PERMIT APPENDICES

APPENDIX 1
GENERAL FACILITY DESCRIPTION

1.1 WHITE SANDS MISSILE RANGE

1.1.1 Site Location

White Sands is a U.S. Army Development Test Command (DTC) installation. Most of the installation is situated within the Tularosa Basin; with areas along the western and northwestern boundary extending into the Jornada del Muerto Basin. White Sands is located in Doña Ana, Socorro, Lincoln, Otero, and Sierra Counties, New Mexico. The headquarters (Main Post) area of White Sands is located at the southwestern corner of the installation, approximately 27 miles (mi) (43.4 kilometers (km)) east-northeast of Las Cruces, New Mexico and 45 mi (72.4 km) north of El Paso, Texas. White Sands' headquarters and most installation support activities are located at the Main Post area. White Sands is the largest land-area military installation in the United States, comprised of nearly 3,200 square (sq.) mi (5,631 sq. km) of land. The installation is approximately 99 mi (159 km) long and 25 to 40 mi (40 to 64 km) wide.

1.1.2 Site Background

White Sands was established July 9, 1945 as White Sands Proving Ground (the name was changed in 1958) to be America's testing range for the new concept of missile weapons. The New Mexico desert was selected to be the nation's testing range for several reasons: the desert is sparsely populated, has almost year-round clear weather and unlimited visibility, and as such, affords relatively easy recovery of spent missiles.

White Sands now functions as a large complex of test ranges, launch sites, impact areas, and instrumentation sites required to develop and test tactical and strategic weapons and weapons systems. White Sands is designated as a National Range (NR) whose mission is the support of missile development and test programs for the Army, Navy, Air Force, National Aeronautics and Space Administration (NASA), other government agencies, and foreign allies.

1.1.3 Road Systems

The traffic system serving White Sands consists of approximately 776 mi (1,249 km) of motor vehicle roads. Of this, approximately 349 mi (562 km) are bituminous surface roads, 68 mi (109 km) are single seated surface roads, and 359 mi (578 km) are graded and graveled roads.

There is no railroad system within White Sands boundaries. The White Sands facility has access to the Southern Pacific Railroad System at Orogrande Range Center located at the extreme southeast corner of White Sands. Hazardous wastes are not transported by railroad.

Primary access to the Main Post area and various facilities in the south area of White Sands is from U.S. Highway 70 (Appendix 2). The main entrance gate to White Sands on Range Road 1 is located approximately 3.5 mi (5.6 km) south of the intersection with U.S. Highway 70. White Sands Range Road 1 is the main military highway that extends north from the southern Range boundary, through the Main Post area, to U.S. Highway 70. It is a divided four-lane, two-way all

weather paved road through the Main Post area that transitions to a two-lane, two-way traffic road past the Main Post area.

1.1.4 Geology

WSMR lies within the Mexican Highland Section of the Basin and Range Province. The geology of WSMR consists predominantly of the Tularosa Basin and the surrounding mountain ranges. The San Andres, San Augustin, and the Oscura Mountains border the Tularosa Basin on the west while the Sacramento Mountains form the eastern border. The average elevation of the Tularosa Basin is 4,000 feet above mean sea level. The majority of WSMR property, including most of the test facilities, is located within the Tularosa Basin. The Tularosa Basin contains thick sequences of Tertiary and Quaternary age alluvial and bolson fill deposits. These sediments, more than 5,000 feet thick in some areas, consist mainly of silt, sand, gypsum, and clay weathered from the surrounding mountains. Surface features consist of flat sandy areas, sand dunes, basalt flows, and playas.

1.1.5 Geohydrology

The WSMR Main Post obtains its potable water supply from an aquifer located in the upper bolson deposits. The majority of ground water recharge to this aquifer occurs through the coarse, unconsolidated Tertiary/Quaternary alluvial fan deposits and arroyos along the eastern flank of the Organ, San Augustin, and San Andres Mountains. To the east ground water becomes more mineralized, primarily with sulfate and chloride. Ground water flow direction is generally toward the center of the Tularosa Basin.

1.2 RCRA PERMITED AND REGULATED UNITS

1.2.1 Hazardous Waste Storage Facility

The HWSF is located within the boundaries of White Sands. It consists of five metal structures located within a fenced area and is located approximately 8 miles (12.9 km) east of the Main Post (Attachment 2). The Universal Transverse Mercator location for the HWSF is 3585108.2 north and 374777.8 east.

The HWSF it is serviced by electric, telephone, and water utilities. A diagram of the HWSF is provided in Appendix 2, Figure 2.

1.2.1.a Building Descriptions

The HWSF consists of four small, portable pre-fabricated buildings and one large permanent building.

- Overflow Storage and Processing Area, Building S22895
- Ignitable Storage, Building S22895 A
- Corrosives, Building S22895 B
- Additional Segregated Wastes, Building S22895 C
- Additional Storage, Building S22895 D

Building S22895 provides 1,760 sq ft (163.5 sq m) of enclosed floor space and is equipped with telephone, grounding, portable fire extinguishers, emergency shower and eyewash, first aid

station, and explosion proof lighting. It is equipped with two ramped entries with roll-up doors and one personnel door. A ramped loading dock is also located on the north side of the building. Terrain surrounding the building is graded to prevent stormwater run-on and promote surface drainage away from the building. The ground surface in the area is in good condition and suitable for safe vehicular movement. If the ground condition deteriorates and becomes unsuitable for vehicular movement, it is re-graded and repaired.

Buildings S22895 A, B, and C, are prefabricated metal, 15 ft by 8 ft (5 m by 2.4 m), providing approximately 120 sq ft (11.1 sq m) of enclosed floor space. Each building is mounted on a concrete slab. All three buildings are grounded, equipped with thermostatic ventilation exhaust systems, explosion proof lighting, dry chemical fire extinguishing systems and fire alarms.

Building S22895 A is additionally equipped with an explosion proof, window-type air conditioner. This air conditioner is modified to meet National Fire Protection Association (NFPA) Class 1, Division 2, Group D specifications. The motor and compressor are enclosed in National Electrical Manufacturers Association (NEMA) 7 enclosures. The thermostat is not adjustable from the outside and all wiring is enclosed in an arc-resisting conduit. The cooling capacity is 12,000 British Thermal Units per hour (BTU/hr) and is designed to maintain Building S22895 A's internal temperature at 78 degrees Fahrenheit (25.6 degrees Celsius) or less.

Building S22895 D is a 7 ft by 8 ft (2.1 m by 2.4 m) prefabricated metal building, providing 56 sq ft (5.2 sq m) of enclosed floor space. This building is mounted along with Buildings A through C on the concrete slab. Building S22895 D is equipped with the same safety features as Buildings S22895 B and C, and is currently used for storage of temporary inventory overflow.

The four portable storage buildings rest on structural channels, separating them from the concrete slab. Terrain surrounding the slab is graded to prevent stormwater run-on and promote surface drainage away from the slab.

The four portable storage buildings are equipped with an ANSUL-SPA-50, Pre-Engineered Dry Chemical Fire Suppression System. The ventilation systems are designed for safe use in atmospheres containing flammable vapor, providing approximately one complete air change per minute, and are Underwriters Laboratories (UL)-listed Class 1, Division 1, totally enclosed, with an explosion-proof motor, a non-static fan, and associated ductwork. The electrical systems include exterior power service panels, relay boxes, explosion-proof junction boxes, conduits, and heat sensors for the ventilation systems. Exterior static grounding connections and two interior grounding/bonding lugs per building are provided. A copper grounding rod is provided with each building. The doors are provided with security locks and inside panic releases. The units are Factory Mutual (FM) System approved and designed for Zone 4 seismic loading. Hold-down brackets for seismic and wind bracing are provided.

1.2.1.b Container Storage

Building S22895 is a permanent structure that is used for waste shipping and receiving and for storage of non-RCRA and overflow RCRA regulated waste. These wastes are stored and managed in containers that comply with requirements of the U.S. Department of Transportation (DOT) container shipping regulations (49 CFR §173 and §178).

Waste is received in Building S22895, inspected and weighed, then transferred by fork lift across the concrete pad to one of the pre-fabricated portable storage buildings. When inventory exceeds the capacity of these portable storage buildings, the excess inventory is stored in Building S22895.

All containers in Building S22895 are stored on standard metal pallets. The unloading of hazardous waste containers is performed by forklift which minimizes human contact with the containers. The two metal roll-up doors are wide and high enough to accommodate small vehicle entry into the building, if needed. There is sufficient area around the concrete dock and building for safe movement of vehicles.

The maximum floor loading in all portable buildings is 250 lb per sq ft (psf) (372,000 kilograms per meter (kg/m)). The maximum design specification for roof snow loading is 40 psf (59,520 kg/m), for wind loading 30 psf (44,640 kg/m) or 110 mi per hour (mph) (177 kilometers per hour (km/h)). All interior surfaces are covered with chemical-resistant coating and the floor is constructed of a corrosion- resistant non-slip design.

Building S22895 is used for waste shipping and receiving and for storage of non-RCRA waste in accordance with (IAW) 49 Code of Federal Regulations (CFR) Part 174.81. Waste is received in Building S22895, inspected and weighed, then transferred by forklift across the concrete pad to one of the four designated storage buildings. When inventory exceeds the capacity of the four nearby portable storage buildings, the excess inventory is stored in Building S22895. All containers in Building S22895 are stored on standard metal pallets. Maximum waste storage capacity is 192 55 gallon (gal) (0.209 cubic meter (cu m)) drums. The unloading of hazardous waste containers is performed by forklift which minimizes human contact with the containers. The two metal roll-up doors are wide and high enough to accommodate small vehicle entry into the building if needed. There is sufficient area around the concrete dock and building for safe movement of vehicles.

Buildings S22895 A through C are designed by the manufacturer for a maximum of fourteen 55-gal (0.209 cu m) drums, or approximately 115 sq ft (10.7 sq m) of interior storage space. Thirty-two ft (9.7 m) of movable corrosion-resistant shelving per building is provided for the storage of smaller containers. Mounting brackets are at sufficient height to permit the placement of 55-gal (0.209 cu m) drums beneath the lower shelf. The smaller building, S22895 D, has a maximum capacity of six 55-gal (0.209 cu m) drums (Attachment 2). The maximum floor loading in all four buildings is 250 lb per sq ft (psf) (372,000 kilograms per meter (kg/m)). The maximum design specification for roof snow loading is 40 psf (59,520 kg/m), for wind loading 30 psf (44,640 kg/m) or 110 miles per hour (mph) (177 kilometers per hour (km/h)). All interior surfaces are covered with chemical-resistant coating and the floor is constructed of a corrosion resistant non-slip design.

Containers to be used in the four storage buildings range in size from 85-gal (0.323 cu m) metal, overpack type drums to 5 (.019 cu m), 10 (.038 cu m), 15 (.057 cu m), 20 (.076 cu m), 30 (.11 cu m), 40 (.15 cu m), and 55-gal (.21 cu m) metal, open and closed-head drums. Additionally, 5-gal (.019 cu m) open and closed top fiber drums along with 10, 15, 20, 30, 40 and 55-gal closed-head fiber drums are utilized. For containment of solids, Tri-Wall fiberboard containers are utilized in accordance with 49 CFR 173. All fiberboard containers must meet

Department of Transportation (DOT) and Performance Oriented Packaging (POP) standards. Larger containers anticipated to be used at the HWSF are 14 and 16 cubic yard (cy) (10.7 and 12.2 cu m) roll-off boxes. Empty drums and drums of sorbent material used for normal operations and emergency cleanup are stored within the buildings and additional absorbent drums are strategically located on the concrete pad.

1.2.1.c Spill Containment

Building S22895 is constructed on a curbed concrete slab. Drums of hazardous waste are stored in a curbed concrete pit that occupies approximately one-half of the building. The containment area within the building is a reinforced concrete pit measuring 47 ft (14 m) by 11 ft (3 m) by 15 in (38.1 cm). The pit has no construction joints and is sealed with a black epoxy polyamide coating to contain spills or leaks. The base of the pit is not sloped and contains no drains.

The internal spill containment systems within the four portable buildings are corrosion-resistant with a capacity exceeding 25 percent of the total storage capacity of the building. The containment reservoir has a polypropylene liner serving as secondary containment. Buildings S22895 A through C provides 500 gal (1.9 cu m) containment capacity each, and Building S22895 D provides 250 gal (0.95 cu m).

Floors in the portable storage buildings are constructed of 10-gauge, American Society of Testing Materials (ASTM)-A36 steel, continuously welded at all seams and coated with chemical resistant epoxy. It serves as the base for the spill containment reservoir and prevents the release of hazardous liquids and solids from the storage facility if they are discharged from a primary container. The floor is supported above the ground by structural channels that permit the exterior inspection of the bottom of the spill containment reservoir.

1.2.1.d Security and Placarding

The HWSF is enclosed with a man-proof type fence (chain-link fence with barbed wire on top) and may be entered only through two gates. The gates are always locked and keys to access the facility are controlled by the accumulation point manager of the HWSF. All of the buildings within the fenced compound are similarly locked. Buildings are placarded to identify hazards associated with each building. The labels are reflective and large enough to be visible from the fence line.

Signs on the entrance gates to the HWSF read as follows in both English and in Spanish: "DANGER, UNAUTHORIZED PERSONNEL KEEP OUT'; and, in English only, "POLYCHLORINATED BIPHENYLS (PCB'S), DANGER!, CANCER SUSPECT AGENT, AUTHORIZED PERSONNEL ONLY". In addition, warning signs spaced approximately 150 ft (46 m) apart are posted on the perimeter fence of the HWSF. The signs, written in both English and Spanish, read as follows: "DANGER, UNAUTHORIZED PERSONNEL KEEP OUT". These signs are visible from all angles of approach. All warning signs at the HWSF are legible from a distance of at least 25 ft (8 m). "No Smoking" signs are posted on three outside walls of Building S22895. The signs read as follows: "NO SMOKING WITHIN 100 FEET OF BUILDING".

1.2.1.e Traffic Patterns

The most significant contributors of waste to the HWSF are Main Post and the High Energy Laser Systems Test Facility (HELSTF). Hazardous waste is transported from Main Post and the HELSTF cleaning facility to the HWSF along Range Road 2. The HWSF is located off a paved road approximately 1,500 ft (457 m) south of the intersection with Range Road 2 (Attachment 2). The road leading to the storage facility is 20 ft (6 m) wide with a 2 ft (0.6m) wide gravel shoulder. White Sands Range Road 2 is the main east-west military route in the south Range area. It extends from Range Road 1 in the Main Post area to the east range boundary for a distance of approximately 24 mi (38.6 km). Range Road 2 is a 22 ft (7 m) wide two-lane, two-way all weather paved road with 6 ft (1.8 m) shoulders. Traffic density on Range Road 2 ranges from 200 to 1,000 motor vehicles per day. About 95 percent of this traffic consists of cars and pickups. The rest of the time, traffic along Range Road 2 is light. There is no traffic within the HWSF area other than the occasional motor vehicle transporting hazardous waste materials to the gate.

Access to HELSTF is from U.S. Highway 70 northwest on White Sands Range Road 264, a two-lane, two-way, all weather-paved road. Motor vehicle transport of hazardous waste material from HELSTF is very infrequent. These materials travel south on Range Road 264 through the intersection with U.S. Highway 70, where Range Road 264 transitions into Range Road 15. The total distance of travel is approximately 25 to 30 mi (40.2 to 48.3 km). Traffic along Range Road 15 is light. Hazardous waste transport is made during low traffic periods. Since only one or two 55-gal (0.209 cu m) drums of waste are transported at one time, a 2-1/2 ton truck can carry the load and does not disrupt normal traffic. Range Road 15 intersects with Range Road 2, where transport vehicles proceed west to the entrance of the HWSF.

1.2.2 Hazardous Test Area - Open Burning/Open Detonation

The Open Burning/Open Detonation (OB/OD) is situated on the westernmost edge of the Hazardous Test Area (HTA), located 10 miles north of the Main Post on the eastern slopes of the San Andres Mountains. The OB/OD consisted of two open detonation pits and an open burn pan. Since 1972, the OB/OD was used for demolition of primary explosives, secondary explosives, propellants, explosives ingredients in propellants, propellant compositions, powders, and smokes. The detonation pits and the burn pan were certified closed in 2003.

1.2.3 Tula Peak Munitions Burial Site and Incinerator

The Tula Peak burial sites are located near the eastern boundary of WSMR, approximately one-quarter mile east of Holloman Air Force Base Road 9. There are four burial pits within 75 feet of each other. Cluster bomb units (CBUs) and other small ordnance were placed in the incinerator and then the debris was buried as part of the ordnance disposal procedure.

1.2.4 Red Rio Bombing Range Landfills

The Red Rio Bombing Range encompasses 29,500 acres near the northeast boundary of WSMR. Two areas were reportedly used for munitions burial from 1963 to 1987. The northern munitions burial site is 0.75 miles south of the gate along an unimproved access road and the southern munitions burial site is on the west side of the Red Rio Mock Runway, approximately 2.25 miles

south of the northern burial site. The units reportedly received dummy projectiles dropped during practice at the Red Rio Range. The projectiles were placed in an open pit, detonated and burned. The residue was buried with fill and a new pit was excavated. At least five pits were created and filled.

1.2.5 Oscura Bombing Range Disposal Pits

The Oscura Bombing Range encompasses approximately 26,400 acres. The munitions burial pits are located four miles west of Range Road 9 and four miles north of Range Road 12 and are accessed via an unimproved road. The pits are trench-like with approximate dimensions of 50 feet by 15 feet and approximately 12 feet deep; however, the pits vary in size. Explosives were placed in the pits, where they were detonated and burned. After burning, the debris was covered with fill. The disposal operation was conducted shifts until the pit was filled. At least five pits were utilized for burial.

1.2.6 Rhodes Canyon Landfill

Rhodes Canyon Landfill is located at the intersection of Range Road 6 and Range Road 7 in Otero County. Closure activities are complete. Post closure activities are being conducted under an approved Corrective Measures Implementation (CMI) Workplan.

1.2.7 HELSTF Landfills (SWMUs 38 and 39)

These landfills are located east of the HELSTF-Laser System Test Center in the southern section of WSMR. Both Landfills were in operation from the early 1960's to 1989. The landfills are two unlined trenches that reportedly received non-hazardous construction wastes.

1.2.8 Former Main Post Landfill #3 at Scrap Yard

Former Main Post Landfill #3 at Scrap Yard is located in the southern portion of the Main Post. The site reportedly operated from 1965 to 1982. The northern portion of the landfill was fenced and used as the WSMR scrap metal accumulation point until 2000.

1.2.9 Former Oscura Range Center Landfill (SWMU 158)

This landfill is located 0.5 miles south of Oscura Range Center. Waste was removed in 1998. Closure activities are complete.

1.2.10 Nuclear Effects Reactor Facility Ponds #1 and #2 (SWMUs 160 and 161)

The Nuclear Effects Reactor Facility is located 3 miles south of the Main Post, just northwest of the WSMR El Paso gate. Pond #1 was known to receive waste water from floor drains, sinks, and toilets in Building 21225. The waste water stream reportedly included human waste and laboratory waste. Pond #2 received waste water from Building 21235. Both ponds have been closed.

1.2.11 Former Acid Neutralization Unit at HWSF (SWMU 89)

The former acid tank is located 8 miles east of the Main Post area at the HWSF. The tank consisted of an open-topped reinforced concrete tank that was used to evaporate liquid chemical wastes generated at photographic laboratories. The unit was occasionally used to store damaged transformers containing PCBs.

1.2.12 Former STP Percolations Ditches (SWMU 82)

This SWMU consists of two excavated soil ditches located immediately east of the WSMR Sewage Treatment Plant (STP) and approximately 2 miles east of the Main Post. The ditches were used from 1958 to 1986 as discharge trenches for STP effluent.

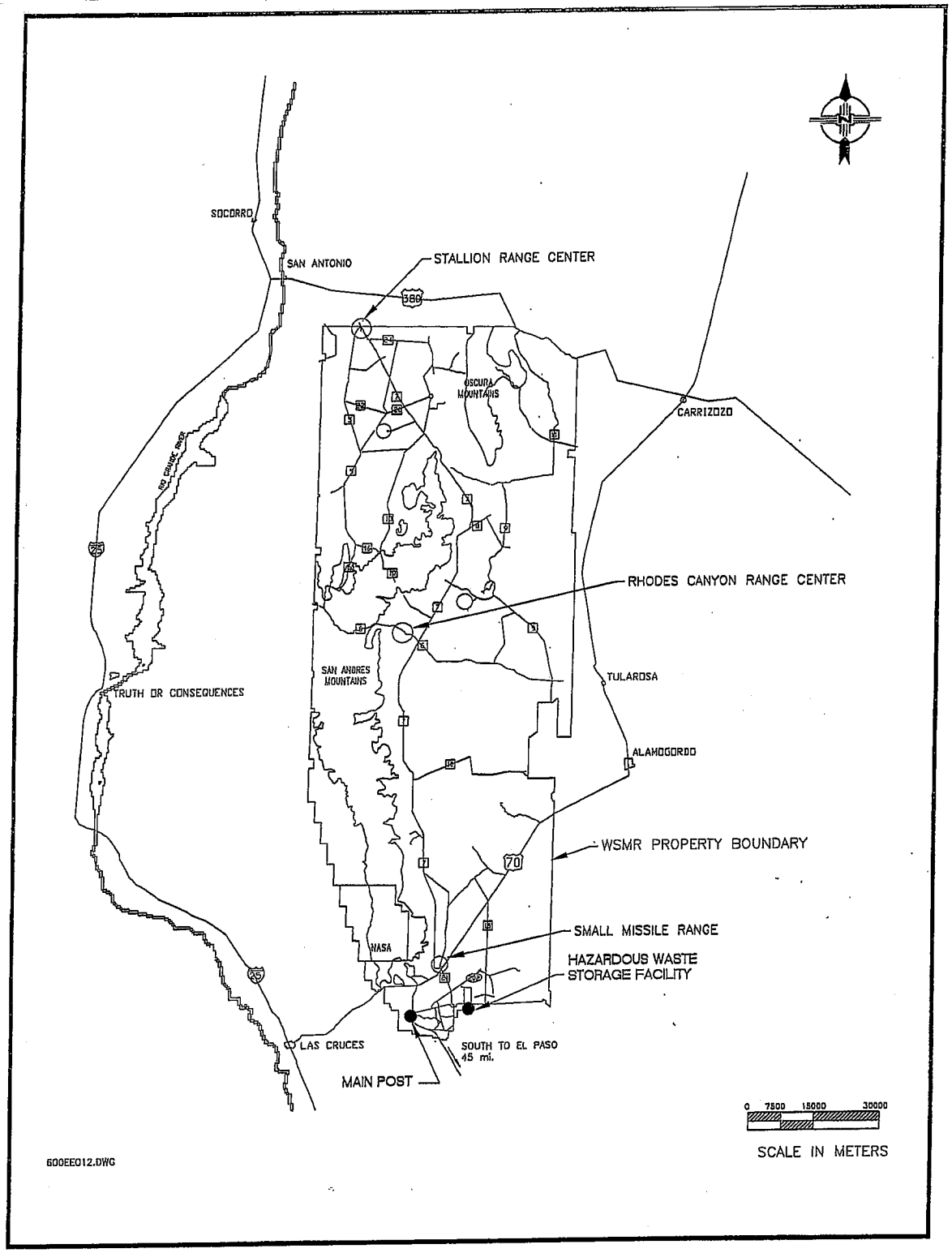
1.2.13 HELSTF Cleaning Facility Sump (SWMU 142)

The sump is located at the HELSTF Cleaning Facility (HCF), Building 26131. The unit is located in the Pre-Clean Room of the HCF and has been active since 1983.

