. These locations, as approved by the USACE and NDEP, and the locations of the IT background samples are shown in Figure 4-1.

Composite soil samples from the 50 sample locations were collected in December 1994. A natural deposition area 2 feet by 2 feet wide was selected at each sample location. Five samples were collected within each area; one from each corner and one from the center to form the composite sample. Each of the five samples were collected from a depth of approximately 0.5 feet. This method of sampling allowed for representative sampling of the shallowest soils at each location to assess naturally occurring and recently deposited anthropogenic concentrations of metals and explosive compounds, respectively. Once the samples were collected, each sample was described according to Unified Soil Classification System (USCS) and recorded on the sample log-in form. The samples were analyzed by a fixed laboratory for the eight RCRA metals, aluminum, beryllium, and explosives compounds.



Approximate locations of Surface Samples collected for background chemical data.

LEGEND:

- ● B35/HWOBORK-3 Background Sample Number and Location
- * B33 Detection of Explosive Compounds

Source: Field mapping

TETRA TECH

Background Surface Sample Location Map

Hawthorne Army Depot
Hawthorne, Nevada

Figure 4-1

Field duplicate samples were also collected to ensure QA/QC. Duplicate soil samples were collected at 18 percent of the 50 sample locations and sent to the primary fixed laboratory for metals and explosive analysis. For laboratory QA/QC, Tt collected 10 percent split samples from the 50 sample locations for analysis of metals and explosives by the USACE Pacific Division Laboratory. The results of the 50 soil samples and the 18 percent field duplicate samples are presented in this section.

4.2. Investigation Derived Waste Management

Investigation derived waste (IDW) generated from this activity included decontamination water (i.e., deionized water, methanol, and alconox solutions). The decontamination water was disposed of at the HWAD wastewater treatment facility on the base.

4.3. Soil Types

Table 4-1 lists the Group A SWMUs and Table 4-2 lists the Group B SWMUs along with their appropriate soil series, USCS classifications, and associated background samples. Figure 4-2 shows the location of the background samples and soil types for the Hawthorne Valley according to USCS classification. Most of these soils are classified as a silty sand (SM), which indicates that the soils at HWAD and at most of the Group A and Group B SWMUs are sands (greater than 50 percent sand size material) with lesser fine grains (less than 50 percent and greater than or equal to 15 percent fine grain) such as silt and clay (USCS, 1986 p. 38, 45, 52). There are some soils on the outskirts of HWAD and near the Old Old Bomb area that are classified as silty gravels (GM) and have greater than 50 percent coarse grain and greater than or equal to 15 percent fine grain material. The Inmo-Orizaba, the only soil that has a high fine grain fraction greater than or equal to 50 percent fine grained material, is classified as a clay (CL) and a silt (ML). This soil series is a small area that lies to the south tip of Walker Lake and is not part of any Group A or Group B SWMUs.

Table 4-1

Group A SWMUs and their Associated Background Samples within their Soil Series

SWMU Number	SWMU Name	Associated Background Samples	USCS Symbols	Soil Series	Mappable Units
A-04	Babbitt Landfill	B3, B6, B7, B48	SM	Inmo	122
A-09a	Ammunition Can Piles	B46	SM/ML	Soda Lake-Cirac	510
A-09b	Battery Disposal Area	B3, B6, B7, B48	SM	Inmo	122
B-07	101-1 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-08	101-1 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-09	101-32 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-09n	101-52 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-09nw	101-54 Disposal Area	B17, B18, B19, B20, B39	SM	Patna	560
B-10	101-3 Catchment Pits	B17, B18, B19, B20, B39	SM	Patna	460
B-11a	101-31 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-11b	101-34 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-12	101-10 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-13	101-24/26 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-14	101-29/36 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-15	101-16 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-16	101-18 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-17a	101-20 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-17b	101-20 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-18	101-62 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-18s	101-68 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-19	101-11 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-20	101-41 Catchment Pits	B17, B18, B19, B20, B39	SM	Patna	460

Table 4-1

Group A SWMUs and their Associated Background Samples within their Soil Series

SWMU Number	SWMU Name	Associated Background Samples	USCS Symbols	Soil Series	Mappable Units
B-21	101-41/44 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-22a	101-44 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-22b	101-44 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-23	103-30 Production Area	B32	SM	Sodaspring	130
B-24	Acid Impoundment	B17, B18, B19, B20, B39	SM	Patna	460
B-26	POL Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-27a	103-16 Catchment Pits	B46/B17, B18, B19, B20, B39	SM/ML	Soda Lake-Cirac/ Patna	510/460
B-29	103-41 Unlined Ponds	B11, B12, B42	SM	Mazuma	570
B-30	101-16 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-31	101-65 Catchment Pit	B21, B22, B24	SM	Lakash-Dermill	470
B-32	101-41 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
B-33	102-51 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460
H-1	Fire Training Pit	B3, B6, B7, B48	SM	Inmo	122
H-3	R & G Waste OB Pit	B46	SM	Soda Lake-Cirac	510
H-4	Navy Side Landfill	B3, B6, B7, B48	SM	Inmo	122
H-5	Depot Laundry	B3, B6, B7, B48	SM	Inmo	122

Table 4-2

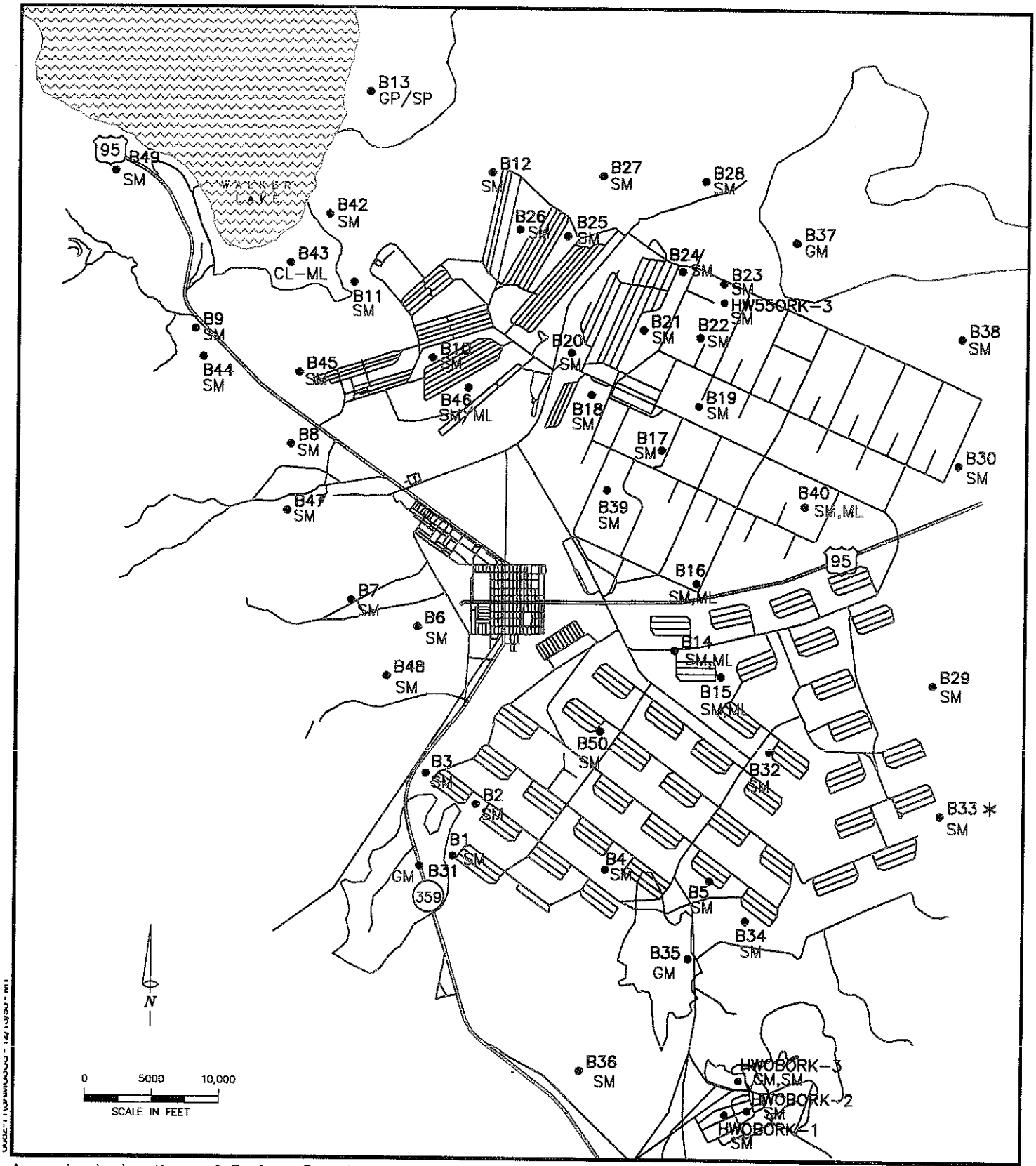
Group B SWMUs and their Associated Background Samples within their Soil Series

SWMU Numbers	SWMU Name	Associated Background Samples	USCS Symbols	Soil Series	Mappable Units
A-03	Coal Ash Landfill	B11, B12, B42	SM	Mazurna	570
A-05	Mustard Gas Disposal Area	B29	SM/GM, SM	Gynelle/ Wardenot	171/201
A-08	Construction Debris Landfill	B3, B6, B7, B48	SM	Inmo	122
A-11	Mag 18AT5 Disposal Pit	B29, B30	SM	Gynelle	171
B-04	101-44 Surface Impoundment	B17, B18, B19, B20, B39	SM	Patna	460
B-05	101-15 Surface Impoundment	B21, B22, B24	SM	Lakash-Demill	470
B-06	101-13 Surface Impoundment	B21, B22, B24	SM	Lakash-Demill	470
B-25	103-7 Inert Waste Impoundment	B17, B18, B19, B20, B39	SM	Patna	460
B-27b	103-8/10 Oxidation Ditch	B17, B18, B19, B20, B39	SM	Patna	460
B-27c	103-20 Surface Impoundment	B17, B18, B19, B20, B39	SM	Patna	460
B-28a	108-20 EO Spill Impoundment	B46	SM/ML	Soda Lake-Cirac	510
B-28b	108-20 EO Spill Impoundment	B46	SM/ML	Soda Lake-Cirac	510
B-28c	104-8 EO Spill Impoundment	B17, B18, B19, B20, B39	SM	Patna	460
B-28d	104-10 EO Spill Impoundment	B17, B18, B19, B20, B39	SM	Patna	460
C-01a/01b	102-31 Rotary Deact. Furnaces	B17, B18, B19, B20, B39	SM	Patna	460
I-02	110/51 Group OB Pits	B21, B22, B24, HW55ORK	SM	Lakash-Demill	470
I-03/04	NUWES 104-7 Pits	B16, B40	SM, ML	Papoose	502
I-05	33-16 Landfill	B4, B5, B34	SM	Inmo	120
I-06	Spill Site 30-5	B1, B2	SM	Inmo	121
I-07	101-44 Landfill	B17, B18, B19, B20, B39	SM	Patna	460
I-08	Building 70 Pit/Landfill	B17, B18, B19, B20, B39	SM	Patna	460
I-09/10	49-10 Pits	B16, B40	SM, ML	Papoose	502
I-11	49-9 Pit/Landfill	B16, B40	SM, ML	Papoose	502
I-13	Building 10 Discharge	B3, B6, B7, B48	SM	Inmo	122
I-14	Building 46 Spill Site	B3, B6, B7, B48	SM	Inmo	122
I-15	101-42 Catchment Pit	B17, B18, B19, B20, B39	SM	Patna	460