1.2.14 Liquid Propellant Evaporation/Neutralization Pits (SWMUs 92 through 100)

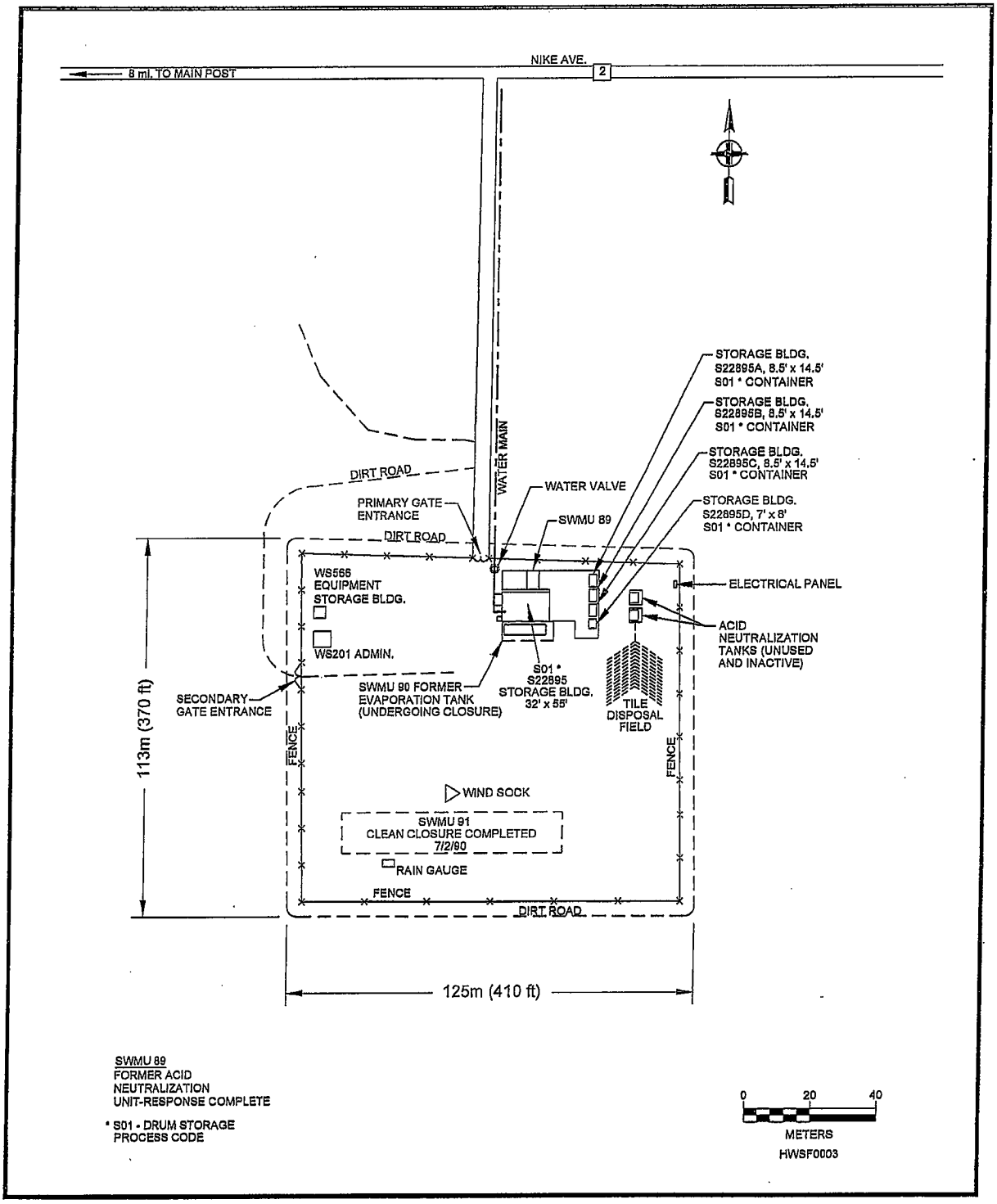
This site consists of ten earthen pits located 2 miles east of the Main Post area in the Liquid Propellant Storage Area. The pits were constructed in 1953 and intended to provide secondary containment for the storage area. The pits are unlined and used for containment of Inhibited Red Fuming Nitric Acid (IRFNA), liquid propellants, monomethyl hydrazine, unsymmetrical dimethyl hydrazine, and petroleum/oils/lubricants.

APPENDIX 2
MAPS AND FIGURES



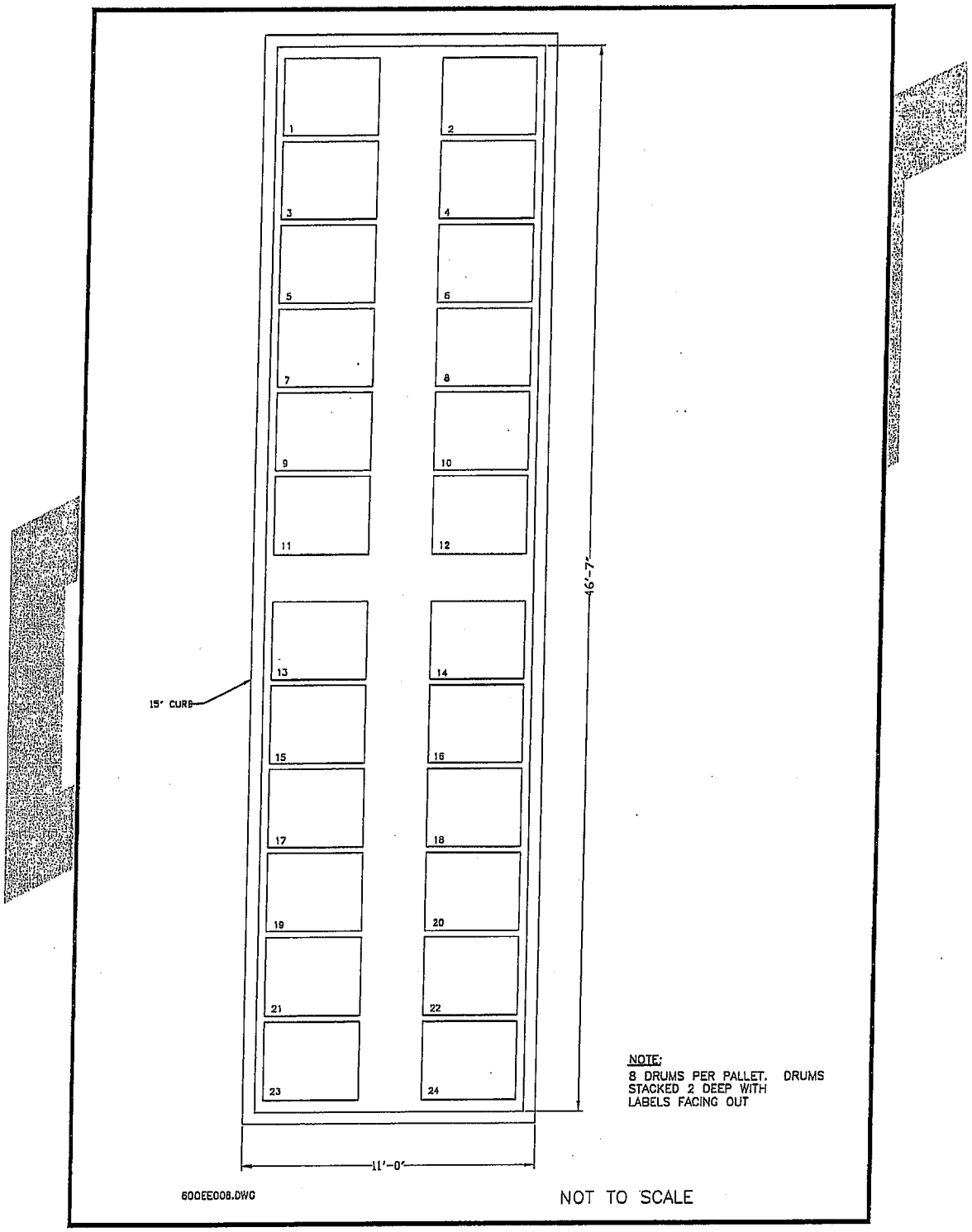
APPENDIX 2--FIGURE 1

Location of Hazardous Waste Storage Facility



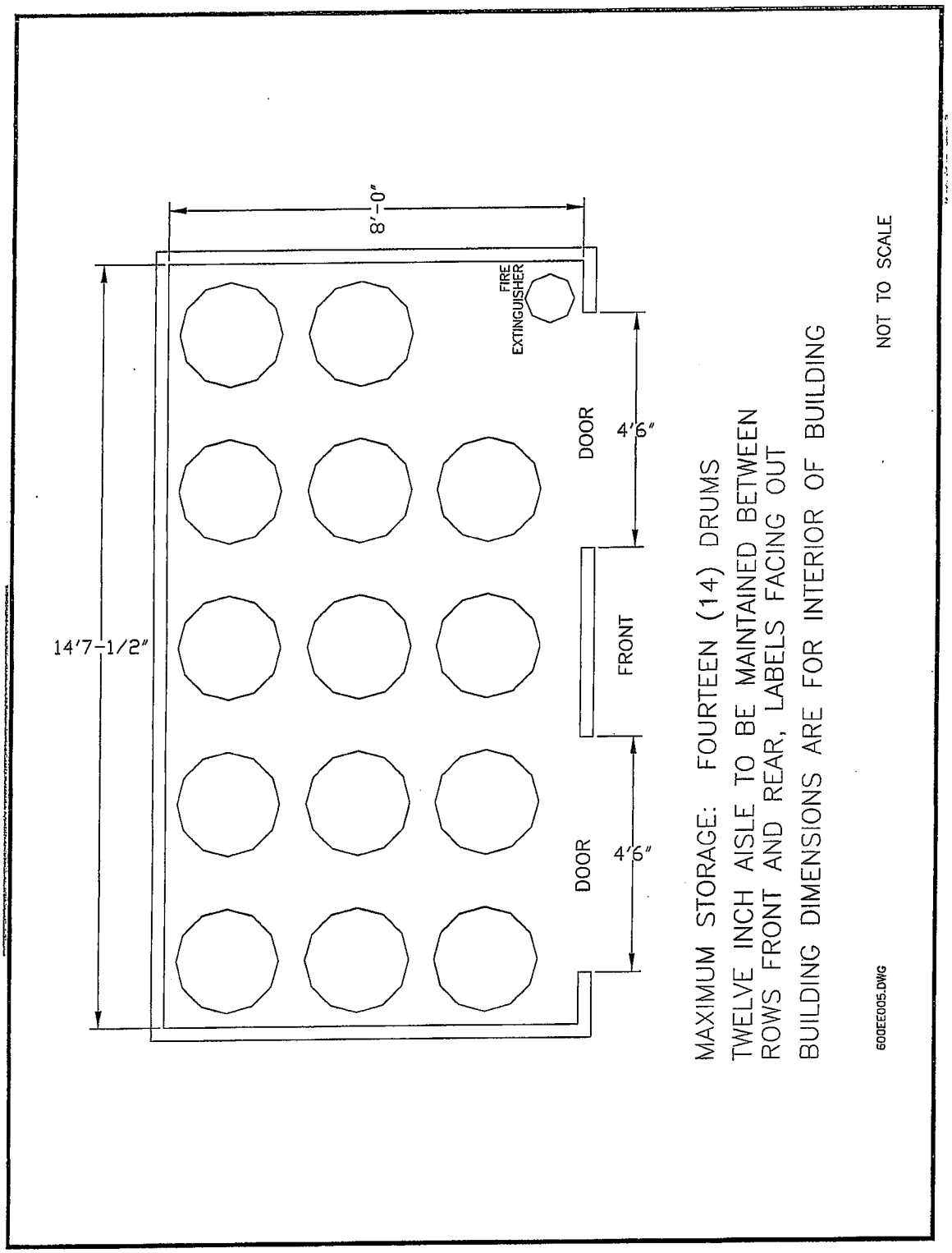
APPENDIX 2--FIGURE 2

HAZARDOUS WASTE STORAGE FACILITY



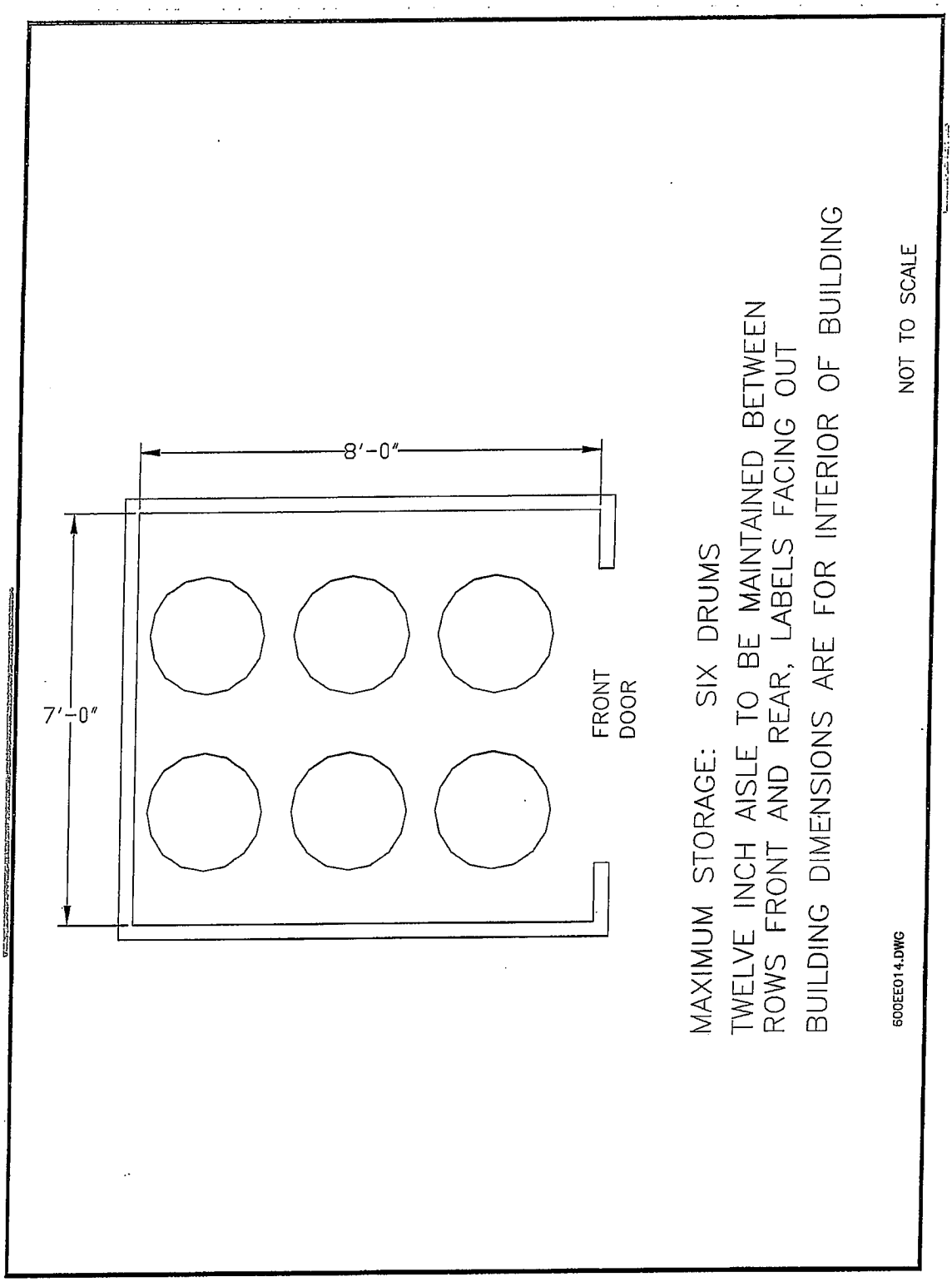
APPENDIX 2--FIGURE 3

Containment area in Building S22895 at the HWSF



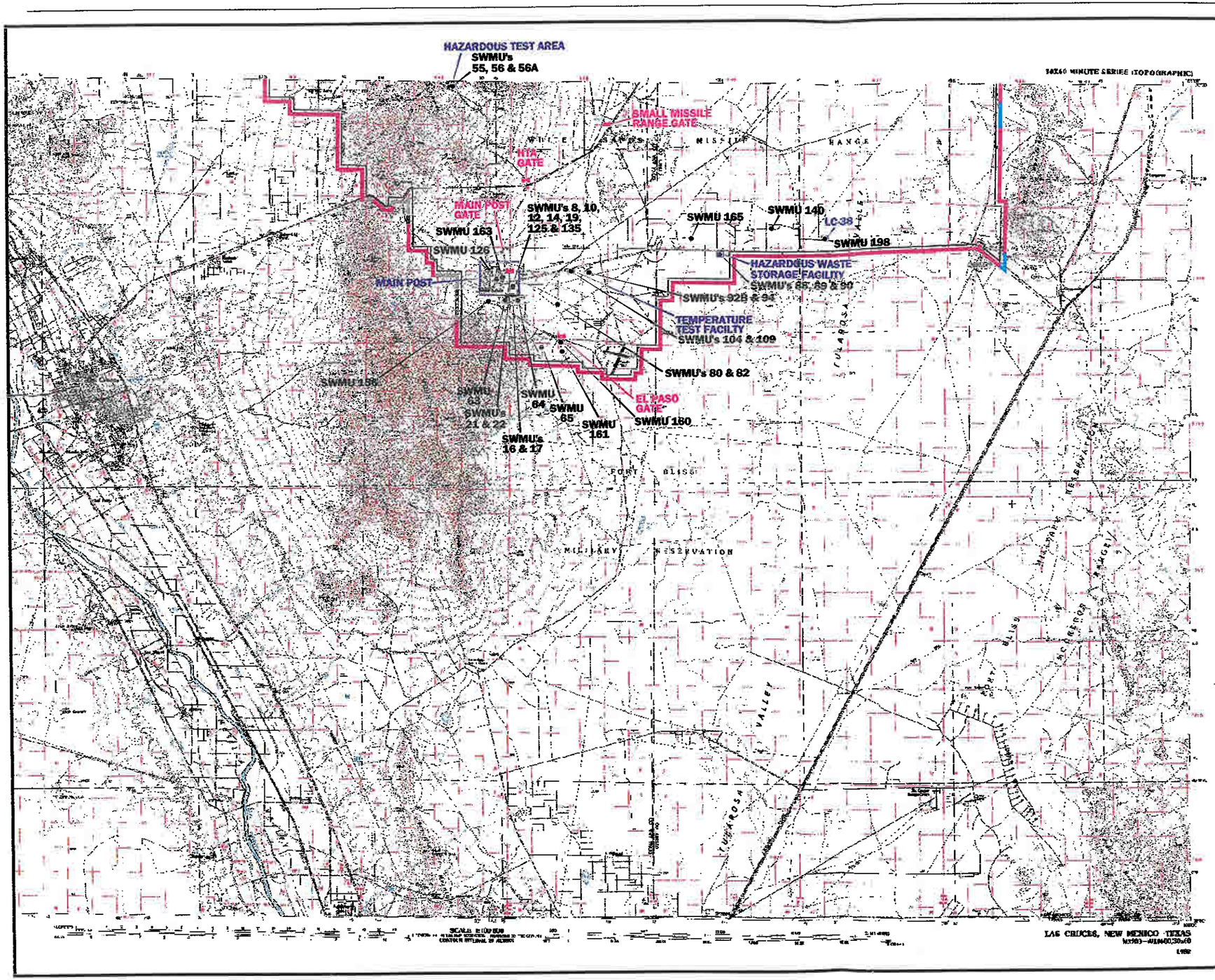
APPENDIX 2--FIGURE 4

Containment Area in Buildings S22895A-C

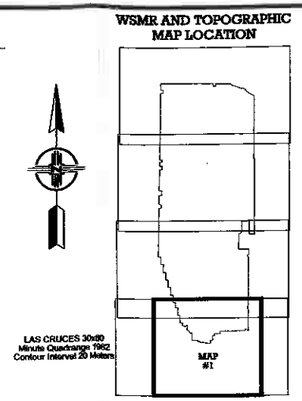


APPENDIX 2--FIGURE 5

Containment Area in Building S22895D



WSMR AND TOPOGRAPHIC MAP LOCATION



White Sands Missile Range
Location Map

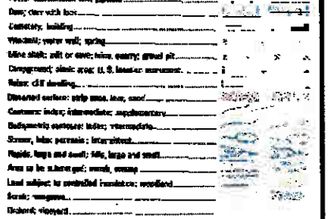
LEGEND

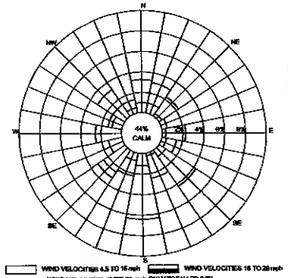
- RANGE BOUNDARY
- WSMR SITES
- WSMR ACCESS GATE
- AREA OF CONCERN
- SWMU SITE LOCATION