Table 4-2

Group B SWMUs and their Associated Background Samples within their Soil Series

SWMU Numbers	SWMU Name	Associated Background Samples	USCS Symbols	Soil Series	Mappable Units
I-17	101-10 Landfill	B17, B18, B19, B20, B39	SM	Patna	460
I-18	104-2 Hydrocarbon Spill	B17, B18, B19, B20, B39	SM	Patna	460
J-02	108 Burn Area/Landfill	B10, B25, B26	SM	Soda Lake	511
J-04	107 Drum Stroage	B10, B25, B26	SM	Soda Lake	511
J-05	Dock 1/Landfill	B17, B18, B19, B20, B39	SM	Patna	460
J-06	Dock 2/Landfill	B17, B18, B19, B20, B39	SM	Patna	460
J-07	Dock 3/Landfill	B14, B15	SM, ML	Papoose	501
J-08	Dock 4/Landfill	B14, B15	SM, ML	Papoose	501
J-09	Dock 5/Landfill	B41	SM/SP-SM	Gynelle	170
J-10	Dock 6/Landfill	B50	SM	Papoose	500
J-11/15	103-16 Landfill/Pile	B46	SM/ML	Soda Lake-Cirac	510
J-12	Landscape Landfill	B46	SM/ML	Soda Lake-Cirac	510
J-13	WADF South Dump	B11, B12, B42	SM	Mazuma	570
J-14	103-16 Trench	B46	SM/ML	Soda Lake-Cirac	510
J-16	111-113 Group Burn Area/Landfill	B10, B25, B26	SM	Soda Lake	511
J-17	Thorne Drums Area	B13	GP/SP	Torriorthents	390
J-21	Bldg 97 Old Dock Area	B1, B2	SM	Inmo	121
J-22	50 Group Pits	B1, B2	SM	Inmo	121
J-23	Trench Dusty Acres Area	B17, B18, B19, B20, B39	SM	Patna	460
J-24	50-60 Trench	B16, B40	SM, ML	Papoose	502
J-25	Thorne Area Landfill		GM	Oricto	160
J-28	108-3 Catchment Pits	B46	SM/ML	Soda Lake-Cirac	510
J-29	103-5 Landfill	B17, B18, B19, B20, B39	SM	Patna	460



Approximate locations of Surface Samples collected for background chemical data.

LEGEND:

• B35/HWOBORK-3	Background Sample Number and Location
*B33	Detection of Explosive Compound
SM	USCS Classification
———	Indicates Different Soil Boundary

TETRA TECH

Background Surface Samples and USCS Classification

Hawthorne Army Depot
Hawthorne, Nevada

Note: For USCS Classification See Appendix D.
Source: Field mapping/Hawthorne Army Ammunition Plant Soil Survey 1991

Figure 4-2

The Soil Survey for the Hawthorne Army Ammunition Plant, prepared by the United States Department of Agriculture (USDA), not only classifies the soils in the Hawthorne Valley according to the USCS classification, but also classifies these soils according to land usage to provide information that can be used in land-planning programs. It contains predictions of soil behavior for selected land uses and highlights limitations inherent to the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment. Even though the soil survey named different soil mappable units, which are based on depth, boundary, color, structure, and many other parameters, it also classified these different soil units as having the same USCS classification of SM (Soil Survey, 1991). Based on this USCS grain size classification, it appears that SM is the dominate soil type in the Hawthorne Valley (see Figure 4-2).

4.4. Analytical Results and Conclusions

The results of the explosive analyses for the 50 background samples reported only one soil sample (B33), collected in the south magazine area, with a detectable concentration of 2-Nitrotoluene at 0.03 mg/kg. Based on this detection, it appears that there may be a slight impact of explosive compounds in the south magazine area (see Figure 4-2 and Table 4-3). No other explosive compounds were detected in any of the other 49 composite soil samples. Therefore, Tt concludes that no anthropogenic background source of explosive compounds exist in the Hawthorne Valley.

The analytical results indicate that aluminum, barium, beryllium, and chromium are present in all 54 background samples (including IT sample results) and are indigenous to the Hawthorne Valley (Table 4-3). Beryllium analytical results range from 0.11 mg/kg to 0.81 mg/kg; aluminum ranges from 1,800 mg/kg to 18,000 mg/kg; barium ranges from 35 to 200 mg/kg; and chromium ranges from 1.2 to 17 mg/kg. Cadmium concentrations range from nondetect to 1.60 mg/kg in all of the 54 samples throughout the Hawthorne Valley. Lead had the highest concentration in the Soda Lake-Cirac soil series at 58 mg/kg and was nondetect in approximately half of the 54 samples analyzed. Arsenic was only detected in the Mazuma, Soda Lake, and

Table 4-3
Background Surface Soil Sample Results
Hawthorne Army Depot, Hawthorne, Nevada

Sample Number	USCS Symbols	Soil Series	Mappable Units	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	Hg mg/kg	Se mg/kg	Ag mg/kg
B1	SM	Inmo	121	8,000	<4	200	0.25	1.40	6.1	12.0	<0.04	<5	<0.9
Dup 300 (B1)	SM	Inmo	121	7,200	<4	150	0.24	1.00	5.4	9.5	<0.04	<5	<0.9
B2	SM	Inmo	121	6,300	<4	86	0.22	0.57	4.9	5.2	<0.04	<5	<0.9
B3	SM	Inmo	122	9,600	<4	80	0.36	0.38	3.3	7.9	<0.04	<5	<0.9
B4	SM	Inmo	120	5,300	<4	67	0.26	0.31	2.5	<5	<0.04	<5	<0.9
B5	SM	Inmo	120	7,900	<4	83	0.30	0.39	5.6	5.4	<0.04	<5	<0.9
Dup 292 (B5)	SM	Inmo	120	7,000	5	79	0.25	0.39	6.2	5.6	<0.04	<5	<0.9
B6	SM	Inmo	122	5,600	<4	51	0.20	<0.2	3.2	6.8	<0.04	<5	<0.9
B7	SM	Inmo	122	7,500	<4	60	0.25	<0.2	3.2	<5	<0.04	<5	<0.9
B8	SM	Itme	531	8,200	<4	74	0.28	0.28	5.2	5.0	<0.04	<5	<0.9
B9	SM	Itme	532	6,400	<4	59	0.27	0.51	4.8	6.5	<0.04	<5	<0.9
Dup 286 (B9)	SM	Itme	531	5,700	<4	59	0.26	0.75	4.9	6.7	<0.04	<5	<0.9
B10	SM	Soda Lake	511	2,100	20	69	0.15	<0.2	2.1	<5	<0.04	<5	<0.9
B11	SM	Mazuma	570	6,300	22	42	0.27	0.63	4.9	<5	<0.04	<5	<0.9
B12	SM	Mazuma	570	2,500	27	77	0.16	0.24	2.7	<5	0.054	<5	<0.9
B13	GP, SP	Torriorthents	390	5,600	4	76	0.23	0.25	4.7	<5	<0.04	<5	<0.9
B14	SM, ML	Papoose	501	8,700	<4	100	0.40	0.84	4.6	8.2	<0.04	<5	<0.9
B15	SM, ML	Papoose	501	7,200	<4	74	0.28	0.68	3.6	6.9	<0.04	<5	<0.9
Dup 294 (B15)	SM, ML	Papoose	501	7,400	<4	76	0.31	0.87	4.3	8.3	<0.04	<5	<0.9
B16	SM, ML	Papoose	502	4,500	<4	80	0.21	0.60	4.6	8.3	<0.04	<5	<0.9
B17	SM	Patna	460	9,200	<4	98	0.36	0.71	7.3	9.8	<0.04	<5	<0.9
B18	SM	Patna	460	5,100	<4	52	0.16	0.44	3.9	13.0	<0.04	<5	<0.9
B19	SM	Patna	460	5,100	<4	72	0.26	0.43	3.9	<5	<0.04	<5	<0.9

Table 4-3

Background Surface Soil Sample Results

Hawthorne Army Depot, Hawthorne, Nevada

Sample Number	USCS Symbols	Soil Series	Mappable Units	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	Hg mg/kg	Se mg/kg	Ag mg/kg
B20	SM	Patna	460	3,200	<4	36	0.11	0.22	2.9	7.0	<0.04	<5	<0.9
B21	SM	Lakash-Dermill	470	7,200	<4	130	0.33	0.80	6.0	5.9	<0.04	<5	<0.9
B22	SM	Lakash-Dermill	470	3,600	<4	60	0.14	0.44	4.7	5.3	<0.04	<5	<0.9
B23	SM	Luning	100	4,000	<4	58	0.14	0.58	4.5	<5	<0.04	<5	<0.9
B24	SM	Lakash-Dermill	470	4,300	<4	67	0.16	0.71	4.6	<5	<0.04	<5	<0.9
B25	SM	Soda Lake	511	2,200	13	72	0.14	<0.2	1.2	<5	<0.04	<5	<0.9
B26	SM	Soda Lake	511	1,900	15	63	0.12	<0.2	1.9	<5	<0.04	<5	<0.9
B27	SM	Nuahs	580	6,800	<4	100	0.28	0.48	5.6	<5	<0.04	<5	<0.9
B28	SM	Luning	100	8,900	<4	120	0.47	0.83	5.5	5.3	0.400	<5	<0.9
B29	SM	Gynelle	171	7,600	<4	87	0.29	0.78	8.4	6.9	<0.04	<5	<0.9
B30	SM	Gynelle	171	7,300	<4	91	0.29	0.59	8.5	<5	<0.04	<5	<0.9
B31	GM, SM	Terico-Annew	432	15,000	<4	110	0.57	0.78	17.0	14.0	<0.04	<5	<0.9
Dup 298 (B31)	GM, SM	Terico-Annew	432	14,000	<4	100	0.61	0.89	17.0	8.9	<0.04	<5	<0.9
B32	SM	Sodaspring	130	6,400	<4	64	0.25	0.76	3.9	5.9	<0.04	<5	<0.9
B33*	SM	Garhill	270	7,800	<4	73	0.29	0.62	6.2	5.8	<0.04	<5	<0.9
B34	SM	Inmo	120	11,000	<4	98	0.53	0.79	7.7	7.9	<0.04	<5	<0.9
B35	GM, SM	Terico-Annew	432	8,400	<4	100	0.43	0.62	6.2	7.6	<0.04	<5	<0.9
B36	SM	Wiskiflat	420	11,000	<4	78	0.35	0.30	2.8	<5	<0.04	<5	<0.9
Dup 302 (B36)	SM	Wiskiflat	420	6,600	<4	61	0.26	0.58	2.4	<5	<0.04	<5	<0.9
B37	GM	Pintwater	330	3,300	<4	44	0.14	0.55	3.7	<5	<0.04	<5	<0.9
Dup 290 (B37)	GM	Pintwater	330	4,000	<4	50	0.15	0.43	5.6	6.6	<0.04	<5	<0.9
B38	SM	Sundown	370	4,700	<4	57	0.19	0.53	4.6	<5	<0.04	<5	<0.9
B39	SM	Patna	460	5,700	<4	79	0.19	0.46	4.2	13.0	<0.04	<5	<0.9