SURROUNDING LAND USAGE

- BLM
- MILITARY
- PRIVATE
- STATE LANDS

Topographic Map Symbols





MAIN POST AREA WIND ROSE

0 2.15 4.3
Miles

0 3.5 7.0
Kilometers

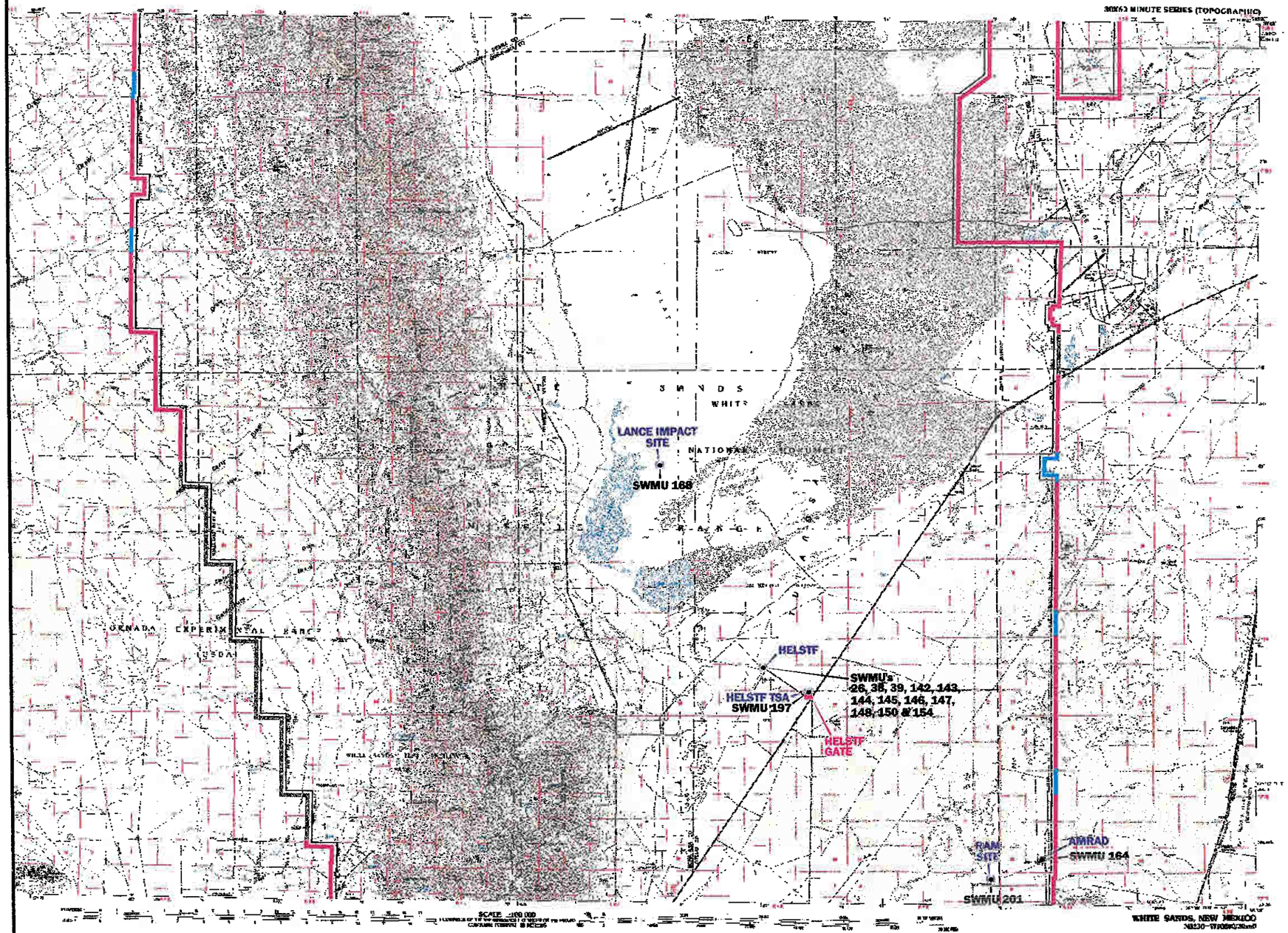
PROJECT TITLE:
WSMR SWMU LOCATION MAP

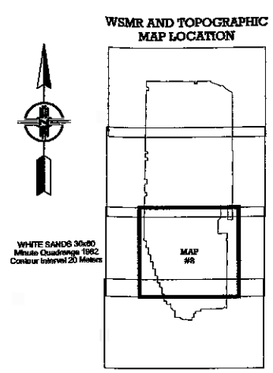
SHEET TITLE:
TOPOGRAPHIC MAP

BAE SYSTEMS
Bldg. 126, 3rd Floor
P.O Box 388
White Sands Missile Range
New Mexico, 88002
(505) 678-0283

ENGR'D BY:	CHECKED BY:	APRV'D BY:	WAO No.
KD	WL	KD	10-UU
CAD BY:	DATE:	DWG No.	REV.
BLBenavidez	July, 2004	RNGM0011	B
DWG SIZE: B	SCALE: Noted	SHEET 1 of 4	

APPENDIX 2
FIGURE 6—PLATE 1





White Sands Missile Range Location Map

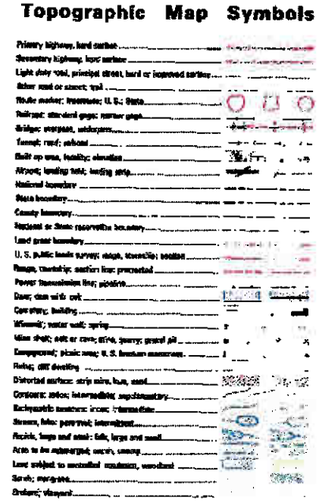
LEGEND

- RANGE BOUNDARY
- WSMR SITES
- WSMR ACCESS GATE
- AREA OF CONCERN
- SWMU SITE LOCATION

SURROUNDING LAND USAGE

- BLM
- MILITARY
- PRIVATE
- STATE LANDS

Topographic Map Symbols



0 2.15 4.3
Miles

0 3.5 7.0
Kilometers

PROJECT TITLE:
WSMR SWMU LOCATION MAP

SHEET TITLE:
TOPOGRAPHIC MAP

BAE SYSTEMS
Bldg. 126, 3rd Floor
P.O Box 389
White Sands Missile Range
New Mexico, 88002
(505) 678-0263

ENGR'D BY:	CHECKED BY:	APR'VD BY:	WAO No.
KD	WL	KD	10-UU
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BLBenavidez	July, 2004	RNGM0011	B
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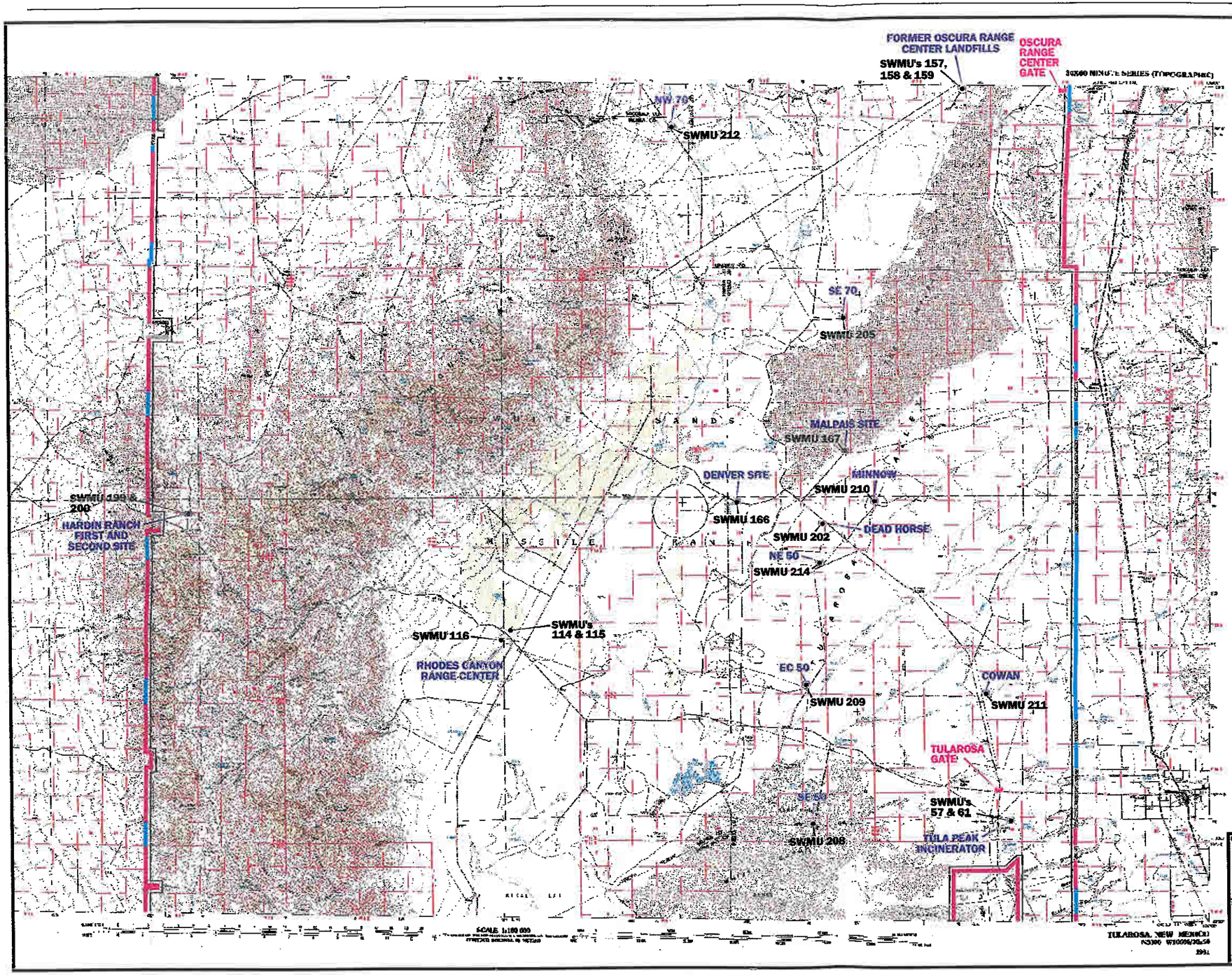
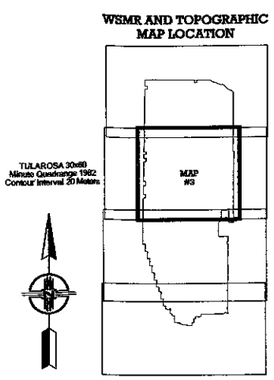


WSMR AND TOPOGRAPHIC MAP LOCATION



White Sands Missile Range Location Map

LEGEND

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- WSMR SITES
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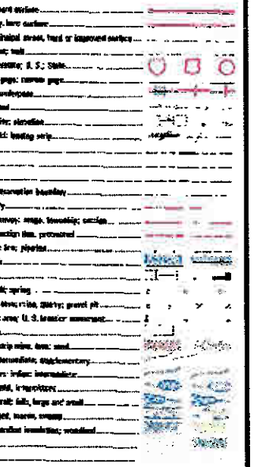
- STATE LANDS

Topographic Map Symbols



0 2.15 4.3
Miles

0 3.5 7.0
Kilometers

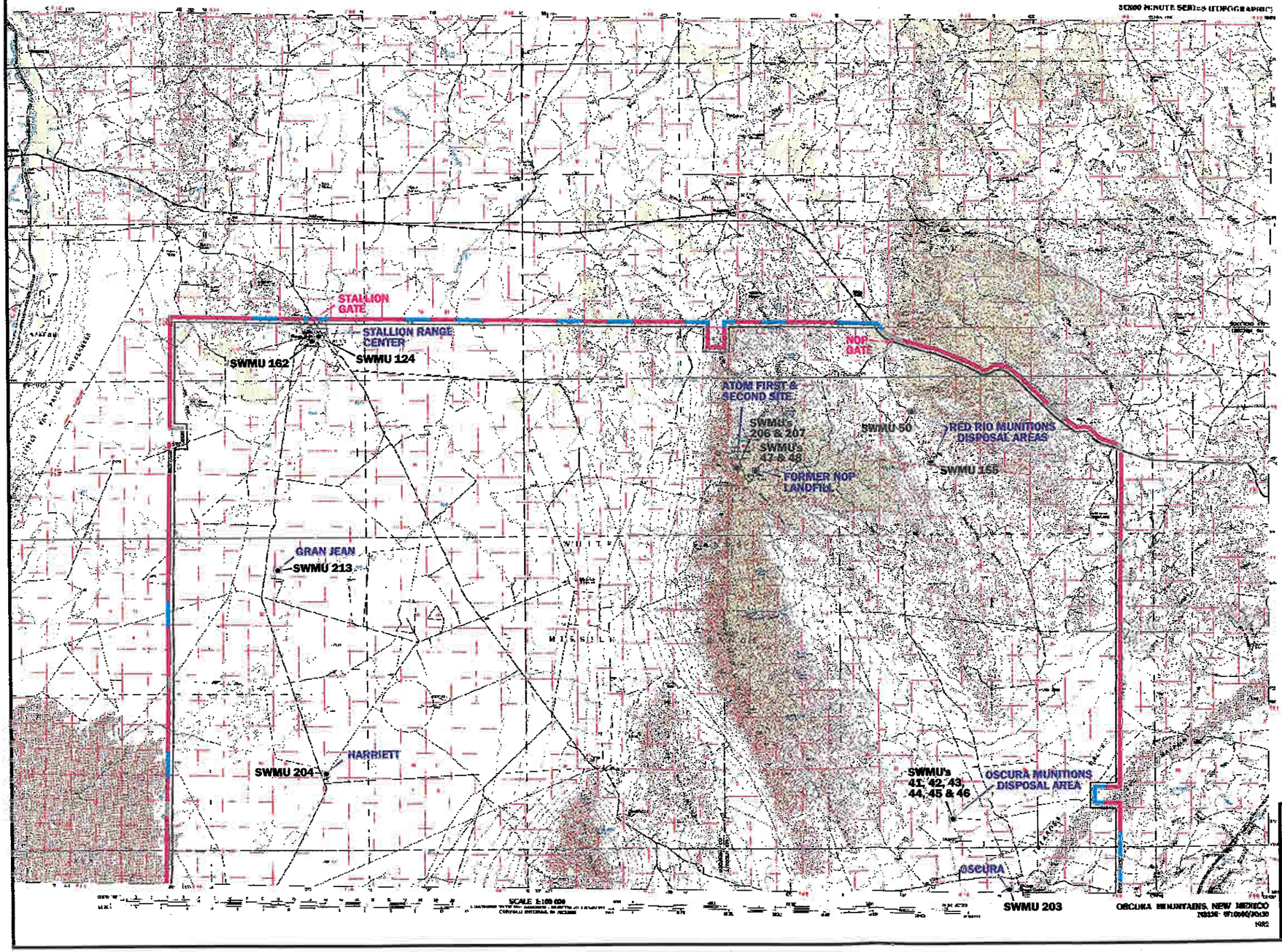
PROJECT TITLE:
WSMR SWMU LOCATION MAP

SHEET TITLE:
TOPOGRAPHIC MAP

BAE SYSTEMS
Bldg. 128, 3rd Floor
P.O Box 399
White Sands Missile Range
New Mexico, 88002
(505) 678-0263

ENGR'D BY:	CHECKED BY:	APP'D BY:	WAO No.
KD	WL	KD	10-UU
CAD BY:	DATE:	DWG No.	REV.
BLBenavidez	July, 2004	RNGM0011	B
DWG SIZE: B	SCALE: Noted	SHEET 3 of 4	

APPENDIX 2
FIGURE 6—PLATE 3



WSMR AND TOPOGRAPHIC MAP LOCATION

OSCURA 30x60 Minute Quadrange 1982 Contour Interval 20 Meters

MAP #4

STATE OF NEW MEXICO

White Sands Missile Range Location Map

LEGEND

- RANGE BOUNDARY
- WSMR SITES
- WSMR ACCESS GATE
- AREA OF CONCERN
- SWMU SITE LOCATION

SURROUNDING LAND USAGE

- BLM
- MILITARY
- PRIVATE
- STATE LANDS

Topographic Map Symbols

0 2.15 4.3
Miles

0 3.5 7.0
Kilometers

PROJECT TITLE:
WSMR SWMU LOCATION MAP

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DWG SIZE: B	SCALE: Noted	SHEET 4 of 4	

APPENDIX 3
CLEAN UP LEVELS

GROUND WATER, SOIL AND SURFACE WATER CLEANUP LEVELS

The Permittee shall attain the cleanup levels specified below when implementing the closure and corrective action requirements of this Permit.

3.1 GROUND WATER CLEANUP LEVELS

1. The Permittee shall attain the following cleanup levels for all hazardous waste and hazardous constituents in groundwater:

    a. For any contaminant for which EPA has adopted a maximum contaminant level (MCL) for drinking water under 40 CFR parts 141 and 143, the MCL shall be the cleanup level;

    b. For any contaminant for which the N.M. Water Quality Control Commission (WQCC) has adopted numeric standards for ground water listed in 20.6.2.3103 NMAC, the ground water standard shall be the cleanup level; and

    c. For any contaminant that the WQCC has identified as a toxic pollutant listed in 20.6.2.7.WW NMAC, the level approved by NMED under paragraph 2 or 3 below shall be the cleanup level.

    For any contaminant for which more than one of the cleanup levels set forth in subparagraphs a, b, and c above would apply, the lowest (or otherwise most protective) level shall be the applicable cleanup level.

2. If a cleanup level under Item 1 above does not exist for a carcinogenic hazardous waste or hazardous constituent, then the Permittee shall use the most recent version of the EPA *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (RSLs) for tap water and a target excess cancer risk level of 10^{-5} to develop a proposed cleanup level for NMED approval. The Permittee may use other scientific or regulatory information currently available to the public to develop and propose a cleanup level for NMED approval provided that the level is lower (or otherwise more protective) than the RSL.

3. If a cleanup level under Item 1 above does not exist for a noncarcinogenic hazardous waste or hazardous constituent, then the Permittee shall use the most recent version of the EPA RSLs for tap water and a Hazard Index (HI) of one (1.0) to develop a proposed cleanup level for NMED approval. The Permittee may use other scientific or regulatory information currently available to the public to develop and propose a cleanup level for NMED approval provided that the level is lower (or otherwise more protective) than the RSL.

4. If perchlorate is detected at concentrations at or greater than 4 μg/L and no groundwater standard or MCL has been adopted by the EIB, WQCC or EPA, then the Permittee shall

use the cleanup goal with a HI of 1.0 to develop the proposed cleanup level for use in their site investigation or corrective measure evaluation.

3.2 SOIL CLEANUP LEVELS

The Permittee shall attain the following cleanup levels for hazardous waste and hazardous constituents in soil:

1. For all individual contaminants for which NMED has specified a soil screening level in NMED's *Technical Background Document for Development of Soil Screening Levels*, the residential or industrial land use scenario cleanup level shall be the screening level specified in the most recent version of that document. The method for determining cleanup levels for sites with multiple contaminants shall follow NMED's *Technical Background Document for Development of Soil Screening Levels (as updated)* and items 2 and 3 below, as applicable;

2. The Permittee shall propose a soil cleanup level for PCBs based on NMED's Position Paper Risk-based Remediation of Polychlorinated Biphenyls at RCRA Corrective Action Sites (March 2000 as updated); and

3. If NMED soil screening level has not been established for a hazardous waste or hazardous constituent, the Permittee shall propose for NMED approval, a cleanup level based on the most recent version of the EPA Region VI HHMSSL (based on a HI of one (1.0) for compounds designated as "n" (noncarcinogen effects), "max" (maximum concentration), and "sat" (soil saturation concentration), or ten times the EPA Region VI HHMSSL for compounds designated "c" (carcinogen effects) (*i.e.* a target excess cancer risk level of 10^{-5}).

3.3 LAND USE DETERMINATION

All soil cleanup levels shall be based on a residential land use scenario unless NMED determines that an alternate land use is appropriate (*e.g.* subsistence farming, cultural, or industrial). The Permittee may only propose an alternate land use with less stringent cleanup levels (e.g. industrial) if NMED or EPA can legally and practicably enforce the institutional controls limiting the land use. If an alternate land use for which NMED or EPA has not established soil cleanup levels is determined to be the current and reasonably foreseeable future land use, then the Permittee may propose cleanup levels based on a risk assessment using a target excess cancer risk level of 10^{-5} for carcinogenic hazardous waste or hazardous constituent or, for noncarcinogenic hazardous waste or hazardous constituent, a HI of one (1.0).

3.4 SURFACE WATER CLEANUP LEVELS

The Respondents shall comply with the surface water quality standards outlined in the Clean Water Act (33 U.S.C. §§ 1251 to 1387), the New Mexico WQCC Regulations (20.6.2 NMAC), the State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC) and the procedures for alternative abatement standards (20.6.2.4103 NMAC).

3.5 ECOLOGICAL RISK CLEANUP LEVELS

The Permittee shall derive cleanup levels for each hazardous waste and hazardous constituent for each ecological zone at the Facility using the methodology in NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening–Level Ecological Risk Assessment.* If the ecological risk evaluation indicates that a lower cleanup level for a hazardous waste or hazardous constituent in groundwater, soil, or surface water is necessary to protect environmental receptors, NMED may establish cleanup levels based on ecological risk for hazardous waste or hazardous constituents in groundwater, soil, or surface water that are lower than levels that are solely protective of human health.

3.6 BACKGROUND CONCENTRATIONS

If the naturally occurring (background) concentration of a hazardous waste or hazardous constituent in ground water, soil, or surface water exceeds the standards specified above, then the cleanup level shall be the background concentration. To use background concentration as a cleanup level, the Permittee must obtain a written background determination from NMED.