Table 4-3

Background Surface Soil Sample Results

Hawthorne Army Depot, Hawthorne, Nevada

Sample Number	USCS Symbols	Soil Series	Mappable Units	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	Hg mg/kg	Se mg/kg	Ag mg/kg
B40	SM, ML	Papoose	502	4,800	<4	51	0.18	0.23	3.3	<5	<0.04	<5	<0.9
B41	SM	Gynelle	170	5,400	<4	71	0.25	1.20	7.9	6.9	<0.04	<5	<0.9
B42	SM	Mazuma	570	1,800	10	74	0.13	<0.2	1.7	<5	<0.04	<5	<0.9
B43	GM	Inmo-Orizaba	124	4,500	15	53	0.21	0.34	4.7	<6	0.140	<5	<0.9
B44	GM	Itme	532	7,800	<4	57	0.39	0.69	5.8	7.5	<0.04	<5	<0.9
B45	SP-SM, SM	Inmo	123	4,300	<4	35	0.13	0.25	1.9	<5	<0.04	<5	<0.9
Dup 288 (B45)	SP-SM, SM	Inmo	123	4,200	<4	34	0.12	<0.2	1.2	<5	<0.04	<5	<0.9
B46	SM	Soda Lake-Cirac	510	18,000	<4	160	0.81	0.94	8.5	58.0	0.049	<5	<0.9
B47	SM	Itme	530	8,600	<4	78	0.26	0.46	6.0	<6	<0.04	<5	<0.9
B48	SM	Inmo	122	7,700	<4	57	0.26	0.86	3.7	<5	<0.04	<5	<0.9
Dup 296 (B48)	SM	Inmo	122	6,500	<4	58	0.24	0.81	3.6	<5	<0.04	<5	<0.9
B49	SM	Itme	532	6,600	<4	46	0.18	0.62	4.4	6.1	<0.04	<5	<0.9
B50	SM, ML	Papoose	500	7,500	<4	150	0.30	1.60	6.1	10.0	<0.04	<5	<0.9
HW55ORK-3	SM	Lakash-Dermill	470	3,860	3	88	0.20	<0.5	3.0	4.0	0.090	<0.3	<0.5
HW55RPK-3 (Dup)	SM	Lakash-Dermill	470	2,860	7	60	0.20	<0.5	1.0	<3	0.14	<0.6	<0.5
HWOBORK-1	SM	Breko-Wiskiflat	180	5,670	13	85	0.50	<0.5	2.0	9.0	0.030	<2	<0.5
HWOBORK-2	SM	Breko-Wiskiflat	180	4,800	7	53	0.30	<0.5	1.0	5.0	<.02	<2	<0.5
HWOBRPK-2 (Dup)	SM	Breko-Wiskiflat	180	4,460	8	51	0.20	<0.5	<1.0	5.0	<.02	<2	<0.5
HWOBORK-3	GM, SM	Wardenot	201	3,710	4	67	0.40	<0.5	2.0	7.0	<0.02	<0.3	<0.5

*Analysis of this sample by EPA Method 8330 for explosives detected 0.03 mg/kg of 2-Nitrotoluene.

All other samples were non-detect for all analytes by this method.

Breko-Wiskiflat soil series, and mercury was detected at low concentrations in the Inmo-Orizaba, Soda Lake-Cirac, Lakash-Dermill, and Breko-Wiskiflat soil series (see Table 4-3). Selenium and silver were both nondetect in all 54 background samples in the Hawthorne Valley.

A statistical analysis and review was conducted for the 54 background samples to assess the validity of the background sampling analyses and to compare the background sample concentrations with the concentrations published in the USGS Professional Paper 1270 for the Western United States. This statistical analysis included calculating the mean, standard deviation, and a range of one standard deviation from the mean. In order to include the sample analyses that are nondetect in the statistical analyses, a value of one-half of the detect limit was assigned to those samples. The results of these statistics are shown in Table 4-4.

The mean values for aluminum, arsenic, barium, beryllium, chromium, lead, and mercury for the 54 background samples are below the mean values presented in the USGS Paper 1270. The ranges of one standard deviation from the mean in the background samples for these metals are also within the ranges that are presented in the USGS paper. Based on this comparison, it appears that the metal concentrations detected in the 54 background samples are consistent and slightly less than the representative background soil samples for the western United States.