3.7 VARIANCE FROM CLEANUP LEVELS

The Permittee may seek a variance from a cleanup level for soil or ground water as follows;

3.7.1 WQCC Standards

The Permittee may seek a technical infeasibility determination or alternative abatement standard from a WQCC standard in accordance with 20.6.2.4103.E or F NMAC.

3.7.2 Soil Standards and Non-WQCC Ground water Standards

The Permittee may seek a variance from any cleanup level for soil or for ground water (other than a WQCC standard) by submitting a written request to NMED for a determination that attainment of the cleanup level is technically infeasible or otherwise impracticable due to conflict with other environmental laws or requirements for the preservation of cultural resources. If based on technical infeasibility, the request shall include a demonstration of technical or physical impossibility of attaining the cleanup level using potential corrective action remedies. If based on conflict with other environmental laws or requirements for the preservation of cultural resources, the request shall include documentation showing that Permittee has attempted to resolve the conflict or mitigate the impact on cultural or natural resources and shall explain why mitigating measures cannot resolve the conflict or adequately protect the cultural or natural resource (e.g. consultation and a determination of incidental taking or reasonable and prudent measures to minimize the impact under 16 U.S.C. § 1536). All requests shall include a discussion of the effectiveness of potential corrective action remedies, whether the proposed variance will allow a present or future hazard to public health or the environment, and any other information required by the NMED. In addition, the request shall propose alternate cleanup levels for NMED approval, based on the effectiveness of potential corrective action remedies and a site-specific risk assessment based on NMED's guidance, *Technical Background Document for Development of Soil Screening Levels* (August 2006 as updated), *Assessing Human Health Risks Posed by Chemicals: Screening Level Risk Assessment* (March

2000), and *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (March 2000, as updated).

APPENDIX 4
SWMU, AOC, AND HAZARDOUS WASTE MANAGEMENT UNIT TABLES

TABLE 4-1
SOLID WASTE MANAGEMENT UNITS (SWMUs) & AREAS OF CONCERN (AOCs) REQUIRING CORRECTIVE ACTION

UNIT ID NUMBER	UNIT DESCRIPTION	COMMENTS
SWMU 1	Floor Drain System for Building 1621	
SWMU 2	Bleach and Fixer Collection Containers	
SWMU 3	Bleach and Fixer Collection Containers	
SWMU 4	Bleach and Fixer Collection Containers	
SWMU 5	Bleach and Fixer Collection Containers	
SWMU 6	Bleach and Fixer Collection Containers	
SWMU 7	Silver Recovery Unit Tailing Tank	
SWMU 8	Waste Oil Tank & Sump at Building 1794	SWMUs 8 & 9 were combined into SWMU 8, Also identified as WSMR-36
SWMU 10	Wash Pad, Drains, & Sump at Building 1778	SWMUs 10 & 11 were combined into SWMU 10, Also identified as WSMR-74
SWMU 12	Wash Ramp, Drains, Sump, & Oil/Waste Separator @ Building 1778	SWMUs 12 & 13 were combined into SWMU 12, Also identified as WSMR-60
SWMU 14	Used Battery Accumulation Area at Main Post	SWMUs 14 & 15 were combined into SWMU 14, Also identified as WSMR-33
SWMU 16	Heavy Equipment Wash Pad & Drain at Building 1736	Also identified as WSMR-79
SWMU 17	Waste Underground Injection Pipe	Also identified as WSMR-73
SWMU 19	Steam Wash Pad & Oil/water Separator @ Building 1753	SWMUs 19 & 20 were combined into SWMU 9, Also identified as WSMR-80
SWMU 21	Main Post Former Fire Fighting Training Area & Pit	Also identified as WSMR-31
SWMU 22	Main Post Former Fire Fighting Training Area Waste Pile	Also identified as WSMR-32
SWMU 23	Hazardous Waste Tank at HELSTF	
SWMU 24	Hazardous Waste Tank at HELSTF	
SWMU 25	Hazardous Waste Tank at HELSTF	
SWMU 26	Vapor Recovery Unit @ HELSTF	
SWMU 27	Sanitary Treatment Impoundment at HELSTF	SWMUs 27, 28, 29, & 30 were combined into SWMU 27, Also identified as WSMR-44

SWMU 31	Chemical Waste Tank	Also identified as WSMR-43
SWMU 32	Chemical Waste Tank	Also identified as WSMR-43
SWMU 33	Fluorspar Tank	Also identified as WSMR-49
SWMU 34	Fluorspar Tank	Also identified as WSMR-49
SWMU 35	Ethylene Glycol Tank at HELSTF	Also identified as WSMR-50
SWMU 36	Ethylene Glycol Tank at HELSTF	Also identified as WSMR-50
SWMU 37	Waste Oil Accumulation Area at Building 26121 at HELSTF	
SWMU 40	Waste Oil Accumulation Drum	
SWMU 47	Former North Oscura Peak Landfill	Also identified as WSMR-71
SWMU 48	Former North Oscura Peak Landfills	SWMUs 48 & 49 were combined into SWMU 48, Also identified as WSMR-71
SWMU 62	Former STP Imhoff Tank	Also identified as WSMR-59
SWMU 63	Former Main Post Landfill 1A	Also identified as WSMR-39
SWMU 64	Former Main Post Landfill 2A	Also identified as WSMR-40
SWMU 66	Main Post Sewage Treatment Plant Subsurface Influent Line	Also identified as WSMR-17
SWMU 67	Main Post Sewage Treatment Plant (STP) Bar Screen and Grinder	Also identified as WSMR-17
SWMU 68	North Primary Clarifiers at the STP	SWMUs 68 through 78 were combined into SWMU 68, Also identified as WSMR-17
SWMU 69	South Primary Clarifiers at the STP	Also identified as WSMR-17
SWMU 79	Sludge Beds at the STP	Also identified as WSMR-29
SWMU 80	STP Sludge Waste Pile Main Post	Also identified as WSMR-30
SWMU 81	Boiler at the STP	
SWMU 84	Effluent Pipeline at the STP	
SWMU 85	STP Discharge at Playa Lake	Also identified as WSMR-42
SWMU 86	Sanitary Landfill at the Main Post	Also identified as WSMR-81
SWMU 87	Construction Landfill	Also identified as WSMR-82
SWMU 102	Burn Pan	
SWMU 103	Scrap Metal Yard	
SWMU 107	Storage Tank at Temperature Test Facility (TTF)	Also identified as WSMR-35
SWMU 108	Vapor Extraction Well at TTF	Also identified as WSMR-41
SWMU 109	Drum Storage Area (Splash Pan) at TTF	
SWMU 110	Methylene Chloride Catchment System at TTF	
SWMU 111	Methylene Chloride Separation System at TTF	
SWMU 112	Methylene Chloride Separation System at TTF	
SWMU 113	Salt Water Evaporation Tanks at TTF	

SWMU 116	Rhodes Subgrade Asphalt Tanks	SWMUs 116, 117, & 118 were combined into SWMU 116, Also identified as WSMR-75
SWMU 119	Stallion Range Landfill	Also identified as WSMR-70
SWMU 120	Former Stallion Center Landfill	Also identified as WSMR-70
SWMU 121	Stallion Asphalt Tank	Also identified as WSMR-67
SWMU 122	Stallion Asphalt Tank	Also identified as WSMR-67
SWMU 123	Stallion Asphalt Tank	Also identified as WSMR-67
SWMU 124	Waste Oil Storage Tank @ Stallion	
SWMU 125	Veterinary Clinic @ McAffee Clinic Incinerators	Also identified as WSMR-77
SWMU 126	Veterinary Clinic @ McAffee Clinic Incinerators	
SWMU 127	Autoclave at McAffee Clinic	
SWMU 128	Silver Recovery System Tailing Tank	
SWMU 129	Cyanide Treatment Unit at Building 1512	
SWMU 130	Former Spent Developer Storage Tank / Acetic Acid Spill Containment Tank	
SWMU 131	Former Spent Developer Storage Tank / Acetic Acid Spill Containment Tank	
SWMU 132	OrograndeWaste Stabilization Pond	Ft. Bliss operated SWMU, Also identified as WSMR-76
SWMU 133	NOMTS Machine Shop Accumulation Area	
SWMU 134	NOMTS Outdoor Accumulation Area	
SWMU 135	Paint Shop Accumulation Area	
SWMU 136	Paint Shop Spray Booth	
SWMU 137	Paint Shop Sump	Also identified as WSMR-56,
SWMU 138	Waste Accumulation Area @ RATSCAT	
SWMU 140	LC-37 Paint Dump	Also identified as WSMR-84
SWMU 141	Equipment Storage Area	Also identified as WSMR-83
SWMU 143	HELSTF Storage Yard Chromium Spill Site	Also identified as WSMR-54
SWMU 144	HELSTF Laser System Test Center Wastewater Discharge Pond	Also identified as WSMR-47
SWMU 145	HELSTF Test Cell Lagoons	Also identified as WSMR-53
SWMU 146	HELSTF STP Dry Pond	Also identified as WSMR-45
SWMU 147	Decontamination Pad & Underground Holding Tank	Also identified as WSMR-78
SWMU 148	Former MAR Waste Stabilization Pond	Also identified as WSMR-83
SWMU 149	Maintenance Building Septic System	Also identified as WSMR-46
SWMU 150	MAR Dump Site	
SWMU 151	Trailer Area Septic System	Also identified as WSMR-46
SWMU 152	Property and Supply Building Septic System	Also identified as WSMR-46

SWMU 153	Vandal Burial Site	Also identified as WSMR-58
SWMU 154	HELSTF Systematic Diesel Spill Site	Also identified as WSMR-55
SWMU 156	Former Golf Course Pesticide Storage Shed @ Building T-1348	Also identified as WSMR-57
SWMU 157	Former Oscura Range Center Landfill-A	Also identified as WSMR-05
SWMU 159	Former Oscura Range Center Landfill-C	Also identified as WSMR-05
SWMU 162	Stallion Range Center Former Fire Fighting Training Area	Also identified as WSMR-66
SWMU 163	Abandoned Disposal Trench @ New Commissary	Also identified as WSMR-72
SWMU 164	AMRAD Facility	
SWMU 165	LC-34 Contaminated Soils @ Buildings 23104 & 23106	
SWMU 166	Denver	
SWMU 167	Malpais	
SWMU 168	Lance Missile Impact @ White Sands National Monument	
SWMU 197	HELSTF Technical Support Area	
SWMU 198	LC-38 Diesel Fuel Oil Release	
SWMU 199	Hardin Ranch First Site	
SWMU 200	Hardin Ranch Second Site	
SWMU 201	RAM (Facility 6002) Site	
SWMU 202	Dead Horse Instrumentation Site	
SWMU 203	Oscura (Facility 31795) Communication Site	
SWMU 204	Harriet (Facility 34600) Instrumentation Site	
SWMU 205	SE-70 (Facility S-31427) Instrumentation Site	
SWMU 206	Atom (Facility S-33151) First Site	
SWMU 207	Atom (Facility S-33151) Second Site	
SWMU 208	SE-50 (Facility 29055) Instrumentation Site	
SWMU 209	EC-50 (Facility29085) Instrumentation Site	
SWMU 210	Minnow (Facility S-31132) Instrumentation Site	
SWMU 211	Cowan Instrumentation Site	
SWMU 212	NM-70 (Facility S-31620) Instrumentation Site	
SWMU 213	Gran Jean (Facility S-34050) Instrumentation Site	

SWMU 214	NE-50 (Facility 29090) Instrumentation Site	
SWMU 215	Missile Graveyard	
SWMU 216	UST at Timing Station, Building 20710, LC-32 (Uncle Site)	
SWMU 217	AAFES Gas Station at Building 270	
SWMU 218	LC-38-Building 23626	1,764-gallon steel UST
SWMU 219	Main Post POL	AST Release Site
AOC A	Sink & Drain System @ Building 1621	
AOC B	Battery Accumulation Area @ North Oscura	
AOC D	Drum Storage Area @ STP	
AOC E	Pesticide Storage Area	
AOC G	Brine (MeCl) Storage Tank	
AOC H, I, J, K, & L	Methylene Chloride Tanks (five tanks)	
AOC P	Chemistry Laboratory Drains at Building 1530	
AOC S	Septic Tanks with Leach Fields	Also identified as WSMR-69
AOC V	HELSTF Pressure Recovery System	
AOC W	Davies Tank	
AOC X	Stallion Range Desalinization/Sewage Lagoons	
AOC Y	Stormwater Drainage Ditches	From RFA* section 6.21, page 6-10
AOC Z	Abandoned Underground Storage Tank	From RFA* section 6.22, page 6-10
AOC AA	Alamogordo Bombing Range	Also identified as WSMR-003-R-01; Active Range, Deferred
AOC AB	Sewage Lagoon	Also identified as WSMR-004-R-01
AOC AC	Condron Field	Also identified as WSMR-005-R-01
AOC AD	Main Cantonment Area	Also identified as WSMR-006-R-01
AOC AE	Red Rio Bombing Range	Active Range, Deferred
AOC AF	Oscura Bombing Range	Active Range, Deferred
AOC AG	Main Post Skeet Range	Active Range, Deferred

* WSMR RCRA Facility Assessment PR/VSI Report, A.T. Kearney, Inc, August 1988

TABLE 4-2
SWMUs & AOCs
CORRECTIVE ACTION COMPLETE WITH CONTROLS

UNIT ID NUMBER	UNIT DESCRIPTION	COMMENTS

TABLE 4-3
SWMUs & AOCs
CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS

UNIT ID NUMBER	UNIT DESCRIPTION	COMMENTS
SWMU 219	Hawk Facility, Building 204548 at LC-38	3,000-gallon UST
SWMU 220	Rhodes Canyon Range Center POL Station, Building 30725-1 & 2)	
SWMU 139		No corresponding SWMU unit assigned to this number
AOC C	Areas Where heavy pesticides and/or herbicides were used	
AOC F	Methane Vent (Flare) at STP	
AOC M	Exploded / Unexploded Low Level Radioactive Ordnance	
AOC N	Process Spills at HELSTF	
AOC O	Miscellaneous Areas ID'd by Aerial Photos	
AOC Q	HELSTF Lab Drains	
AOC T	Collection Lines to the STP	
AOC U	Miscellaneous Spills	

TABLE 4-4
HAZARDOUS WASTE MANAGEMENT UNITS

UNIT ID NUMBER	UNIT DESCRIPTION	COMMENTS
SWMU 38	HELSTF Landfill	Also identified as WSMR-52, Closure required
SWMU 39	HELSTF Landfill	Also identified as WSMR-52, Closure required
SWMU 41	Oscura Munitions Landfill	Also identified as WSMR-03, Closure required
SWMU 42	Oscura Munitions Landfill	Also identified as WSMR-03, Closure required
SWMU 43	Oscura Munitions Landfill	Also identified as WSMR-03, Closure required
SWMU 44	Oscura Munitions Landfill	Also identified as WSMR-03, Closure required
SWMU 45	Oscura Munitions Landfill	Also identified as WSMR-03, Closure required
SWMU 46	Oscura Munitions Landfill	Also identified as WSMR-03, Closure required
SWMU 50	Red Rio North Landfill	Also identified as WSMR-02, SWMUs 50-54 were combined into SWMU 50, Closure required
SWMU 55	Open Burn Pit at the OB/OD	Post Closure Care Plan Required
SWMU 56	Open Detonation Pit at the OB/OD	Post Closure Care Plan Required
SWMU 56A	Open Detonation Pit at the OB/OD	Post Closure Care Plan Required
SWMU 57	Tula Peak Burial Sites	Also identified as WSMR-23, SWMUs 57-60 were combined into SWMU 57, Closure required
SWMU 61	Tula Peak Incinerator	Also identified as WSMR-24, Closure required
SWMU 65	Former Main Post Landfill #3 at Scrap Yard	Also identified as WSMR-61, Closure required
SWMU 82	Former STP Ditches	SWMUs 82 and 83 were combined into SWMU 82. Also identified as WSMR-62, Closure required
SWMU 88	Container Storage Area	Operating
SWMU 89	Former Acid Neutralization Unit at the Hazardous Waste Storage Facility	Also identified as WSMR-27, Closure required
SWMU 90	Evaporation Tank at Building 22895	Also identified as WSMR-37, Clean closure complete
SWMU 91	Hazardous Waste Landfill	Clean closure complete

SWMU 92A	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 92B	Liquid Propellant Evaporation – Neutralization Pit 2	Closure required, Also identified as WSMR-11
SWMU 93	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 94	Liquid Propellant Evaporation – Neutralization Pit 4	Closure required, Also identified as WSMR-11
SWMU 95	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 96	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 97	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 98	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 99	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 100	Liquid Propellant Evaporation Neutralization Pits	Closure required, Also identified as WSMR-11
SWMU 101	Acid Neutralization Pit	Closure required
SWMU 104	Temperature Test Facility	Also identified as WSMR-34, Clean closure complete
SWMU 105	New Evaporation Tank at TTF	Closure complete
SWMU 106	Discharge Pipe at TTF	Closure required
SWMU 114	Rhodes Canyon Landfill	Also identified as WSMR-14, Closure complete, Post-closure Plan is included in the approved CMI Report
SWMU 115	Rhodes Canyon Landfill	Also identified as WSMR-14, Closure complete. Post-closure care plan is included in the approved CMI Report
SWMU 142	HELSTF Cleaning Facility Sump	Also identified as WSMR-48, Closure required
SWMU 155	Red Rio South Landfill	Closure required
SWMU 158	Former Oscura Range Landfill	Also identified as WSMR-05, Clean closure complete
SWMU 160	Nuclear Effects Reactor Facility Pond #1	Also identified as WSMR-09, Clean closure complete
SWMU 161	Nuclear Effects Reactor Facility Pond #2	Also identified as WSMR-09, Clean closure complete

APPENDIX 5
INVESTIGATION AND SAMPLING METHODS AND PROCEDURES

The Permittee shall submit to NMED, for review and written approval, site-specific work plans for sites prior to the commencement of field activities where environmental investigation, corrective action, sampling or monitoring is being conducted or proposed. The site-specific work plans shall include the methods to be used to conduct all activities at each site or unit and shall be prepared in accordance with the format described in the Permit Appendix 7 (*Reporting Requirements*). The Permittee shall provide notification to NMED of corrective action field activities a minimum of 20 days prior to commencing the activity.

The methods used to conduct investigation, remediation, and monitoring activities shall be sufficient to fulfill the requirements of this Permit and provide accurate data for the evaluation of site conditions, the nature and extent of contamination and contaminant migration, and for remedy selection and implementation, where necessary. The methods presented in Section 5.2 of this Permit Appendix are minimum requirements for environmental investigation and sampling, and are not intended to include all methods that may be necessary to fulfill the requirements of this Permit. The methods for conducting investigations, corrective actions, and monitoring at the Facility must be determined based on the conditions and contaminants that exist at each site or unit.

Work plans prepared pursuant to this Permit Appendix shall be subject to the procedures of Permit Section I.L.

5.1 STANDARD OPERATING PROCEDURES

The Permittee shall provide a brief description of investigation, sampling or analytical methods and procedures in documents submitted to NMED that includes sufficient detail to evaluate the quality of the acquired data. Facility standard operating procedures (SOPs) shall not be substituted for such descriptions.

5.2 INVESTIGATION, SAMPLING, AND ANALYSIS METHODS

5.2.1 Introduction and Purpose

This section of the Permit Appendix 5 provides minimum requirements for field investigations, sample collection, handling and screening procedures, field and laboratory sample analysis, and quality assurance procedures for samples of the medium being investigated or tested at the Facility.

The purpose of this section is to: 1) provide minimum requirements for drilling and sample collection in exploratory borings and other excavations; 2) provide minimum requirements for sampling of the target media; 3) provide minimum requirements for monitoring of groundwater and vadose zone conditions; and 4) identify minimum required screening, analytical, and quality assurance procedures that shall be implemented during field sampling activities and laboratory analyses.

The quality assurance procedures referenced in the previous paragraph include: 1) the Facility investigation data quality objectives; 2) the requirements for QA/QC to be followed during field investigations and by the analytical laboratories; and 3) the methodology for the review and evaluation of the field and laboratory QA/QC results and documentation.

5.2.2 Field Exploration Activities

Exploratory borings shall be advanced at locations specified in NMED approved site-specific work plans. NMED may require additional exploratory borings to fulfill the requirements of this Permit. Any additional boring locations, if required, will be determined or approved by NMED. The depths and locations of all exploratory and monitoring well borings shall be specified in the site-specific work plans submitted to NMED for approval prior to the start of the respective field activities. NMED must approve proposed unit aggregates grouped for the purpose of site investigation, remediation, and/or monitoring activities.

5.2.2.a Subsurface Features/Utility Geophysical Surveys

The Permittee shall conduct surveys to locate underground utilities, pipelines structures, drums, debris, and other buried features, including buried waste, in the shallow subsurface prior to the start of field exploration activities. The methods used to conduct the surveys, such as magnetometer, ground penetrating radar, resistivity, or other methods, shall be selected based on the characteristics of the site and the possible or suspected underground structures. The results of the surveys shall be included in the investigation reports submitted to NMED.

5.2.2.b Drilling and Soil, Rock, and Sediment Sampling

5.2.2.b.i Drilling

Exploratory and monitoring well borings shall be drilled using the most effective, proven, and practicable method for recovery of undisturbed samples and potential contaminants. NMED shall approve the drilling methods selected for advancement of each boring prior to the start of field activities. Based on the drilling conditions, the borings shall be advanced using one of the following methods:

- Hollow-stem auger
- Air rotary
- Mud rotary
- Percussion hammer
- Sonic
- Dual wall air rotary
- Direct Push Technology (DPT)
- Cryogenic
- Cable tool

Hollow-stem auger or DPT drilling methods are preferred if vapor-phase or VOC contamination is known or suspected to be present. The type of drilling fluid used, if necessary, shall be approved by NMED prior to the start of drilling activities or prior to use at any site.

All drilling equipment shall be in good working condition and capable of performing the assigned task. Drilling rigs and equipment shall be operated by properly trained, experienced, and responsible crews. The Permittee is responsible for ensuring that contaminants from another site or facility are not introduced into the site under investigation due to malfunctioning equipment or poor site maintenance. The drilling equipment shall be properly decontaminated before drilling each boring.

Exploratory borings shall be advanced to unit- and location-specific depths specified or approved by NMED. The Permittee shall propose drilling depths in the site-specific work plans submitted for each subject area. Unless otherwise specified by NMED, the borings shall be advanced to the following minimum depths:

1. In all borings, 25 ft below the deepest detected contamination based on field screening, laboratory analyses, and/or previous investigations at the site;
2. Twenty ft below the base of disposal units if contamination is not detected;
3. Five ft below the base of shallow structures such as tanks, piping or building sumps, or other building structures;
4. Depths specified by NMED based on regional or unit specific data needs.

The Permittee shall notify NMED as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the depths specified by NMED or proposed in an approved work plan so that alternative actions may be discussed. Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities. Contaminant zones shall be isolated from other zones encountered in the borings.

The drilling and sampling shall be accomplished under the direction of a qualified engineer or geologist who shall maintain a detailed log of the materials and conditions encountered in each boring. Both sample information and visual observations of the cuttings and core samples shall be recorded on the boring log. Known site features and/or site survey grid markers shall be used as references to locate each boring prior to surveying the location as described in Section 5.2.2.f of this Permit Appendix 5. The boring locations shall be measured to the nearest foot, and locations shall be recorded on a scaled site map upon completion of each boring.

Trenching and other exploratory excavation methods shall follow the applicable general procedures outlined in this Permit Appendix. The particular methods proposed for use by the Permittee for exploratory excavation and sampling at any specific unit shall be included in the site-specific investigation work plan submitted to NMED. NMED will include any changes or additional requirements for conducting exploratory excavation and sampling activities at the subject unit in its response to the Permittee after review of the investigation work plans.

5.2.2.b.ii Soil and Rock Sampling

Relatively undisturbed discrete soil and rock samples shall be obtained, where possible, during the advancement of each boring for the purpose of logging, field screening, and analytical testing. Generally, the samples shall be collected at the following intervals and depths:

1. At five-ft intervals, ten-ft intervals, continuously, or as approved by NMED;

2. At the depth immediately below the base of the disposal unit or Facility structure;
3. At the maximum depth of each boring;
4. At the depths of contacts or first encounter, observed during drilling, with geologic units of different lithology, changes in structural or textural characteristics, or zones of relatively higher or lower permeability;
5. Of soil or rock types relatively more likely to sorb or retain contaminants than surrounding lithology;
6. At the depth of the first encounter, during drilling, with shallow or intermediate saturated zones;
7. At intervals suspected of being source or contaminated zones;
8. At the top of the regional aquifer; and
9. At other intervals approved or required by NMED.

The sampling interval for the borings may be modified, or samples may be obtained from a specific depth, based on field observations. A decontaminated split-barrel sampler lined with brass sleeves, a coring device, or other method approved by NMED shall be used to obtain samples during the drilling of each boring.

A split barrel sampler lined with brass sleeves or a coring device is the preferred sampling method for borehole soil, rock, and sediment sampling. The following procedures should be followed if a split barrel sampler is used. Upon recovery of the sample, one or more brass sleeves shall be removed from the split barrel sampler and the open ends of the sleeves covered with Teflon tape or foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory. If brass sleeves are not used, a portion of the sample shall be placed in pre-cleaned, laboratory-prepared sample containers for laboratory chemical analysis. The remaining portions of the sample shall be used for logging and field screening, as described in Sections 5.2.2.c and 5.2.2.d of this Permit Appendix, respectively.

Discrete samples shall be collected for field screening and laboratory analyses. Homogenization of discrete samples collected for analyses other than for VOC and SVOC analyses shall be performed by the analytical laboratory, if necessary. The Permittee may submit site-specific, alternative methods for homogenization of samples in the field to NMED for review and written approval.

Samples to be submitted for laboratory analyses shall be selected based on: 1) the results of the field screening or mobile laboratory analyses; 2) the position of the sample relative to groundwater, suspected releases, or site structures; 3) the sample location relative to former or altered site features or structures; 4) suspected migration pathways and the stratigraphy encountered in the boring; and 5) the specific objectives and requirements of this Permit and the approved site-specific work plan. The proposed number of samples and analytical parameters shall be included as part of the site-specific work plan submitted to NMED for approval prior to the start of field investigation activities at each unit. The work plans shall allow for flexibility in modifying the project-specific tasks based on information obtained during the course of the investigation. Modifications to site-specific work plan tasks must be pre-approved in writing by NMED.

5.2.2.b.iii Sediment Sampling

Sediment samples shall be collected in the same manner as described in Section 5.2.2.b.ii for soil and rock sampling where borings are drilled to explore alluvial subsurface conditions. The sampling device shall be a decontaminated, hand-held stainless steel coring device, shelby tube, thin-wall sampler, or other device approved by NMED where sediment sampling is conducted without the use of the drilling methods described in Section 5.2.2.b.i of this Permit Appendix. The samples shall be transferred to pre-cleaned laboratory prepared containers for submittal to the laboratory. Samples obtained for volatiles analysis shall be collected using shelby tubes, thin-wall samplers, or other device approved by NMED. The ends of the samplers shall be lined with Teflon tape or aluminum foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory.

The physical characteristics of the sediment (such as mineralogy, ASTM soil classification, AGI [American Geological Institute] rock classification, moisture content, texture, color, presence of stains or odors, and/or field screening results), depth where each sample was obtained, method of sample collection, and other observations shall be recorded in the field log.

5.2.2.b.iv Drill Cuttings (Investigation Derived Waste)

Drill cuttings, excess sample material and decontamination fluids, and all other investigation derived waste (IDW) shall be contained and characterized using methods based on the boring location, boring depth, drilling method, and type of contaminants suspected or encountered. Proposed IDW management shall be included with the unit-specific investigation work plan submitted to NMED for approval prior to the start of field investigations. NMED shall approve the method of containment for drill cuttings prior to the start of drilling activities. Borings not completed as groundwater or vapor monitoring wells shall be properly abandoned in accordance with the methods listed in Section 6.4 (*Well Abandonment*) of Permit Appendix 6. Borings completed as groundwater monitoring wells shall be constructed in accordance with the requirements described in Section 6.3 of this Permit Appendix 6 (*Well Construction/Completion Requirements*).

5.2.2.c Logging of Soil/Rock and Sediment Samples

Samples obtained from all exploratory borings and excavations shall be visually inspected and the soil or rock type classified in general accordance with ASTM D2487 (Unified Soil Classification System) and D2488, or AGI Methods for soil and rock classification. Detailed logs of each boring shall be completed in the field by a qualified engineer or geologist. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling shall be recorded on the logs. Field boring logs, test pit logs, and field well construction diagrams shall be converted to the format acceptable for use in final reports submitted to NMED. If requested, draft boring logs, test pit logs, and well construction diagrams shall be submitted to NMED for review within 30 days after the completion of each boring or monitoring well.

5.2.2.d Soil, Rock, and Sediment Sample Field Screening

Samples obtained from borings shall be screened in the field for evidence of the potential presence of contaminants. Field screening results shall be recorded on the exploratory boring and excavation logs. Field screening results are used as a general guideline to determine the nature and extent of possible contamination. In addition, screening results shall be used to aid in the selection of soil, rock,

sediment, and vapor-phase samples for laboratory analysis. NMED recognizes that field screening alone will not detect the possible presence or full nature and extent of all contaminants that may be encountered at the site.

The primary screening methods to be used shall include: 1) visual examination; 2) headspace vapor screening for VOCs; and 3) metals screening using X-ray fluorescence (XRF). Additional screening for site- or release-specific characteristics such as pH, High Explosives (HE), Total Petroleum Hydrocarbons (TPH), nitrates, or for other specific compounds using field test kits shall be conducted where appropriate.

Headspace vapor screening shall target VOCs and shall be conducted by placing a soil or rock sample in a plastic sample bag or a foil-sealed container allowing space for ambient air. The container shall be sealed and then shaken gently to expose the soil or rock to the air trapped in the container. The sealed container shall be allowed to rest for a minimum of five minutes while vapors equilibrate. Vapors present within the sample bag headspace will then be measured by inserting the probe of the instrument in a small opening in the bag or through the foil. The maximum value and the ambient air temperature shall be recorded on the field boring or test pit log for each sample. The monitoring instruments shall be calibrated each day to the manufacturers standard for instrument operation. A photo-ionization detector (PID) equipped with a 10.6 or higher electron volt (eV) lamp, combustible gas indicator, or other instrument approved by NMED shall be used for VOC field screening. The limitations, precision, and calibration procedures of the instrument to be used for VOC field screening shall be included in the site-specific investigation work plan prepared for each unit.

XRF may be used to screen soil, rock, or sediment samples for the presence of metals. XRF screening requires proper sample preparation and proper instrument calibration. Sample preparation and instrument calibration procedures shall be documented in the field logs. The methods and procedures for sample preparation and instrument calibration shall be approved by NMED prior to the start of field activities. Field XRF screening results for selected metals may be used in lieu of laboratory analyses upon written approval by NMED; however, the results shall, at a minimum, be confirmed by laboratory analyses at a frequency of 20 percent (one sample per every five analyzed by XRF analysis).

Field screening results are site- and boring-specific and the results vary with instrument type, media screened, weather conditions, moisture content, soil or rock type, and type of contaminant. The Permittee shall record on the field logs all conditions capable of influencing the results of field screening. The Permittee shall submit to NMED conditions potentially influencing field screening results as part of the site-specific investigation, remediation, or monitoring reports.

At a minimum, the Permittee shall submit the samples with the greatest apparent degree of contamination, based on field observations and field screening, for laboratory analysis. The Permittee shall also use the location of the sample relative to groundwater, stratigraphic units or contacts, and the proximity to significant site or subsurface features or structures as a guideline for sample selection. In addition, the Permittee shall submit the samples with no or little apparent contamination, based on field screening, for laboratory analysis if the intention is to confirm that the base (or other depth interval) of a boring or other sample location is not contaminated.

5.2.2.e Soil, Rock, and Sediment Sample Types

The Permittee shall collect soil, rock, and sediment samples at the frequencies outlined in the site-specific investigation, corrective action, or monitoring work plans for each SWMU, AOC, or other site submitted by the Permittee for review and written approval by NMED. The samples collected shall be representative of the media and site conditions being investigated or monitored. The Permittee shall collect QA/QC samples to monitor the validity of the soil, rock, and sediment sample collection procedures. Field duplicates will be collected at a rate of ten percent. The Permittee shall collect equipment blanks from all sampling apparatus at a frequency of ten percent for chemical analysis. Equipment blanks shall be collected at a frequency of one per day if disposable sampling equipment is used. The Permittee shall collect field blanks at a frequency of one per day for each medium (with the exception of air samples) at each SWMU, AOC, or other site. Reagent blanks shall be used if chemical analytical procedures requiring reagents are employed in the field as part of the investigation or monitoring program. The resulting data will provide information on the variability associated with sample collection, handling, and laboratory analysis operations. The blanks and duplicates shall be submitted for laboratory analyses associated with the project-specific contaminants, data quality concerns, and media being sampled.

5.2.2.f Sample Point and Structure Location Surveying

The horizontal and vertical coordinates of the top of each monitoring well casing and the ground surface at each monitoring well location shall be determined by a registered New Mexico professional land surveyor in accordance with the State Plane Coordinate System (NMSA 1978 47-1-49-56 (Repl. Pamp. 1993)). The surveys shall be conducted in accordance with Sections 500.1 through 500.12 of the Regulations and Rules of the Board of Registration for Professional Engineers and Surveyors Minimum Standards for Surveying in New Mexico. Horizontal positions shall be measured to the nearest 0.1-ft, and vertical elevations shall be measured to the nearest 0.01-ft. The Permittee shall prepare site map(s), certified by a registered New Mexico professional land surveyor, presenting all surveyed locations and elevations including relevant site features and structures for submittal with all associated reports to NMED.

Site attributes (e.g., soil sample locations, sediment sample locations, springs, outfalls, pertinent structures, monitoring stations, as well as staked out sampling grids), shall be located by using the global positioning system (GPS), another NMED-approved surveying system, or by using a registered New Mexico Registered Land Surveyor using the methods described in the paragraph above. If using GPS, horizontal locations shall be measured to the nearest 0.5 ft. The Permittee shall provide NMED a statement of accuracy for survey data upon request.

5.2.2.g Subsurface Vapor-Phase Monitoring and Sampling

Samples of subsurface vapors shall be collected from vapor monitoring points from both discrete zones, selected based on investigation and field screening results, and as total well subsurface vapor samples where required by NMED.

During subsurface drilling explorations at sites where there is a potential for vapor-phase contamination to be present, soil gas samples shall be obtained at NMED-approved intervals for field screening and/or laboratory analyses. An inflatable packer shall be dropped to isolate the bottom 2-3

feet of the borehole. The isolated portion of the borehole shall be purged by slowly removing approximately five times the volume of the annular space beneath the packer, followed by a VOC measurement using a PID equipped with a 11.7 eV lamp, a combustible gas indicator or other instrument approved by NMED. The data shall be logged and also used for determining the samples to be sent to an analytical laboratory.

The Permittee shall, as directed by NMED, collect vapor samples for field measurement of the following during subsurface vapor monitoring activities:

- Percent oxygen;
- Organic vapors (using a photo-ionization detector with an 11.7 eV (electron volt) lamp, a combustible vapor indicator or other method approved by NMED);
- Percent carbon dioxide;
- Static subsurface pressure; and
- Other parameters (such as carbon monoxide and hydrogen sulfide) as required by NMED.

The Permittee also shall collect vapor samples for laboratory analysis of the following as required:

- Percent moisture;
- VOCs; and
- Other analytes required by NMED.

Vapor samples analyzed by the laboratory for percent moisture and VOCs shall be collected using SUMMA canisters or other sample collection method approved by NMED. The samples shall be analyzed for VOC concentrations by EPA Method TO-15, as it may be updated, or equivalent VOC analytical method.

Field vapor measurements, the date and time of each measurement, and the instrument used shall be recorded on a vapor monitoring data sheet. The instruments used for field measurements shall be calibrated daily in accordance with the manufacturers specifications and as described in Section 5.2.4. The methods used to obtain vapor-phase field measurements and samples shall be approved by NMED in writing prior to the start of air monitoring at each Facility site where vapor-phase monitoring is conducted.

5.2.2.h Groundwater Monitoring

5.2.2.h.i Groundwater Levels

Groundwater level measurements shall be obtained at intervals required by NMED. Groundwater levels also shall be obtained prior to purging in preparation for a sampling event. Measurement data and the date and time of each measurement shall be recorded on a site monitoring data sheet. The depth to groundwater shall be measured to the nearest 0.01 ft. The depth to groundwater shall be recorded relative to the surveyed well casing rim or other surveyed datum.

Groundwater levels shall be measured in all wells at the Facility (or the number of wells otherwise specified in a NMED approved groundwater monitoring work plan) within 14 days of the

commencement of the monitoring activities. The Permittee shall conduct periodic measuring events, the schedule for which shall be provided in the groundwater monitoring work plans.

5.2.2.i Groundwater Sampling

Groundwater samples shall initially be obtained from newly installed monitoring wells between ten and 30 days after completion of well development. Groundwater monitoring and sampling shall be conducted at an interval approved by NMED after the initial sampling event. The Permittee shall sample all saturated zones screened to allow entry of groundwater into each monitoring well during each sampling event (or as otherwise specified in a NMED approved groundwater monitoring work plan). All requests for variances from the groundwater sampling schedule shall be submitted to NMED, in writing, no less than 30 days prior to the start of scheduled monitoring and sampling events. Groundwater samples shall be collected from all saturated zones, where possible, within exploratory borings not intended to be completed as monitoring wells prior to abandonment of the borings.

Water samples shall be analyzed in accordance with the NMED-approved groundwater monitoring work plan for one or more of the following general chemistry parameters as required by NMED:

nitrate/nitrite	sulfate	chloride	sodium
dissolved CO_2	alkalinity	carbonate/bicarbonate	boron
fluoride	manganese	calcium	silicon
ferric/ferrous iron	ammonia	potassium	phosphorus/phosphate
sulfide	bromide	magnesium	methane
TKN	total organic carbon	total dissolved solids	

5.2.2.i.i Well Purging

All zones in each monitoring well shall be purged by removing groundwater prior to sampling and in order to ensure that formation water is being sampled. Purge volumes shall be determined by monitoring, at a minimum, groundwater pH, specific conductance, dissolved oxygen concentrations, turbidity, redox potential, and temperature during purging of volumes and at measurement intervals approved by NMED in writing. The groundwater quality parameters shall be measured using a flow-through cell and instruments approved by NMED in writing. The volume of groundwater purged, the instruments used, and the readings obtained at each interval shall be recorded on the field monitoring log. In general, water samples may be obtained from the well after the measured parameters of the purge water have stabilized to within ten percent for three consecutive measurements. Well purging may also be conducted in accordance with NMED's Position Paper "Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring" (October 30, 2001). The Permittee may submit, to NMED for approval, a written request for a variance from the described methods of well purging for individual wells no later than 90 days prior to scheduled sampling activities. NMED will respond to the request, in writing, within 60 days of receipt of the variance request.

5.2.2.i.ii Groundwater Sample Collection

Groundwater samples shall be obtained from each well after a sufficient amount of water has been removed from the well casing to ensure that the sample is representative of formation water. Groundwater samples shall be obtained using methods approved by NMED within twenty-four hours of the completion of well purging. Sample collection methods shall be documented in the field monitoring reports. The samples shall be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures are described in Section 5.2.2.j of this Permit Appendix. Decontamination procedures shall be established for reusable water sampling equipment as described in Section 5.2.3 of this Permit Appendix.

All purged groundwater and decontamination water shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums, less-than-90-day storage areas or other containers approved by NMED until proper characterization and disposal can be arranged. The methods for disposal of purge/decontamination water shall be approved by NMED prior to removal from the temporary storage area. Disposable materials shall be handled as described in Section 5.2.5 of this Permit Appendix.

Groundwater samples intended for metals analysis shall be submitted to the laboratory as total metals samples. If required by NMED, the Permittee shall obtain groundwater samples for dissolved metals analysis to be filtered using disposable in-line filters with a 0.45 micron or other mesh size approved by NMED.

5.2.2.i.iii Surface Water Sample Collection

Surface water samples shall be collected using methods approved by NMED. Samples shall be collected in clean laboratory-prepared sampling containers. The methods and instruments used to measure field parameters shall be approved by NMED prior to conducting surface water sampling. The sampling and monitoring techniques used and the measurements obtained shall be recorded in the field monitoring reports.

5.2.2.i.iv Groundwater and Surface Water Sample Types

Groundwater samples shall be collected from each monitoring well and surface water samples shall be collected at predetermined locations. Field duplicates, field blanks, equipment rinseate blanks, reagent blanks, if necessary, and trip blanks shall be obtained for quality assurance during groundwater and surface water sampling activities. The samples shall be handled as described in Section 5.2.2.j of this Permit Appendix.

Field duplicate surface water and groundwater samples shall be obtained at a frequency of ten percent. At a minimum, one duplicate sample per sampling event shall always be obtained.

Field blanks shall be obtained at a frequency of no less than one per day per site or unit. Field blanks shall be generated by filling sample containers in the field with deionized water and submitting the samples, along with the groundwater or surface water samples, to the analytical laboratory for the appropriate analyses.

Equipment rinseate blanks shall be obtained for chemical analysis at the rate of five percent but no fewer than one rinseate blank per sampling day. Equipment rinsate blanks shall be collected at a rate of one per sampling day if disposable sampling apparatus is used. Rinsate samples shall be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinsate sample then shall be placed in the appropriate sample container and submitted with the groundwater or surface water samples to the analytical laboratory for the appropriate analyses.

Reagent blanks shall be obtained at a frequency of ten percent but no fewer than one per day per unit if chemical analyses requiring the use of chemical reagents are conducted in the field during water sampling activities.

Trip blanks shall accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks shall consist of a sample of analyte-free deionized water prepared by the laboratory and placed in an appropriate sample container. The trip blank shall be prepared by the analytical laboratory prior to the sampling event and shall be kept with the shipping containers and placed with other water samples obtained from the site each day. Trip blanks shall be analyzed at a frequency of one for each shipping container of samples.

5.2.2.j Sample Handling

At a minimum, the following procedures shall be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves shall be worn when collecting samples. New disposable gloves shall be used to collect each sample;

2. All samples collected of each medium for chemical analysis shall be transferred into clean sample containers supplied by the project analytical laboratory with the exception of soil, rock, and sediment samples obtained in brass sleeves, shelby tubes, thin wall samplers, or in Encore™ samplers. Upon recovery of the sample collected using split barrel samplers with brass sleeves, the brass sleeves shall be removed from the split barrel sampler and the open ends of the sleeves shall be lined with Teflon tape or foil and sealed with plastic caps. The caps shall be fastened to the sleeve with tape for storage and shipment to the analytical laboratory. Samples collected in shelby tubes or thin wall samplers shall be capped in a similar fashion. The sample depth and the top of the sample shall be clearly marked. Sample container volumes and preservation methods shall be in accordance with EPA SW-846 and established industry practices for use by accredited analytical laboratories. Sufficient sample volume shall be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis; and

3. Sample labels and documentation shall be completed for each sample following procedures included in the site-specific work plans approved by NMED. Immediately after the samples are collected, they shall be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described in Section 5.2.6.b of this Permit Appendix, shall be followed for all samples collected. All samples shall be submitted to the laboratory soon enough to allow the

laboratory to conduct the analyses within the method holding times. All samples shall be submitted to the laboratory within 48 hours after their collection.

Shipment procedures shall include the following:

1. Individual sample containers shall be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler shall be sealed and secured in case of sample container leakage. Temperature blanks shall be included with each shipping container;
2. Each cooler or other container shall be delivered directly to the analytical laboratory;
3. Glass bottles shall be separated in the shipping container by cushioning material to prevent breakage;
4. Plastic containers shall be protected from possible puncture during shipping using cushioning material;
5. The chain-of-custody form and sample request form shall be shipped inside the sealed storage container to be delivered to the laboratory;
6. Chain-of-custody seals shall be used to seal the sample-shipping container in conformance with EPA protocol; and
7. Signed and dated chain-of-custody seals shall be applied to each cooler prior to transport of samples from the site.