Since metal concentrations for the Hawthorne Valley fall within the appropriate range presented by Paper 1270 for the Western United States, Tt concludes that all background sample concentrations appear to be indigenous to the Hawthorne Valley. The results from the metals analyses also confirm that the background soil sample metal concentrations are spread uniformly throughout the Hawthorne Valley. Finally, Tt can conclude that only one major soil type (SM) exists in the Hawthorne Valley, even though the Hawthorne Army Ammunition Plant Soil Survey acknowledges many different soil mappable units.

4.5. Proposed Subsurface Background Sampling

Based on the detection of moderate concentrations of beryllium and arsenic in subsurface samples collected at depths of up to 30 feet at several of the Group A SWMUs, the USACE, HWAD, and NDEP have proposed that additional background samples be collected at depth and

Table 4-4

Comparison of Metal Concentrations between the Hawthorne Valley Background Samples and the USGS Professional Paper 1270

Hawthorne Army Depot, Hawthorne, Nevada

	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	Hg mg/kg	Se mg/kg	Ag mg/kg
Max.	18,000	27	200	0.81	1.60	17.0	58.0	0.40	<5.0	<0.9
Min.	1,800	<4.0	35	0.11	<0.2	1.2	<5.0	<0.04	<5.0	<0.9
Mean	6,406	4.2	77	0.3	0.5	4.7	6.3	0.03	NA	NA
Stdev.	2,979	5.3	31	0.1	0.3	2.9	7.2	0.09	NA	NA
Range @ 1 Stdev.	3,427-9,385	0-9.5	46-108	0.2-0.4	0.2-0.8	1.6-7.6	0-13.5	0-0.12	NA	NA
Concentrations from USGS Professional Paper 1270 for the Western United States										
Mean	58,000	5.5	580	0.68	NA	41.0	17.0	0.046	0.23	NA
Stdev.	20,000	1.98	1.72	2.30	NA	2.19	1.80	2.33	2.43	NA
Range @ 1 Stdev.	38,000-78,000	3.52-7.48	578-581	0-2.98	NA	38.81-43.19	15.2-18.8	0-2.376	0-2.66	NA

Note: Mean values for HWAD concentrations were calculated by summing the total concentrations and dividing by the sample population. Nondetect values were included as half of the detect limit. No statistical evaluation was conducted if the total population was reported below the detection limit.

analyzed for metals. To facilitate this proposal, additional background samples will be incorporated into the basewide monitoring well installation procedure. The objective of the subsurface background sampling is to assess the levels of indigenous subsurface metal concentrations in the Hawthorne Valley. These subsurface background samples will be collected from 20 different pilot boring locations at approximate depths of 10, 20, and 30 feet during the monitoring well installation program. The samples will be collected from the vadose zone above the first encountered ground water. The depths may vary depending on the depth of the water table level in each boring. Three samples from each of the 20 pilot borings will be collected for a total of 60 samples. The samples will be analyzed for the eight RCRA metals, aluminum, and beryllium. A standard 10 percent duplicate samples will be collected and analyzed to ensure QA/QC. Decontamination procedures will follow in accordance to CDAP protocol. The base-wide monitoring well program will be conducted as described in the HWAD Group A SWMU RCRA Facility Investigation Final Work Plan (Tetra Tech 1996).

APPENDIX J

WEATHER/CLIMATE HISTORY

FOR

HAWTHORNE AND SOURROUNDING AREA

Hawthorne, NV Weather

(http://www.idcide.com/weather/nv/hawthorne.htm)

Hawthorne, NV climate is warm during summer when temperatures tend to be in the 70's and very cold during winter when temperatures tend to be in the 30's.

The warmest month of the year is July with an average maximum temperature of 95.30 degrees Fahrenheit, while the coldest month of the year is December with an average minimum temperature of 24.60 degrees Fahrenheit.

Temperature variations between night and day tend to be relatively big during summer with a difference that can reach 34 degrees Fahrenheit, and moderate during winter with an average difference of 24 degrees Fahrenheit.

The annual average precipitation at Hawthorne is 4.46 Inches. Rainfall in is fairly evenly distributed throughout the year. The wettest month of the year is April with an average rainfall of 0.54 Inches.

Normal Temperatures

(HAWTHORNE AP Weather station, 3.05 miles from Hawthorne)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max °F	47.9	54.9	61.4	68.9	77.8	87.5	95.3	92.7	84.3	71.2	57.5	48.3	70.6
Mean °F	36.4	42.2	47.8	54.1	62.2	70.9	78.2	75.9	67.7	56.1	44.7	36.5	56.1
Min °F	24.9	29.4	34.1	39.2	46.5	54.3	61.0	59.0	51.0	41.0	31.8	24.6	41.4

Normal Precipitation

(HAWTHORNE AP Weather station, 3.05 miles from Hawthorne)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Inch	0.42	0.40	0.37	0.54	0.47	0.44	0.26	0.26	0.29	0.40	0.35	0.26	4.46

HAWTHORNE, NEVADA (263512)

Period of Record Monthly Climate Summary

Period of Record: 8/19/1954 to 12/31/2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	47.9	53.4	62.3	67.9	76.4	85.7	96.1	94.0	85.1	73.1	57.1	49.7	70.7
Average Min. Temperature (F)	24.3	27.8	33.4	37.4	46.1	53.4	61.4	59.8	51.3	41.7	30.5	25.7	41.1
Average Total Precipitation (in.)	0.40	0.51	0.42	0.38	0.78	0.47	0.33	0.18	0.27	0.17	0.39	0.25	4.54
Average Total Snow Fall (in.)	0.7	0.4	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	1.0	0.1	2.8
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 26.3% Min. Temp.: 26.2% Precipitation: 28.1% Snowfall: 28.2% Snow Depth: 28%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

HAWTHORNE, NEVADA

Period of Record General Climate Summary - Precipitation

Station:(263512) HAWTHORNE														
From Year=1954 To Year=2006														
	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.		>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	dd/yyyy or yyyymmdd	# Days	# Days	# Days	# Days	in.	in.	-
January	0.40	1.29	1997	0.00	1999	0.49	03/2006	3	2	0	0	0.7	7.8	1962
February	0.51	2.26	1962	0.00	1999	1.08	11/1962	3	2	0	0	0.4	5.4	1962
March	0.42	1.96	1993	0.00	1997	1.10	13/1996	3	1	0	0	0.2	1.8	1964
April	0.38	0.98	1965	0.00	1962	0.75	01/1998	3	1	0	0	0.1	2.5	1963
May	0.78	3.14	1995	0.00	1993	1.15	05/1995	4	2	0	0	0.2	4.2	1964
June	0.47	1.68	1963	0.00	1994	1.15	03/1998	3	1	0	0	0.0	0.0	1955
July	0.33	1.06	1997	0.00	1963	0.67	29/1997	2	1	0	0	0.0	0.0	1955
August	0.18	1.18	1961	0.00	1955	0.53	05/1961	2	0	0	0	0.0	0.0	1955
September	0.27	1.40	1961	0.00	1954	1.14	09/1961	2	1	0	0	0.0	0.0	1954
October	0.17	0.55	2004	0.00	1995	0.30	31/1996	1	1	0	0	0.0	0.0	1954

November	0.39	1.51	2004	0.00	1954	0.55	12/1993	3	1	0	0	1.0	6.0	1993
December	0.25	0.86	1995	0.00	1962	0.42	12/1995	2	1	0	0	0.1	2.5	1961
Annual	4.54	8.76	1962	1.31	1999	1.15	19950505	29	14	2	0	2.8	15.6	1964
Winter	1.16	3.54	1962	0.01	1999	1.08	19620211	9	5	0	0	1.2	15.7	1962
Spring	1.57	3.89	1995	0.12	1997	1.15	19950505	9	5	1	0	0.6	6.1	1964
Summer	0.98	2.41	1997	0.08	1955	1.15	19980603	6	3	0	0	0.0	0.0	1955
Fall	0.82	2.11	1961	0.00	2005	1.14	19610909	6	2	0	0	1.0	6.0	1993

Table updated on Jul 28, 2006

For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons

Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May

Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

Western Regional Climate Center, wrcc@dri.edu

MINA, NEVADA (265168)

Period of Record Monthly Climate Summary

Period of Record : 3/ 1/1896 to 7/31/2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	46.2	52.2	59.3	66.8	76.2	86.8	95.6	93.4	84.7	71.8	57.1	47.4	69.8
Average Min. Temperature (F)	20.6	25.1	29.7	36.0	44.6	53.6	61.1	58.3	48.5	37.6	28.1	21.2	38.7
Average Total Precipitation (in.)	0.42	0.38	0.38	0.48	0.60	0.35	0.34	0.35	0.27	0.33	0.28	0.32	4.50
Average Total Snow Fall (in.)	1.9	1.3	1.1	0.7	0.2	0.0	0.0	0.0	0.0	0.2	0.6	1.3	7.3
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.

Max. Temp.: 92.6% Min. Temp.: 93% Precipitation: 95.8% Snowfall: 98.5% Snow Depth: 94.3%

Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

SCHURZ, NEVADA (267358)

Period of Record Monthly Climate Summary

Period of Record: 1/ 1/1920 to 4/30/1957

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	46.5	53.4	60.9	68.5	76.4	84.5	93.4	91.7	84.5	72.5	59.3	49.3	70.1
Average Min. Temperature (F)	17.4	22.1	26.8	33.1	41.2	46.8	53.0	50.5	41.4	32.1	23.7	18.8	33.9
Average Total Precipitation (in.)	0.50	0.52	0.45	0.52	0.60	0.40	0.34	0.31	0.32	0.43	0.40	0.60	5.40
Average Total Snow Fall (in.)	3.4	1.4	0.9	0.5	0.2	0.0	0.0	0.0	0.0	0.0	1.6	2.1	10.1
Average Snow Depth (in.)	1	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.

Max. Temp.: 93.1% Min. Temp.: 92.4% Precipitation: 96.2% Snowfall: 96.1% Snow Depth: 92.7%

Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

APPENDIX K
Waste Minimization Plan

WASTE MINIMIZATION PLAN

FOR

Hawthorne Army Depot (HWAD)

SOC Environmental Services
March 2012

INTRODUCTION

Hawthorne Army Depot (HWAD) Main Base is classified as a "large quantity generator" of hazardous waste by the Nevada Department of Environmental Protection and the U.S. Environmental Protection Agency. These agencies enforce the Resource Conservation and Recovery Act (RCRA) of 1984, which requires a "large quantity generator" to certify that it has a program in place to reduce the volume and toxicity of waste generated to the degree it has determined to be economically practicable. Waste Minimization is necessary in order to minimize present and future threats to human health and the environment. HWAD has an Environmental Policy statement in place to help achieve our goal in reducing waste.

While the Waste Minimization is written to meet the RCRA regulatory requirements, the Pollution Prevention (P2) is written to meet the requirements of AR 200-1. These two plans are very similar but very different; therefore the P2 requirements are listed in a separate document.