5.2.2.k In-situ Testing

In-situ permeability tests, remediation system pilot tests, stream flow tests, and other tests conducted to evaluate site and subsurface conditions shall be designed to accommodate specific site conditions and to achieve the test objectives. The testing methods shall be approved, in writing, by NMED prior to implementation. The tests shall be conducted in order to appropriately represent site conditions and in accordance with USGS, ASTM or other methods generally accepted by the industry. Detailed logs of all relevant site conditions and measurements shall be maintained during the testing events. If requested, a summary of the general test results, including unexpected or unusual test results and equipment failures or testing limitations shall be reported to NMED within 30 days of completion of the test. The summary shall be presented in a format acceptable to NMED and in general accordance with the report formats outlined in Permit Attachment 7 (*Reporting Requirements*). A report summarizing the results of each test shall be submitted to NMED within one hundred and twenty (120) days of completion of each test.

5.2.3 Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination. A designated decontamination area shall be established for decontamination of drilling equipment, reusable sampling equipment and well materials. The drilling rig shall be decontaminated prior to entering the site or unit. Drilling equipment or other exploration equipment that may come in contact with the borehole shall be decontaminated by steam cleaning, by hot-water pressure washing, or by other method approved by NMED prior to drilling each new boring.

Sampling or measurement equipment, including but not limited to, stainless steel sampling tools, split-barrel or core samplers, well developing or purging equipment, groundwater quality measurement instruments, and water level measurement instruments, shall be decontaminated in accordance with the following procedures or other methods approved by NMED before each sampling attempt or measurement:

1. Brush equipment with a wire or other suitable brush, if necessary or practicable, to remove large particulate matter;
2. Rinse with potable tap water;
3. Wash with nonphosphate detergent or other detergent approved by NMED (examples include Fantastik™, Liqui-Nox®) followed by a tap water rinse;
4. Rinse with 0.1 molar nitric acid (to remove trace metals, if necessary) followed by a tap water rinse;
5. Rinse with methanol (to remove organic compounds, if necessary) followed by a tap water rinse;
6. Rinse with potable tap water; and
7. Double rinse with deionized water.

All decontamination solutions shall be collected and stored temporarily as described in Section 5.2.5 of this Permit Appendix. Decontamination procedures and the cleaning agents used shall be documented in the daily field log.

5.2.4 Field Equipment Calibration Procedures

Field equipment requiring calibration shall be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. At a minimum, calibration checks shall be conducted daily, or at other intervals approved by NMED, and the instruments shall be recalibrated, if necessary. Calibration measurements shall be recorded in the daily field logs. If field equipment becomes inoperable, its use shall be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument shall be used.

5.2.5 Collection and Management of Investigation Derived Waste

Investigation derived waste (IDW) includes general refuse, drill cuttings, excess sample material, water (decontamination, development and purge), and disposable equipment generated during the course of investigation, corrective action, or monitoring activities. All IDW shall be properly characterized and disposed of in accordance with all Federal, State, and local rules and regulations for storage, labeling, handling, transport, and disposal of waste. The Permittee shall include a description of anticipated management of IDW as part of the applicable work plan submitted to NMED for approval prior to disposal of any IDW produced during investigation, corrective action, or monitoring activities. The Permittee may submit a request to NMED to dispose of IDW on a case-by-case basis prior to submittal of the applicable work plan.

All water generated during sampling and decontamination activities shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums or other containers

approved by NMED until proper characterization and disposal can be arranged. The IDW may be characterized for disposal based on the known or suspected contaminants potentially present in the waste. The methods for waste characterization and disposal of IDW shall be approved by NMED prior to removal from the temporary storage area.

5.2.6 Documentation of Field Activities

5.2.6.a General

Daily field activities, including observations and field procedures, shall be recorded on appropriate forms. The original field forms shall be maintained at the Facility. Copies of the completed forms shall be maintained in a bound and sequentially numbered field file for reference during field activities. Indelible ink shall be used to record all field activities. Photographic documentation of field activities shall be performed, as appropriate. The daily record of field activities shall include the following:

- Site or unit designation;
- Date;
- Time of arrival and departure;
- Field investigation team members including subcontractors and visitors;
- Weather conditions;
- Daily activities and times conducted;
- Observations;
- Record of samples collected with sample designations and locations specified;
- Photographic log;
- Field monitoring data, including health and safety monitoring if conditions arise that require modification of required work;
- Equipment used and calibration records, if appropriate;
- List of additional data sheets and maps completed;
- An inventory of the waste generated and the method of storage or disposal; and
- Signature of personnel completing the field record.

5.2.6.b Sample Custody

All samples collected for analysis shall be recorded in the field report or data sheets. Chain-of-custody forms shall be completed at the end of each sampling day, prior to the transfer of samples off site, and shall accompany the samples during shipment to the laboratory. A signed and dated custody seal shall be affixed to the lid of the shipping container. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form shall be signed as received by the laboratory, and the conditions of the samples shall be recorded on the form. The original chain-of-custody form shall remain with the laboratory and copies shall be returned to the relinquishing party. The Permittee shall maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of

the chain-of-custody records (either paper copies or electronically scanned in PDF format) shall be included with all draft and final laboratory reports submitted to NMED.

5.3 CHEMICAL ANALYSES

The Permittee shall submit all samples for laboratory analysis to accredited contract laboratories. The laboratories shall use the most recent EPA and industry-accepted extraction and analytical methods for chemical analyses for target analytes as the testing methods for each medium sampled. The Permittee shall use the most sensitive laboratory methods (with the lowest detection limits) available unless specific conditions preclude their use.

The Permittee shall submit a list of analytes and analytical methods to NMED, for review and written approval as part of each site-specific investigation, corrective action, or monitoring work plan. The detection limits for each method shall be less than applicable background, screening, and regulatory cleanup levels. The preferred method detection limits are a maximum of 20 percent of the cleanup, screening, or background levels. Analyses conducted with detection limits that are greater than applicable background, screening, and regulatory cleanup levels shall be considered data quality exceptions and the reasons for the elevated detection limits shall be reported to NMED. These data cannot be used for statistical analyses. All analytical data (non-detects, estimated blanks, and detects) shall be included in the electronic copy of the investigation report in Microsoft™ Excel format with qualifiers as attached from the analytical laboratory. The summary tables shall include only detects of the data based on the corresponding qualifiers. The Permittee shall not censor the data based on detection limits, quantitation limits, or measurement uncertainty.

5.3.1 Laboratory QA/QC Requirements

The following requirements for laboratory QA/QC procedures shall be considered the minimum QA/QC standards for the laboratories employed by the Permittee that provide analytical services for environmental investigation, corrective action, and monitoring activities conducted at the Facility. The Permittee shall provide the names of the contract analytical laboratories and copies of the laboratory quality assurance manuals to NMED within 90 days of awarding a contract for analytical services to any contract laboratory.

5.3.1.a Quality Assurance Procedures

Contract analytical laboratories shall maintain internal quality assurance programs in accordance with EPA and industry-wide accepted practices and procedures. At a minimum, the laboratories shall use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), blank spike/blank spike duplicates (BS/BSD), and laboratory control samples to demonstrate analytical QA/QC. The laboratories shall establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories shall establish internal QA/QC that meets EPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

5.3.1.b Equipment Calibration Procedures and Frequency

The laboratories' equipment calibration procedures, calibration frequency, and calibration standards shall be in accordance with the EPA test methodology requirements and documented in the

laboratories' quality assurance and SOP manuals. All instruments and equipment used by the laboratory shall be operated, calibrated, and maintained according to manufacturers' guidelines and recommendations. Operation, calibration, and maintenance shall be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance shall be kept on file at the laboratory.

5.3.1.c Laboratory QA/QC Samples

Analytical procedures shall be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs, and laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed shall be documented in the cited EPA or DOE test methodologies. At a minimum, the laboratory shall analyze laboratory blanks, MS/MSDs, BS/BSDs, and laboratory duplicates at a frequency of one in twenty for all batch runs requiring EPA test methods and at a frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples shall be specific to the project.

5.3.1.d Laboratory Deliverables

The laboratory analytical data package shall be prepared in accordance with EPA-established Level III or IV analytical support protocol. The following shall be provided in the analytical laboratory reports submitted to the Permittee either electronically or in hard (paper) copy for this project:

1. Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any data quality exceptions, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report.
2. Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; soil, rock, or sediment sample results in consistent units (mg/kg) or micrograms per kilogram in dry-weight basis; water sample results in consistent units (milligrams per liter or micrograms per liter (µg/L)); vapor sample results in consistent units (ppm or $\mu g/m^3$); and detection limits for undetected analytes. Results shall be reported for all field samples, including field duplicates and blanks, submitted for analysis.
3. Method blank results, including detection limits for undetected analytes.
4. Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only).
5. MS/MSD and/or BS/BSD spike concentrations, percent recoveries, relative percent differences (RPDs), and corresponding control limits.
6. Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits.
7. Sample chain-of-custody documentation.
8. Holding times and conditions.
9. Conformance with required analytical protocol(s).

10. Instrument calibration.
11. Blanks.
12. Detection/quantitation limits.
13. Recoveries of surrogates.
14. Variability for duplicate analyses.
15. Completeness.
16. Data report formats.
17. The following data deliverables for organic compounds shall be required from the laboratory:

- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;
- Report of sample collection, extraction, and analysis dates, including sample holding conditions;
- Tabulated results for samples in units as specified, including data qualification in conformance with EPA protocol, and definition of data descriptor codes;
- Reconstructed ion chromatograms for gas chromatograph/mass spectrometry (GC/MS) analyses for each sample and standard calibration;
- Selected ion chromatograms and mass spectra of detected target analytes (GC/MS) for each sample and calibration with associated library/reference spectra;
- Gas chromatograph/electron capture device (GC/ECD) and/or gas chromatograph/flame ionization detector (GC/FID) chromatograms for each sample and standard calibration;
- Raw data quantification reports for each sample and calibrations, including areas and retention times for analytes, surrogates, and internal standards;
- A calibration data summary reporting calibration range used and a measure of linearity [include decafluorotriphenylphosphine (DFTPP) and p-bromofluorobenzene (BFB) spectra and compliance with tuning criteria for GC/MS];
- Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitation limit for each analyte;
- Analyte concentrations with reporting units identified, including data qualification in conformance with the CLP Statement of Work (SOW) (include definition of data descriptor codes);
- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample;
- Recovery assessments and a replicate sample summary, including all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts); and

- Report of tentatively identified compounds with comparison of mass spectra to library/reference spectra.

18. The following data deliverables for inorganic compounds shall be required from the laboratory:

- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications; including signature from authority representative certifying to the quality and authenticity of data as reported;
- Report of sample collection, digestion, and analysis dates, with sample holding conditions;
- Tabulated results for samples in units as specified, including data qualification in conformance with the CLP SOW (including definition of data descriptor codes);
- Results of all method QA/QC checks, including inductively coupled plasma (ICP) Interference Check Sample and ICP serial dilution results;
- Tabulation of instrument and method practical detection/quantitation limits;
- Raw data quantification report for each sample;
- A calibration data summary reporting calibration range used and a measure of linearity, where appropriate;
- Final digestate volumes (and dilutions required), sample size, and wet-to-dry weight ratios;
- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample; and
- Recovery assessments and a replicate sample summary, including post-digestate spike analysis; all MS data (including spike concentrations) for each sample, if accomplished; all MS results (recoveries and spike amounts); and laboratory control sample analytical results).

The Permittee shall present summary tables of these data and Level II QA/QC results to NMED in the formats described in Permit Appendix 7 (*Reporting Requirements*) of this Permit. The raw analytical data, including calibration curves, instrument calibration data, data calculation work sheets, and other laboratory support data for samples from this project, shall be compiled and kept on file at the Facility for reference. The Permittee shall make the data available to NMED upon request.

5.3.2 Review of Field and Laboratory QA/QC Data

The Permittee shall evaluate the sample data, field, and laboratory QA/QC results for acceptability with respect to the data quality objectives (DQOs). Each group of samples shall be compared with the DQOs and evaluated using data validation guidelines contained in EPA guidance documents, the latest version of SW-846, and industry-accepted QA/QC methods and procedures.

The Permittee shall require the laboratory to notify the Facility project manager of data quality exceptions within one business day of discovery in order to allow for sample re-analysis, if possible. The Facility project manager shall contact NMED within one business day of receipt of laboratory notification of data quality exceptions that may affect the ability to meet the objectives of the investigation or compliance activity in order to discuss the implications and determine whether the data will still be considered acceptable or if sample re-analysis or resampling is necessary. The Facility

project manager shall summarize the results of the discussion with the NMED project leader regarding the data quality exceptions in a memorandum. The Permittee shall submit the memorandum to NMED by fax or electronic mail within three business days of the conclusion of the data quality discussion.

5.3.3 Blanks, Field Duplicates, Reporting Limits and Holding Times

5.3.3.a Blanks

The analytical results of field blanks and field rinseate blanks shall be reviewed to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by decontamination of sampling equipment. The analytical results of trip blanks shall be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. The analytical results of laboratory blanks shall be reviewed to evaluate the possibility of contamination caused by the analytical procedures. If contaminants are detected in field or laboratory blanks, the sample data shall be qualified, as appropriate.

5.3.3.b Field Duplicates

Field duplicates shall consist of two samples either split from the same sample device or collected sequentially. Field duplicate samples shall be collected at a minimum frequency of ten percent of the total number of samples submitted for analysis. RPDs for field duplicates shall be calculated. A precision of no more than 20 percent for duplicates shall be considered acceptable for soil, rock, and sediment sampling conducted at the Facility. The analytical DQO for precision shall be used for water duplicates.

5.3.3.c Method Reporting Limits

Method reporting limits for sample analyses for each medium shall be established at the lowest level practicable for the method and analyte concentrations and shall not exceed soil, groundwater, surface water, or vapor emissions background levels, cleanup standards, and screening levels. The preferred method detection limits are a maximum of 20 percent of the background, screening, or cleanup levels. Detection limits that exceed established soil, groundwater, surface water, or air emissions cleanup standards, screening levels, or background levels and are reported as "not detected" shall be considered data quality exceptions and an explanation for the exceedance and its acceptability for use shall be provided.

5.3.3.d Holding Times

The Permittee shall review the sampling, extraction, and analysis dates to confirm that extraction and analyses were completed within the recommended holding times, as specified by EPA protocol. Appropriate data qualifiers shall be noted if holding times were exceeded.

5.3.4 Representativeness and Comparability

5.3.4.a Representativeness

Representativeness is a qualitative parameter related to the degree to which the sample data represent the relevant specific characteristics of the media sampled. The Permittee shall implement procedures to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. The Permittee shall note any procedures or variations that may affect the collection or analysis of representative samples and shall qualify the data.

5.3.4.b Comparability

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, the Permittee shall report analytical results in appropriate units for comparison with other data (past studies, comparable sites, screening levels, and cleanup standards), and shall implement standard collection and analytical procedures. Any procedure or variation that may affect comparability shall be noted and the data shall be qualified.

5.3.5 Laboratory Reporting, Documentation, Data Reduction, and Corrective Action

Upon receipt of each laboratory data package, data shall be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria shall be noted and the data will be qualified. A full review and discussion of analytical data QA/QC and all data qualifiers shall be submitted as appendices or attachments to investigation and monitoring reports prepared in accordance with Permit Appendix 7 (*Reporting Requirements*) of this Permit. Data validation procedures for all samples shall include checking the following, when appropriate:

1. Holding times;
2. Detection limits;
3. Field equipment rinseate blanks;
4. Field blanks;
5. Field duplicates;
6. Trip blanks;
7. Reagent blanks;
8. Laboratory duplicates;
9. Laboratory blanks;
10. Laboratory matrix spikes;
11. Laboratory matrix spike duplicates;
12. Laboratory blank spikes;
13. Laboratory blank spike duplicates; and

14. Surrogate recoveries.

If significant quality assurance problems are encountered, appropriate corrective action shall be implemented. All corrective action shall be defensible and the corrected data shall be qualified.

5.4 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

The Permittee shall prepare human health and ecological risk assessment report for determination of clean closure, risk-based closure, and/or in support of corrective action. Risk assessments shall be conducted in accordance with current and acceptable United States Environmental Protection Agency (EPA), Regional EPA, and NMED guidance and methodology.

5.4.1 Human Health Risk Assessment Methods

A risk assessment may be required for human receptors that are potentially exposed to site-related chemicals in environmental media. The risk assessment shall contain a conceptual site model (CSM), which shall aid in understanding and describing each site. The CSM shall address the following components:

1. Identification of suspected sources,
2. Identification of contaminants,
3. Identification of contaminant releases,
4. Identification of transport mechanisms,
5. Identification of affected media,
6. Identification of land use scenarios,
7. Identification of potential receptors under current land use scenario,
8. Identification of potential receptors under future land use scenario, and
9. Identification of potential routes of exposure.

Potential human receptors under current and/or future land use scenarios may include residential, industrial, construction, and recreational. Other special receptors may be required on a site-specific basis.

5.4.1.a Exposure Pathways

The identification of exposure pathways shall include of discussion of all potential pathways and justify whether the pathways are complete. Pathways that shall be considered include soil, groundwater, air, surface water, sediment, and biota. An evaluation of the potential for contaminants to migrate from soil to groundwater shall also be provided. The risk assessment shall also address exposure mechanisms for each exposure pathway, including ingestion, inhalation, dermal, and inhalation of volatile organic compounds volatilized from soil and/or groundwater.

5.4.1.b Data quality Assurance

The risk assessment shall include an evaluation of analytical data and the usability of the data in the assessment. Data validation shall be conducted in accordance with current EPA guidelines. The evaluation of data shall also include a comparison of detection limits with appropriate and current risk-based screening levels. Current EPA methodology for handling non-detects and replicates in the risk assessment shall be applied.

5.4.1.c Constituents of Potential Concern

Appropriate EPA and/or NMED guidance shall be used to identify constituents of potential concern (COPCs). With the exception of chemicals attributed to field or laboratory contamination, all analytes detected in sampled media (i.e., soil, air, surface water, groundwater, biota, and/or sediment) shall be retained or eliminated as COPCs using one or more of the following processes:

1. Site attribution analysis,

2. Essential nutrients, and/or

3. Risk-based toxicity screen.

Unless sufficient evidence and special circumstances can be provided by the Permittee, all detected organics not attributable to field or laboratory contamination shall be retained and treated as site-related chemicals.

Inorganics detected in site media shall be compared to an appropriate background data set to determine if concentrations are present at levels significantly above background. The site attribution analysis may consist of a tiered approached as follows:

1. Comparison of maximum detected site concentrations to a background reference value (e.g., upper tolerance limit, UTL);

2. If the site maximum exceeds the background reference value, and sample size is sufficient, statistically compare the site data set to the background data set using appropriate statistical analyses (e.g., Wilcoxon Rank Sum Test);

3. Conduct a graphical analysis of site data and background data (e.g., histograms and/or box and whisker plots);

4. Conduct a geochemical analysis of site data to a background reference chemical; and/or

5. Evaluate essential nutrients and compare to recommended daily allowances and/or upper intake limits.

All inorganics for which the site attribution analyses indicate are present above natural background shall be retained as COPCs for the risk assessments.

5.4.1.d Risk-based Toxicity Screen

The Permittee may conduct a risk-based screening assessment to identify the COPCs that are likely to contribute significantly to risks calculated for each exposure scenario and exposure medium in order to focus the risk assessment on those chemicals that contribute the greatest significance to overall risk. The risk-based screening assessment shall consist of the comparison of the maximum detected site concentration to an appropriate risk-based screening level (e.g., New Mexico Soil Screening Levels or EPA Regional Screening Levels). Chemicals for which the maximum detected site concentrations exceed the respective risk-based screening levels shall be retained for further risk analysis.

5.4.1.e Exposure Point Concentrations

The Permittee shall determine exposure point concentrations (EPCs) that are representative of the concentrations of chemicals in each given medium to which a receptor may be exposed. EPA recommends a 95% estimate of the upper confidence limit (95% UCL) on the arithmetic mean be used as an EPC for chronic exposures. For acute exposures, the maximum detected site concentration shall be used as the EPC.

The EPCs shall be determined using statistical analyses that are data distribution and size dependent. EPA and/or NMED accepted guidance and methodologies shall be used, such as the ProUCL software.

EPCs shall be calculated for soil, groundwater, surface water, sediment, and biota.

EPA does not recommend estimating intakes for the air inhalation pathway, but rather compares estimated volatile/particulate air concentrations adjusted for exposure frequencies, duration, and time. For inhalation of volatiles/particulates from soil, EPCs shall be determined based upon the current EPA and/or State methodology, based upon the volatilization factor or particulate emission factor. Indoor air concentrations shall be determined using EPA and State accepted approaches, such as the EPA-recommended Johnson and Ettinger model.

5.4.1.f Exposure Assumptions

The Permittee shall use EPA and/or State approved exposure assumptions. Exposure assumptions may be based upon site-specific data.

5.4.1.g Toxicity Assessment

1. The Permittee shall use the most recently available toxicity factors to calculate carcinogenic and noncarcinogenic risks/hazards based upon the currently acceptable hierarchy of sources for toxicity data.

5.4.1.h Toxicity Assessment

The Permittee shall quantitatively estimate the potential for carcinogenic (risk) and noncarcinogenic (hazard) effects for all chemicals with toxicity data and provide a discussion of uncertainties associated with the risk assessment. Cumulative effects for risk and hazard shall be determined.

For those chemicals without toxicity data, appropriate surrogate data may be applied. If surrogate toxicity data are not available, risks/hazards shall be qualitatively addressed in the uncertainties section of the report.

5.4.1.i Uncertainties

The Permittee shall provide an uncertainties section that discusses all assumptions, professional judgments, and data which may result in uncertainties in the final estimates of risk and hazard. The uncertainties shall also discuss whether risks/hazards may have been under or overestimated due to the assumptions made in the assessment.

5.4.2 Ecological Risk Assessment Methods

An ecological risk assessment may be required for receptors that are potentially exposed to site-related chemicals in environmental media. The ecological risk assessment process shall consist of a scoping assessment, a screening-level assessment, and if warranted, a site-specific assessment. Based upon the results of the scoping assessment, the Permittee shall demonstrate whether additional analyses are warranted. If the scoping assessment indicates that there is potential for ecological hazard, a screening-level ecological risk assessment shall be conducted. Based upon the results of the screening assessment, a site-specific ecological risk assessment may or may not be necessary.

5.4.2.a Scoping Assessment

In order to assess whether ecological hazards are a concern at the site, the Permittee shall conduct a scoping assessment. The New Mexico Environment Department's "Site Assessment Checklist" and/or other current EPA and/or NMED guidance shall be used for conducting the scoping assessment. The site assessment checklist and/or scoping report shall contain the following information:

1. Scope and intent,

2. Specific site information (including site location and site characterization),

3. Findings of a site investigation (including habitat and exposure pathway evaluation),

4. Identification of ecological receptors of potential concern, and

5. Preliminary conceptual site exposure model (including complete exposure pathways).

If the scoping assessment indicates that there are any rare, threatened, endangered or otherwise protected species using the property, and/or there are any species which are considered a recreational or a commercial resource, and/or plants or animal species using the affected property for habitat or foraging and could come into contact with site contaminants, then the Permittee shall conduct a screening level ecological risk assessment.

5.4.2.b Screening Level Ecological Risk Assessment

The screening level ecological risk assessment shall be conducted in accordance with current EPA and/or NMED approved methodologies. The Permittee shall establish ecologically based screening levels (EBSL) calculated using dietary exposure models and toxicity reference values (TRVs). The screening level hazard quotient shall be calculated for each constituent of potential ecological concern (COPEC) in each media using the maximum detected site concentration and the calculated EBSL. The assessment of overall risk shall include cumulative risk if more than one COPEC is present at a site.

5.4.2.c Site-specific Ecological Risk Assessment

If the screening level ecological risk assessment indicates unacceptable risk, then the Permittee shall conduct a site-specific ecological risk assessment. The assessment shall be conducted using EPA and/or NMED approved guidance and methodologies. The ecological risk assessment shall follow the same methodologies outlined above in the human health risk assessment for determining COPEC and data quality assurance.

5.5 DETERMINATION OF BACKGROUND

The Permittee shall determine an appropriate background data set for inorganic constituents at the site. The Permittee shall determine whether one or more background data sets are appropriate depending on soil types and geology at the site. Background concentrations for groundwater shall be collected from upgradient wells. The background data set shall be representative of natural conditions unaffected by site activities and shall be statistically defensible. A sufficient number of background samples shall be collected for use in the risk assessment, including conducting site attribution analyses and comparison of data sets.

The Permittee shall provide summary statistics for background metals concentrations in each medium of concern and include the following information:

1. Number of detects,
2. Total number of samples,
3. Frequency of detection,
4. Minimum detected concentration,
5. Maximum detected concentration,
6. Minimum sample quantitation limit (SQL),
7. Maximum SQL,
8. Arithmetic mean,
9. Median,

10. Standard deviation, and

11. Coefficient of variation.

The Permittee shall determine the 95% upper tolerance limit (UTL) for each metal using statistical methods that are distribution based.

5.5.1 Comparing Site Data to Background

The 95% UTL for each metal shall be used as the background reference value for use in screening assessments and determining whether metals are present in soil/groundwater/surface water/sediment due to site activities. The site maximum detected concentration shall be compared to the 95% UTL for each metal. If the site maximum detected concentration is greater than the background reference value, then additional site attribution analyses shall be conducted.

Site attribution analyses shall be conducted in accordance with current EPA and/or NMED accepted guidance. The site attribution analyses shall consist of a statistical comparison of the background data set to the site data set, using distribution based tests such as the Wilcoxon Rank Sum Test.

If the results of the site attribution analyses indicate that the metal is present at the site above naturally occurring levels, then the Permittee shall include that metal as a site contaminant.

APPENDIX 6
MONITORING WELL CONSTRUCTION REQUIREMENTS

6.1 TYPES OF MONITORING WELLS

Two types of groundwater monitoring wells may be installed at the Facility: single completion (containing one screened interval) and multiple screened wells. General drilling procedures are presented in Section 6.2 and monitoring well construction requirements are presented in Section 6.3 of this Permit Attachment.

6.2 DRILLING METHODS

Groundwater monitoring wells and piezometers must be designed and constructed in a manner which will yield high quality samples, ensure that the well will last the duration of the project, and ensure that the well will not serve as a conduit for contaminants to migrate between different stratigraphic units or aquifers. The design and construction of groundwater monitoring wells shall comply with the guidelines established in various EPA RCRA guidance, including, but not limited to:

- U.S. EPA, *RCRA Groundwater Monitoring: Draft Technical Guidance*, EPA/530-R-93-001, November, 1992;
- U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986; and
- Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., and Denne, J.E., *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA 600/4-89/034, 1989.

A variety of methods are available for drilling monitoring wells. While the selection of the drilling procedure is usually based on the site-specific geologic conditions, the following issues shall also be considered:

- Drilling shall be performed in a manner that minimizes impacts to the natural properties of the subsurface materials.
- Contamination and cross-contamination of groundwater and aquifer materials during drilling shall be avoided.
- The drilling method shall allow for the collection of representative samples of rock, unconsolidated materials, and soil.
- The drilling method shall allow the Permittee to determine when the appropriate location for the screened interval(s) has been encountered.
- The drilling method shall allow for the proper placement of the filter pack and annular sealants. The borehole diameter shall be at least four inches larger in diameter than the nominal diameter of the well casing and screen to allow adequate space for placement of the filter pack and annular sealants.

The drilling method shall allow for the collection of representative groundwater samples. Drilling fluids (which includes air) shall be used only when minimal impact to the surrounding formation and groundwater can be ensured.

A brief description of the different drilling methods that may be appropriate for the construction of monitoring wells at the Facility follows. Many of these methods may be used alone, or in combination, to install monitoring wells at the Facility. While the selection of the specific drilling procedure will usually depend on the site-specific geologic conditions, justification for the method selected must be provided to NMED.

6.2.1 Hollow-Stem Auger

The hollow-stem continuous flight auger consists of a hollow, steel shaft with a continuous, spiraled steel flight welded onto the exterior site of the stem. The stem is connected to an auger bit and, when rotated, transports cuttings to the surface. The hollow stem of the auger allows drill rods, split-spoon core barrels, Shelby tubes, and other samplers to be inserted through the center of the auger so that samples may be retrieved during the drilling operations. The hollow stem also acts to temporarily case the borehole, so that the well screen and casing (riser) may be inserted down through the center of the augers once the desired depth is reached, minimizing the risk of possible collapse of the borehole. A bottom plug or pilot bit can be fastened onto the bottom of the augers to keep out most of the soils and/or water that have a tendency to clog the bottom of the augers during drilling. Drilling without a center plug is acceptable provided that the soil plug, formed in the bottom of the auger, is removed before sampling or installing well casings. The soil plug can be removed by washing out the plug using a side discharge rotary bit, or augering out the plug with a solid-stem auger bit sized to fit inside the hollow-stem auger. In situations where heaving sands are a problem, potable water may be poured into the augers to equalize the pressure so that the inflow of formation materials and water shall be held to a minimum when the bottom plug is removed. The hollow-stem auger method is best suited for drilling shallow overburden wells.

6.2.2 Air Rotary/Air Down-The-Hole Hammer/ODEX

The air rotary method consists of a drill pipe or drill stem coupled to a drill bit that rotates and cuts through soils and rock. The cuttings produced from the rotation of the drilling bit are transported to the surface by compressed air, which is forced down the borehole through the drill pipe and returns to the surface through the annular space (between the drill pipe and the borehole wall). The circulation of the compressed air not only removes the cuttings from the borehole but also helps to cool the drill bit. The use of air rotary drilling is best suited for hard-rock formations. In soft unconsolidated formations, casing is driven to keep the formation from caving. When using air rotary, the air compressor shall have an in-line filter system to filter the air coming from the compressor. The filter system shall be inspected regularly to insure that the system is functioning properly. In addition, a cyclone velocity dissipator or similar air containment/dust-suppression system shall be used to funnel the cuttings to one location instead of allowing the cuttings to discharge uncontrolled from the borehole. Air rotary that employs the dual-tube (reverse circulation) drilling system is acceptable because the cuttings are contained within the drill stem and are discharged through a cyclone velocity dissipator to the ground surface.

The injection of air into the borehole during air rotary drilling has the potential to alter the natural properties of the subsurface. This can occur through air-stripping of the VOCs in both soil and groundwater in the vicinity of the borehole, altering the groundwater geochemical parameters (e.g., pH and redox potential), and potentially increasing biodegradation of organic compounds in the aquifer near the borehole. These factors may prevent the well from yielding groundwater samples that are representative of in-situ conditions.

In hard, abrasive, consolidated rock, a down-the-hole hammer may be more appropriate than the air rotary method. In this method, compressed air is used to actuate and operate a pneumatic hammer as well as lift the cuttings to the surface and cool the hammer bit. One drawback of the down-the-hole hammer is that oil is required in the air stream to lubricate the hammer-actuating device, and this oil could potentially contaminate the soil in the vicinity of the borehole and the aquifer.

The ODEX method is a variation of the air rotary method in which a casing-driving technique is used in combination with air rotary drilling. With the ODEX system, the drill bit extends outward and reams a pilot hole large enough for a casing assembly to slide down behind the drill bit assembly. As a result, casing is advanced simultaneously while drilling the hole.

6.2.3 Water Rotary and Mud Rotary

The water and mud rotary drilling methods consist of rotary drilling techniques where water or drilling mud is used as the circulating fluid. In both methods, the circulating fluid is pumped down through the drill pipe and is returned back up the borehole through the annular space. The circulating fluid stabilizes the borehole, cools the drill bit, and carries the drill cuttings up to the surface. While the water and mud rotary drilling techniques are rapid and effective drilling methods, the recognition of water-bearing zones is hampered by the addition of water into the system.

Mud rotary drilling is similar to water rotary drilling with the exception that mud additives are added to the water to change the properties (e.g., density, viscosity, yield point, gel strength, fluid-loss-control effectiveness, and lubricity) of the circulating fluid. Drilling muds provide greater borehole stabilization than water alone. There are several types of mud presently available, including bentonite, barium sulfate, organic polymers, cellulose polymers, and polyacrylamides. While drilling muds enhance the stability of the borehole and allow for drilling in formations not appropriate to other methods, they can adversely affect the hydrologic properties and geochemistry of the aquifer. For example, drilling fluid invasion and the buildup of borehole filter cake may reduce the effective porosity of the aquifer in the vicinity of the borehole. In addition, bentonite drilling muds may affect the pH of groundwater and organic polymer drilling muds have been observed to facilitate bacterial growth, which reduces the reliability of sampling results. If polymer emulsions are to be used in the drilling program at the Facility, polymer dispersion agents shall be used at the completion of the drilling program to remove the polymers from the boreholes. For example, if EZ Mud® is used as a drilling additive, a dispersant (e.g., BARAFOS® or five percent sodium hypochlorite) shall be used to disperse and chemically breakdown the polymer prior to developing and sampling the well. If drilling fluids are used as part of well installation, the Permittee must demonstrate that all data acquired from the well is representative of existing subsurface conditions using methods approved by NMED. The NMED may require additional sampling and testing periodically to ensure that the data collected is not affected by residual drilling fluids.

6.2.4 Dual-Wall Reverse Circulation

The dual-wall reverse circulation drilling method utilizes a double-wall drill pipe and has the reverse circulation of other conventional rotary drilling methods. The circulating fluid (water or air) is pumped down the borehole between the outer and inner drill pipe, and returns up the inner drill pipe. Cuttings are lifted to the surface through the inner drill pipe. The inner drill pipe rotates the bit, and the outer drill pipe acts as a casing and stabilizes the borehole. Typically, a tri-cone bit is used when drilling through unconsolidated formations and a down-the-hole hammer is used in hard rock.

The dual-wall reverse circulation rotary method is one of the better methods available for obtaining representative and continuous formation samples while drilling. If a roller cone bit is used, the formation that is being drilled is located only a few inches ahead of the double-wall pipe. As a result, the cuttings observed at the surface represent no more than one foot of the formation at any point in time.

When drilling with air, an in-line filter shall be used to remove oil or other impurities from the airstream. However, if a down-the-hole hammer is used, it must be used with caution since it requires oil in the airstream to lubricate the hammer. This could possibly introduce contaminants to the borehole and aquifer.

6.2.5 Resonant Sonic

Resonant sonic drilling is a method that uses a sonic drill head to produce high-frequency, high-force vibrations in a steel drill pipe. The vibrations in the pipe create a cutting action at the bit face, which allows a continuous core of the formation to move into a core barrel. The method requires no drilling fluid, drills very fast (up to one ft/sec in certain formations), drills at any angle through all formations (rock, clay, sand, boulders, permafrost, glacial till), and yields virtually no cuttings in the drilling process. While there are numerous advantages to this process, the primary disadvantage is the cost of the method. This drilling method has been proven and used at various facilities.

6.2.6 Cryogenic

Cryogenic drilling is a technique that uses standard air rotary drilling methods, but employs cold nitrogen gas as the circulating fluid instead of compressed air. The use of nitrogen gas as the circulation fluid freezes the borehole wall while drilling, which stabilizes unconsolidated sediments and prevents potential cross-contamination of different water-bearing zones. In addition, the method produces fewer cuttings than liquid based drilling methods, requires minimal equipment modifications to existing drill rigs, and does not add contaminants to the borehole during the drilling process due to the benign nature of nitrogen gas. The method is especially applicable for drilling through alternating hard (competent) and soft (unconsolidated) formations. This drilling method has been tested by the DOE and proposed for future use at various DOE facilities.

6.3 WELL CONSTRUCTION/COMPLETION METHODS

6.3.1 Well Construction Materials

Well construction materials shall be selected based on the goals and objectives of the proposed monitoring program and the geologic conditions at the site. When selecting well construction materials, the primary concern shall be selecting materials that will not contribute foreign constituents or remove contaminants from the groundwater. Other factors to be considered include the tensile strength, compressive strength, and collapse strength of the materials; length of time the monitoring well will be in service; and the material's resistance to chemical and microbiological corrosion. Generally, if the monitoring program requires the analysis of organic constituents, stainless steel or fluoropolymer materials should be used. However, if the monitoring program requires only inorganic constituent analyses, polyvinyl chloride (PVC) materials may be used. PVC should not be used for monitoring wells where organic constituents will be analyzed due to its potential for sorption and leaching of contaminants.

Well screen and casing materials acceptable for the construction of RCRA monitoring wells include stainless steel (304 or 316), rigid PVC (meeting American National Standards Institute/National Sanitation Foundation Standard 14), and fluoropolymer materials (polytetrafluoroethylene, fluorinated ethylene propylene, and polyvinylidene). In addition, there are other materials available for the construction of monitoring wells including acrylonitrile butadiene styrene (ABS), fiberglass-reinforced plastic (FRP), black iron, carbon steel, and galvanized steel, but these materials are not recommended for use in long term monitoring wells due to their low resistance to chemical attack and potential contribution of contamination to the groundwater. However, these materials may be used in the construction of monitoring wells where they will not be in contact with the groundwater that will be sampled (e.g., carbon steel pipe used as surface casing).

6.3.2 Well Construction Techniques

6.3.2.a Single-cased Wells

The borehole shall be bored, drilled, or augered as close to vertical as possible, and checked with a plumb bob, level, or appropriate downhole logging tool. Slanted boreholes shall not be acceptable unless specified in the design. The borehole shall be of sufficient diameter so that well construction can proceed without major difficulties. To assure an adequate size, a minimum two-inch annular space is required between the casing and the borehole wall (or the hollow-stem auger wall). The two-inch annular space around the casing will allow the filter pack, bentonite seal, and annular grout to be placed at an acceptable thickness. Also, the two-inch annular space will allow up to a 1.5-inch outer diameter tremie pipe to be used for placing the filter pack, bentonite seal, and grout at the specified intervals.

It may be necessary to overdrill the borehole so that any soils that have not been removed (or that have fallen into the borehole during augering or drill stem retrieval) will fall to the bottom of the borehole below the depth where the filter pack and well screen are to be placed. Normally, three to five ft is sufficient for overdrilling shallow wells. Deep wells may require deeper overdrilling. The borehole can also be overdrilled to allow for an extra space for a well sump to be installed. If the borehole is overdrilled deeper than desired, it can be backfilled to the designated depth with bentonite pellets or the filter pack.

The well casings (riser assembly) should be secured to the well screen by flush-jointed threads or other appropriate connections and placed into the borehole and plumbed by the use of centralizers, a plumb bob, or a level. No petroleum-based lubricating oils or grease shall be used on casing threads. Teflon tape can be used to wrap the threads to insure a tight fit and minimize leakage. No glue of any type shall be used to secure casing joints. Teflon "O" rings can also be used to ensure a tight fit and minimize leakage. "O" rings made of materials other than Teflon are not acceptable if the well will be sampled for organic compound analyses. Before the well screen and casings are placed at the bottom of the borehole, at least six inches of filter material shall be placed at the bottom to serve as a firm footing. The string of well screen and casing should then be placed into the borehole and plumbed. If centralizers are used, they shall be placed below the well screens and above the bentonite annular seals so that the placement of the filter pack, overlying bentonite seal, and annular grout will not be hindered. Centralizers placed in the wrong locations can cause bridging during material placement. If installing the well screen and casings through hollow-stem augers, the augers shall be slowly extracted as the filter pack, bentonite seal, and grout are tremied or poured into place. The gradual extraction of the augers will allow the materials being placed in the augers to flow out

of the bottom of the augers into the borehole. If the augers are not gradually extracted, the materials will accumulate at the bottom of the augers causing potential bridging problems. After the string of well screen and casing is plumb, the filter material shall be placed around the well screen (preferably by the tremie pipe method) up to the designated depth. After the filter pack has been installed, the bentonite seal shall be placed directly on top of the filter pack up to the designated depth or a minimum of two ft above the filter pack, whichever is greater. After the bentonite seal has hydrated for the specified time, the annular grout shall be pumped by the tremie method into the annular space around the casings (riser assembly) up to within two ft of the ground surface or below the frost line, whichever is greater. The grout shall be allowed to cure for a minimum of 24 hours before the surface pad and protective casing are installed. After the surface pad and protective casing are installed, bumper guards (guideposts) shall be installed (if necessary).

6.3.2.b Double-cased Wells

Double-cased wells should be constructed when there is reason to believe that interconnection of two aquifers by well construction may cause cross contamination, or when flowing sands make it impossible to install a monitoring well using conventional methods. A pilot borehole should be advanced through the overburden and the contaminated zone into a clay, confining layer, or bedrock. An outer casing (surface or pilot casing) shall be placed into the borehole and sealed with grout. The borehole and outer casing should extend into tight clay a minimum of two ft or into competent bedrock a minimum of one foot. The total depth into the clay or bedrock will vary depending upon the plasticity of the clay and the extent of weathering and fracturing of the bedrock. The size of the outer casing shall be of sufficient inside diameter to contain the inner casing and the two-inch annular space. In addition, the borehole shall be of sufficient size to contain the outer casing and the two-inch minimum outer annular space, if applicable.

The outer casing shall be grouted by the tremie method from the bottom of the borehole to within two ft of the ground surface. The grout shall be pumped into the annular space between the outer casing and the borehole wall. This can be accomplished by either placing the tremie pipe in the annular space and pumping the grout from the bottom of the borehole to the surface, or placing a grout shoe or plug inside the casing at the bottom of the borehole and pumping the grout through the bottom grout plug and up the annular space on the outside of the casing. The grout shall consist of a Type I Portland cement and bentonite or other approved grout to provide a rigid seal. A minimum of 24 hours shall be allowed for the grout plug (seal) to cure before attempting to drill through it. When drilling through the seal, care shall be taken to avoid cracking, shattering, and washing out of the seal. If caving conditions exist so that the outer casing cannot be sufficiently sealed by grouting, the outer casing shall be driven into place and a grout seal placed in the bottom of the casing.

6.3.2.c Bedrock Wells

The installation of monitoring wells into bedrock can be accomplished in two ways. The first method is to drill or bore a pilot borehole through the soil overburden into the bedrock. An outer casing is installed into the borehole by setting it into the bedrock, and grouting it into place. After the grout has set, the borehole can be advanced through the grout seal into the bedrock. The preferred method of advancing the borehole into the bedrock is rock coring. Rock coring makes a smooth, round hole through the seal and into the bedrock without cracking or shattering the seal. Roller cone bits are used in soft bedrock, but extreme caution should be taken when using a roller cone bit to advance through the grout seal in the bottom of the borehole because excessive water and

bit pressure can cause cracking, eroding (washing), and/or shattering of the seal. Low volume air hammers may be used to advance the borehole, but they have a tendency to shatter the seal because of the hammering action. If the structural integrity of the grout seal is in question, a pressure test can be utilized to check for leaks. If the seal leaks, the seal is not acceptable. When the drilling is complete, the finished well will consist of an open borehole from the ground surface to the bottom of the well. The major limitation of open borehole bedrock wells is that the entire bedrock interval serves as the monitoring zone.

The second method is to install the outer surface casing and drill the borehole into bedrock, and then install an inner casing and well screen with the filter pack, bentonite seal, and annular grout. The well is completed with a surface protective casing and concrete pad. This well installation method gives the flexibility of isolating the monitoring zone(s) and minimizing inter-aquifer flow. In addition, it gives structural integrity to the well, especially in unstable areas (e.g., steeply dipping shales) where the bedrock has a tendency to shift or move when disturbed.

6.3.3 Well Screen and Filter Pack Design

Well screens and filter packs shall be designed to accurately sample the aquifer zone that the well is intended to sample, minimize the passage of formation materials (turbidity) into the well, and ensure sufficient structural integrity to prevent the collapse of the intake structure. The selection of the well screen length depends upon the objective of the well. Piezometers and wells where only a discrete flow path is monitored are generally completed with short screens (two ft or less). While monitoring wells are usually constructed with longer screens (usually five to ten ft), they shall be kept to the minimum length appropriate for intercepting a contaminant plume. The screen slot size shall be selected to retain from 90 to 100 percent of the filter pack material in artificially filter packed wells, and from 50 to 100 percent of the formation material in naturally packed wells. All well screens shall be factory wire-wrapped or machine slotted.