P2 is implemented at the HWAD, when technically feasible and cost effective, to achieve and maintain compliance with environmental laws and regulations. This includes reducing pollutants at the source; modifying manufacturing, packaging & shipping processes, maintenance or other industrial practices; modifying product designs; developing and modifying acquisition systems; recycling/reuse (to include implementing water and energy conservation measures), especially in closed loop processes; preventing disposal & transfer of pollution between media; meeting affirmative procurement requirements & promoting the acquisition & use of environmental preferable products & services; and promoting use of nontoxic substances. HWAD uses P2 to complement, and where practicable, replace traditional pollution control approaches as well as incorporates P2 planning throughout the mission, operations or product life cycle at the HWAD.

WHAT IS WASTE MINIMIZATION?

Waste minimization is a waste management approach that focuses on reducing the amount and toxicity of hazardous waste that is generated. In addition to hazardous waste regulated under RCRA, the EPA encourages waste minimization techniques that focus on preventing waste from ever being created, (source reduction) and recycling. Waste minimization does not include waste treatment, that is, any process designed to change the physical, chemical, or biological composition of waste streams. It is important that every employee of HWAD be aware of the environmental and financial impacts related to the disposal of hazardous wastes and material and to help minimize the volumes that are generated. Areas on the Depot that generate hazardous waste and materials include chemical laboratory, maintenance/garage shops, production jobs, machine shops, subcontractors, and tenants. There are three general methods of waste minimization: **source reduction**, **recycling**, and **treatment**.

SOURCE REDUCTION

Source reduction reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. Source reduction includes equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

Here are some examples of HWAD efforts and ideas to help control waste generation at the source.

- Improve housekeeping and awareness by personnel regarding the proper management and use of toxic and hazardous materials. This can greatly reduce the amount of accidental spills, releases and waste generation.
- Redesign and modify production processes to possibly limit or prevent pollution or waste generation from occurring.
- Date all chemical containers when received so that the older chemicals will be used first, and most importantly label product containers to prevent accumulation of unknown products.
- When feasible, substitute non-hazardous or less hazardous materials to reduce the toxicity of the resulting waste stream. Generally, the lower degree of hazard requires lower level of control and may result in less stringent regulation.
- Purchase only what is needed, in the smallest quantities needed. Maintain inventories at a minimum, and redistribute any excess products to other divisions who may utilize to help to reduce, avoid or eliminate the generation of hazardous waste.

RECYCLING

Another method of waste minimization is recycling. Recycling is when a waste material is used for another purpose, treated and reused in the same process or reclaimed for another process. Recycling is such a broad term that encompasses the reuse of materials in original or changed forms rather that discarding them as wastes. HWAD has common examples of recycling include:

- Some materials are commercially recycled by off-site industrial contractors including: used oil, batteries, and solvents.
- Derived dunnage from off loading commercial conveyances is sent to Property Reutilization Office (PRO) for resale.
- Metal Casing and other inert components may be separated from the energetic production job and sent to PRO.
- HWAD conducts routine open detonation shrapnel collection operations as a recycling measure which is also sent to PRO.

TREATMENT

The last technique for waste minimization is treatment of waste. Treatment should be investigated for any waste that is unavoidably generated and that cannot be recycled in its current form. Treatment is any method, technique, or process that changes the physical, chemical, or biological character of a waste. Treatment renders the waste less hazardous and, therefore, recyclable or safer to transport, store, and dispose. Note that treatment does not prevent the creation of pollutants. Treatment involves changing the nature of the waste or reducing or eliminating the pollutants in a waste. Example of treatment:

- Rotary Furnace – 9 is used for the treatment of waste small arms ammunition (up to and including 20MM) as well as other small items such as fuses and primers. Use of the furnace is limited by its treatment capability and treatment limits imposed by the RCRA permit.
- Open burn pans are used to dispose of propellants and explosives that are no longer safe to store due to instability. Use of the burn pans are limited by the treatment limits imposed by the RCRA permit.
- Open detonation is used to dispose of munitions that cannot safely be processed in any other process at HWAD. Open detonation is limited by the treatment limits imposed by the RCRA permit.

At HWAD, treatment is used only for those items that cannot be safely recycled, using the least polluting method allowed under the limitations of the RCRA Permit and the treatment capability of the existing processes.

WASTE MINIMIZATION CONCLUSION

Waste prevention and minimization has positive environmental, human health and safety, and economic impacts. Waste minimization is important because it helps to protect the environment and its makes good business sense. Waste minimization saves money through avoided disposal costs, creates safer working conditions for employees, and the bottom line: protects human health and the environment. For waste minimization to be effective, all generators of hazardous waste need to have an active role. Waste minimization is a feasible and obtainable goal if carefully planned and implemented.

Therefore, waste minimization is an important goal at Hawthorne Army Depot. Implementing a "less is better" concept provides better protection of human health and safety by reducing exposures, generating less demand for disposal on the environment. Less waste also lowers disposal cost. It is our mission to eliminate waste generation at the source wherever possible without compromising product quality. The bottom line: HWAD will utilize ISO14001:2004 to help minimize and reduce waste. Senior management support is critical for the Plan's success at HWAD.

WASTE MINIMIZATION CERTIFICATION

March 2012

This Hawthorne Army Depot Facility has in-place a program to reduce the volume and toxicity of all hazardous wastes which are generated by the facility operations to the degree, determined by the Permittee, to be economically practicable; and that the method of treatment, storage, or disposal is the only practicable method or combination of methods currently available to the facility that minimizes the present and future threat to human health and the environment.

Clifford Cichowlaz,
General Manager, SOC Nevada, LLC

APPENDIX L
Human Health and Ecological Risk Assessment (HHERA)