A filter pack shall be used when: 1) the natural formation is poorly sorted; 2) a long screen interval is required or the screen spans highly stratified geologic materials of widely varying grain sizes; 3) the natural formation is uniform fine sand, silt, or clay, 4) the natural formation is thin-bedded; 5) the natural formation is poorly cemented sandstone; 6) the natural formation is highly fractured or characterized by relatively large solution channels; 7) the natural formation is shale or coal that will act as a constant source of turbidity to groundwater samples; or 8) the diameter of the borehole is significantly greater than the diameter of the screen. The use of natural formation material as a filter pack is only recommended when the natural formation materials are relatively coarse-grained, permeable, and uniform in grain size.

Filter pack materials shall consist of clean, rounded to well-rounded, hard, insoluble particles of siliceous composition (industrial grade quartz sand or glass beads). The required grain-size distribution or particle sizes of the filter pack materials shall be selected based upon a sieve analysis of the aquifer materials or the formation to be monitored, or the characteristics of the aquifer materials using information acquired during previous investigations.

Where sieve analyses are used to select the appropriate filter pack particle size, the results of a sieve analysis of the formation materials are plotted on a grain-size distribution graph, and a grain-size distribution curve is generated. The 70 percent retained grain size value should be multiplied by a factor between four and six (four for fine, uniform formations and six for coarse, non-uniform formations). A second grain-size distribution curve is then drawn on the graph for this new value,

ensuring that the uniformity coefficient does not exceed 2.5. The filter pack that shall be used will fall within the area defined by these two curves.

Once the filter pack size is determined, the screen slot size shall be selected to retain at least 90 percent of the filter pack material. The Permittee may propose the use of a pre-determined well screen slot size and filter pack for monitoring wells in the site-specific work plans submitted to NMED.

The filter pack shall be installed in a manner that prevents bridging and particle-size segregation. Filter packs placed below the water table shall be installed by the tremie pipe method. Filter pack materials shall not be poured into the annular space unless the well is shallow (e.g., less than 30 ft deep) and the filter pack material can be poured continuously into the well without stopping. At least two inches of filter pack material shall be installed between the well screen and the borehole wall, and two ft of material shall extend above the top of the well screen. A minimum of six-inches of filter pack material shall also be placed under the bottom of the well screen to provide a firm footing and an unrestricted flow under the screened area. In deep wells (e.g., greater than 200 ft deep), the filter pack may not compress when initially installed. As a result, filter packs may need to be installed as high as five ft above the screened interval in these situations. The precise volume of filter pack material required shall be calculated and recorded before placement, and the actual volume used shall be determined and recorded during well construction. Any significant discrepancy between the calculated and actual volume shall be explained. Prior to installing the filter pack annular seal, a one to two-ft layer of chemically inert fine sand shall be placed over the filter pack to prevent the intrusion of annular sealants into the filter pack.

Several pre-fabricated groundwater sampling systems that can be installed in open boreholes are available on the market. These include multi-level borehole completion systems (e.g., Westbay MP System®) and pneumatically deployed inverting PVC membranes (e.g., SEAMIST). If these types of borehole completions are to be used in the Facility wells, they shall be installed under the supervision of personnel from the authorized vendor.

6.3.4 Annular Sealant

The annular space between the well casing and the borehole must be properly sealed to prevent cross-contamination of samples and the groundwater. The materials used for annular sealants shall be chemically inert with respect to the highest anticipated concentration of chemical constituents expected in the groundwater at the Facility. In general, the permeability of the sealing material shall be one to two orders of magnitude lower than the least permeable parts of the formation in contact with the well. The precise volume of annular sealants required shall be calculated and recorded before placement, and the actual volume shall be determined and recorded during well construction. Any significant discrepancy between the calculated volume and the actual volume shall be explained.

During well construction, an annular seal shall be placed on top of the filter pack. This seal shall consist of a high solids (10-30 percent) bentonite material in the form of bentonite pellets, granular bentonite, or bentonite chips. The bentonite seal shall be placed in the annulus through a tremie pipe if the well is deep (greater than 30 ft), or by pouring directly down the annulus in shallow wells (less than 30 ft). If the bentonite materials are poured directly down the annulus (which is an acceptable method only in wells less than 30 feet deep), a tamping device shall be used to ensure that the seal is emplaced at the proper depth and the bentonite has not bridged higher in the well casing. The

bentonite seal shall be placed above the filter pack a minimum of two ft vertical thickness. The bentonite seal shall be allowed to completely hydrate in conformance with the manufacturer's specifications prior to installing the overlying annular grout seal. The time required for the bentonite seal to completely hydrate will differ with the materials used and the specific conditions encountered, but is generally a minimum of four to 24 hours.

A grout seal shall be installed on top of the filter pack annular seal. The grout seal may consist of a high solids (30 percent) bentonite grout, a neat cement grout, or a cement/bentonite grout. The grout shall be pumped under pressure (not gravity fed) into the annular space by the tremie pipe method, from the top of the filter pack annular seal to within a few ft of the ground surface. The tremie pipe shall be equipped with a side discharge port (or bottom discharge for grouting at depths greater than 100 feet) to minimize damage to the filter pack or filter pack annular bentonite seal during grout placement. The grout seal shall be allowed to cure for a minimum of 24 hours before the concrete surface pad is installed. All grouts shall be prepared in accordance with the manufacturer's specifications. High solids (30 percent) bentonite grouts shall have a minimum density of ten pounds per gallon (as measured by a mud balance) to ensure proper setup. Cement grouts shall be mixed using six and one-half to seven gallons of water per 94-pound bag of Type I Portand cement. Bentonite (five to ten percent) may be added to delay the setting time and reduce the shrinkage of the grout.

6.3.5 Well Development

All monitoring wells shall be developed to create an effective filter pack around the well screen, correct damage to the formation caused by drilling, remove fine particles from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the well. Development stresses the formation around the screen, as well as the filter pack, so that mobile fines, silts, and clays are pulled into the well and removed. Development is also used to remove any foreign materials (e.g., water, drilling mud) that may have been introduced into the borehole during the drilling and well installation activities, and to aid in the equilibration that will occur between the filter pack, well casing, and the formation water. The development of a well is extremely important to ensuring the collection of representative groundwater samples.

Newly installed monitoring wells shall not be developed for at least 48 hours after the surface pad and outer protective casing are installed. This will allow sufficient time for the well materials to cure before the development procedures are initiated. A new monitoring well shall be developed until the column of water in the well is free of visible sediment, and the pH, temperature, turbidity, and specific conductivity have stabilized. In most cases, the above requirements can be satisfied. However, in some cases, the pH, temperature, and specific conductivity may stabilize but the water remains turbid. In this case, the well may still contain well construction materials, such as drilling mud in the form of a mud cake or formation soils that have not been washed out of the borehole. Thick drilling mud cannot be flushed out of a borehole with one or two well volumes of flushing. Instead, continuous flushing over a period of several days may be necessary to complete the well development. If the well is pumped dry, the water level shall be allowed to sufficiently recover before the next development period is initiated. The common methods used for developing wells include:

- Pumping and overpumping;
- Backwashing;

- Surging (with a surge block);
- Bailing;
- Jetting; and
- Airlift pumping.

These development procedures can be used, either individually or in combination, to achieve the most effective well development. However, the most favorable well development methods include pumping, overpumping, bailing, surging, or a combination of these methods. Well development methods and equipment that alter the chemical composition of the groundwater shall not be used. Development methods that involve adding water or other fluids to the well or borehole, or that use air to accomplish well development should be avoided, if possible. Approval shall be obtained from NMED prior to introducing air, water, or other fluids into the well for the purpose of well development. If water is introduced to a borehole during well drilling and completion, then the same or greater volume of water shall be removed from the well during development. In addition, the volume of water withdrawn from a well during development shall be recorded.

6.3.6 Surface Completion

Monitoring wells may be completed either as flush-mounted wells, or as above-ground completions. A surface seal shall be installed over the grout seal and extended vertically up the well annulus to the land surface. The lower end of the surface seal shall extend a minimum of one foot below the frost line to prevent damage from frost heaving. The composition of the surface seal shall be neat cement or concrete. In above-ground completions, a three-feet wide, four-inch thick concrete surface pad shall be installed around the well at the same time the protective casing is installed. The surface pad shall be sloped so that drainage will flow away from the protective casing and off the pad. In addition, a minimum of one inch of the finished pad shall be below grade or ground elevation to prevent washing and undermining by soil erosion.

A locking protective casing shall be installed around the well casing (riser) to prevent damage or unauthorized entry. The protective casing shall be anchored in the concrete surface pad below the frost line and extend several inches above the well riser stickup. A weep hole shall be drilled into the protective casing just above the top of the concrete surface pad to prevent water from accumulating and freezing inside the protective casing around the well riser. A cap shall be placed on the well riser to prevent tampering or the entry of foreign materials, and a lock shall be installed on the protective casing to provide security. If the wells are located in an area that receives traffic, a minimum of three bumper guards consisting of steel pipes three to four inches in diameter and a minimum of five-feet length should be installed. The bumper guards should be installed to a minimum depth of two feet below the ground surface in a concrete footing and extend a minimum of three feet above ground surface. The pipes should be filled with concrete to provide additional strength. The pipes should be painted a bright color to reduce the possibility of vehicular damage.

If flush-mounted completions are required (e.g., in active roadway areas), a protective structure such as a utility vault or meter box should be installed around the well casing. In addition, measures should be taken to prevent the accumulation of surface water in the protective structure and around the well intake. These measures should include outfitting the protective structure with a steel lid or manhole cover that has a rubber seal or gasket, and ensuring that the bond between the cement surface seal and the protective structure is watertight.

6.4 WELL ABANDONMENT

All well abandonment must be conducted in accordance with 19.27.4 NMAC. Wells are usually abandoned when they are no longer required in the monitoring network or when they are damaged beyond repair. The goal of well abandonment is to seal the borehole in such a manner that the well cannot act as a conduit for migration of contaminants from the ground surface to the aquifer or between aquifers. To properly abandon a well, the preferred method is to completely remove the well casing and screen from the borehole, clean out the borehole, and backfill with a cement or bentonite grout, neat cement, or concrete. The well abandonment procedure must also comply with current EPA well abandonment guidance.

For wells with small diameter casing, abandonment shall be accomplished by overdrilling the well with a large diameter hollow-stem auger. After the well has been overdrilled, the well casing and grout can be lifted out of the ground with a drill rig, and the remaining filter pack can be drilled out. The open borehole can then be pressure grouted (via the tremie pipe method) from the bottom of the borehole to the ground surface. After the grout has cured, the top two ft of the borehole shall be filled with concrete to insure a secure surface seal.

Several other well abandonment procedures are available for wells with larger diameter screens and casings. One method is to force a drill stem with a tapered wedge assembly or a solid-stem auger into the well casing and pull the casing out of the ground. However, if the casing breaks or the well cannot be pulled from the ground, the well will have to be grouted in place. To abandon a well in place, a tremie pipe shall be placed at the lowest point in the well (at the bottom of the screen or in the well sump). The entire well is then pressure grouted from the bottom of the well upward. The pressurized grout will be forced out through the well screen into the filter pack and up the inside of the well casing sealing off all breaks and holes in the casing. Once the well is grouted, the casing is cut off even with the ground surface and covered with concrete.

If a PVC well cannot be abandoned due to internal casing damage (e.g., the tremie pipe cannot be extended to the bottom of the screen), it may be necessary to drill out the casing with a roller cone or drag bit using the wet rotary drilling method, or grind out the casing using a solid-stem auger equipped with a carbide tooth bit. Once the casing is removed, the open borehole can be cleaned out and pressure grouted from the bottom of the borehole upward.

6.5 DOCUMENTATION

All information on the design, construction, and development of each monitoring well shall be recorded and presented on a boring log, a well construction log, and well construction diagram. The well construction log and well construction diagram shall include the following information:

- Well name/number;
- Date/time of well construction;
- Borehole diameter and well casing diameter;
- Well depth;
- Casing length;
- Casing materials;

- Casing and screen joint type;
- Screened interval(s);
- Screen materials;
- Screen slot size and design;
- Filter pack material and size;
- Filter pack volume (calculated and actual);
- Filter pack placement method;
- Filter pack interval(s);
- Annular sealant composition;
- Annular sealant placement method;
- Annular sealant volume (calculated and actual);
- Annular sealant interval(s);
- Surface sealant composition;
- Surface seal placement method;
- Surface sealant volume (calculated and actual);
- Surface sealant interval;
- Surface seal and well apron design and construction;
- Well development procedure and turbidity measurements;
- Well development purge volume(s) and stabilization parameter measurements;
- Type and design and construction of protective casing;
- Well cap and lock;
- Ground surface elevation;
- Survey reference point elevation on well casing;
- Top of monitoring well casing elevation; and
- Top of protective steel casing elevation.

APPENDIX 7
REPORTING REQUIREMENTS

7.1 GENERAL

The purpose of this Appendix 7 is to provide the reporting requirements and report formats for corrective action activities at all SWMUs, AOCs, and permitted units required under this Permit. This attachment is not intended to provide reporting requirements for every potential corrective action conducted at the Facility; therefore, the formats for all types of reports are not presented below. The described formats include the general reporting requirements and formats for site-specific investigation work plans, investigation reports, periodic monitoring reports, risk assessment reports, and corrective measures evaluations. The Permittee shall generally consider the reports to be the equivalents of RCRA Facility Investigation (RFI) work plans, RFI reports, periodic monitoring reports, risk assessments, Corrective Measures Study (CMS) plans, and CMS reports, for the purposes of RCRA compliance. The Permittee shall include detailed, site-specific requirements in all SWMU, AOC, permitted unit and Facility-wide investigation work plans, investigation reports, monitoring reports, and corrective measures evaluations. All plans and reports shall be prepared with technical and regulatory input from NMED. All work plans, reports and other documents shall be submitted to NMED in the form of two paper copies and one copy in electronic or other format acceptable to NMED. The Permittee shall submit maps and figures in a format specified by NMED (e.g., *shp, *dwg).

The reporting requirements listed in this attachment do not include all sections that may be necessary to complete each type of report listed and may include sections that are not relevant for a specific site action. The Permittee or NMED may determine that additional sections may be needed to address additional site-specific issues or information collected during corrective action or monitoring activities not listed below. However, the Permittee must submit variations of the general report format and the formats for reports not listed in this Appendix (7) in outline form to NMED for approval prior to submittal of the reports. All work plans and reports are subject to the procedures in Permit Section I.L. NMED will approve or disapprove, in writing, the proposed report outline within 90 days of receipt of the outline. If NMED disapproves the report outline, NMED will notify the Permittee, in writing, of the outline's deficiencies and will specify a date for submittal of a revised report outline. All reports submitted by the Permittee shall follow the general approach and limitations for data presentation described in this attachment.

7.2 INVESTIGATION WORK PLAN

The Permittee shall prepare work plans subject to the procedures of Permit Section I.L for site investigations or corrective action activities at the Facility using the general outline below. The minimum requirements for describing proposed activities within each section are included. All research, locations, depths and methods of exploration, field procedures, analytical results, data collection methods, and schedules shall be included in each work plan. In general, interpretation of data acquired during previous investigations shall be presented only in the background sections of the work plans. The other text sections of the work plans shall be reserved for presentation of anticipated site-specific activities and procedures relevant to the project. The general work plan outline is described below.

7.2.1 Title Page

The title page shall include the type of document; Facility name; Area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible WSMR representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 CFR 270.11(d)(1).

7.2.2 Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose and scope of the investigation to be conducted at the subject site. The Facility, SWMU or AOC name, site name, any other unit name, location, and Area designation shall be included in the executive summary.

7.2.3 Table of Contents

The table of contents shall list all text sections, tables, figures, and appendices or attachments included in the work plan. The corresponding page numbers for the titles of each section of the work plan shall be included in the table of contents.

7.2.4 Introduction

The introduction shall include the Facility name, Area designation, unit location, and unit status (e.g., closed, corrective action). General information on the current site usage and status shall be included in this section. A brief description of the purpose of the investigation and the type of site investigation to be conducted shall be provided in this section.

7.2.5 Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of pertinent subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background summary and labeled on the figure, unless none exist.

This section shall identify potential receptors, including groundwater, and include a brief summary of the type and characteristics of all waste and all contaminants managed or released at the site, the known and possible sources of contamination, the history of releases or discharges of contamination, and the known extent of contamination. This section shall include brief summaries of results of previous investigations, if conducted, including references to pertinent figures, data summary tables, and text in previous reports. At a minimum, detections of contaminants encountered during previous investigations shall be presented in table format, with an accompanying figure showing sample locations. References to previous reports shall include page, table, and figure numbers for referenced information. Summary data tables and site plans showing relevant investigation locations shall be included in the Tables and Figures sections of the document, respectively.

7.2.6 Site Conditions

7.2.6.a Surface Conditions

A section on surface conditions shall provide a brief detailed description of current site topography, features and structures including a description of topographic drainages, man-made drainages, vegetation, erosional features, and basins. It shall also include a detailed description of current site usage and any current operations at the site. In addition, descriptions of features located in surrounding sites that may have an impact on the subject site regarding sediment transport, surface water runoff, or contaminant fate and transport shall be included in this section.

7.2.6.b Subsurface Conditions

A section on subsurface conditions shall provide a brief, detailed description of the site conditions observed during previous subsurface investigations, including relevant soil horizons, stratigraphy, presence of groundwater, and other relevant information. A site plan showing the locations of all borings and excavations advanced during previous investigations shall be included in the Figures section of the work plan. A brief description of the anticipated stratigraphic units that may be encountered during the investigation may be included in this subsection if no previous investigations have been conducted at the site.

7.2.7 Scope of Activities

A section on the scope of activities shall briefly describe a list of all anticipated activities to be performed during the investigation including background information research, health and safety requirements that may affect or limit the completion of tasks, drilling, test pit or other excavations, well construction, field data collection, survey data collection, chemical analytical testing, aquifer testing, remediation system pilot tests, and IDW storage and disposal.

7.2.8 Investigation Methods

A section on investigation methods shall provide a description of all anticipated locations and methods for conducting the activities to be performed during the investigation. This section shall include research methods, health and safety practices that may affect the completion of tasks, drilling methods, test pit or other excavation methods, sampling intervals and methods, well construction methods, field data collection methods, geophysical and land survey methods, field screening methods, chemical analytical testing, materials testing, aquifer testing, pilot tests, and other proposed investigation and testing methods. This information may also be summarized in table format, if appropriate.

7.2.9 Monitoring And Sampling Program

A section on monitoring and sampling shall provide a description of the groundwater, ambient air, subsurface vapor, remediation system, engineering controls, and other monitoring and sampling programs currently being implemented at the site.

7.2.10 Schedule

A section shall set forth the anticipated schedule for completion of field investigation, pilot testing, and monitoring and sampling activities. In addition, this section shall set forth a schedule for submittal of reports and data to NMED including a schedule for submitting all status reports and preliminary data.

7.2.11 Tables

The following summary tables may be included in the investigation work plans, if previous investigations have been conducted at the site. Data presented in the tables shall include information on dates of data collection, analytical methods, detection limits, and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. Summaries of regulatory criteria, background, and applicable cleanup levels (may be included in the analytical data tables instead of as separate tables).
2. Summaries of historical field survey location data.
3. Summaries of historical field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.
4. Summaries of historical soil, rock, or sediment laboratory analytical data shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
5. Summaries of historical groundwater elevation and depth to groundwater data. The table shall include the monitoring well depths, the screened intervals in each well, and the dates and times measurements were taken.
6. Summaries of historical groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
7. Summary of historical surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
8. Summary of historical air sample screening and chemical analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.
9. Summary of historical pilot or other test data, if applicable, including units of measurement and types of instruments used to obtain measurements.

7.2.12 Figures

The following figures shall be included with each investigation work plan for each site, including presentation of data where previous investigations have been conducted. All figures must include an accurate bar scale and a north arrow. An explanation shall be included on each figure for all abbreviations, symbols, acronyms, and qualifiers. All maps shall contain a date of preparation.

1. A vicinity map showing topography and the general location of the site relative to surrounding features and properties.
2. A site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system locations and details. Off-site well locations and other relevant features shall be included on the site plan, if appropriate. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. Figures showing historical and proposed soil boring or excavation locations and sampling locations.
4. Figures presenting historical soil sample field screening and laboratory analytical data if applicable.
5. Figures presenting the locations of all existing and proposed borings and vapor monitoring well locations.
6. Figures showing all existing and proposed wells and piezometers, presenting historical groundwater elevation data, and indicating groundwater flow directions.
7. Figures presenting historical groundwater laboratory analytical data, if applicable. The chemical analytical data corresponding to each sampling location can be presented in tabular form on the figure or as an isoconcentration map.
8. Figures presenting historical and proposed surface water sample locations and field measurement data, if applicable.
9. Figures presenting historical surface water laboratory analytical data, if applicable.
10. Figures showing historical and proposed air or vapor sampling locations and presenting historical air quality data, if applicable.
11. Figures presenting historical pilot and other testing locations and data, where applicable, including site plans and graphic data presentation.
12. Figures presenting geologic cross-sections, based on outcrop and borehole data acquired during previous investigations, if applicable.

7.2.13 Appendices

A description of IDW management shall be included as an appendix to the investigation work plan. The results of historical investigations required in this Permit shall be submitted with the investigation work plan as a separate document. Additional appendices may be necessary to present additional data or documentation not listed above.

7.3 INVESTIGATION REPORT

The Permittee shall prepare investigation reports at the Facility using the general outline below. The Investigation Report shall be the reporting mechanism for presenting the results of completed Investigation Work Plans. This Section (7.3) describes the minimum requirements for reporting on site investigations. All data collected during each site investigation event in the reporting period shall be included in the reports. In general, interpretation of data shall be presented only in the background, conclusions and recommendations sections of the reports. The other text sections of the

reports shall be reserved for presentation of facts and data without interpretation or qualifications. The general report outline is provided below.

7.3.1 Title Page

The title page shall include the type of document; Facility name; Area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible WSMR representatives shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

7.3.2 Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose, scope, and results of the investigation; site names; location; and Area designation. In addition, this section shall include a brief summary of conclusions included in the Report based on the investigation data collected and recommendations for future investigation, monitoring, remedial action or site closure.

7.3.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the report. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

7.3.4 Introduction

The introduction section shall include the Facility name, Area designation, unit location, and unit status (e.g., closed, corrective action). General information on the site usage and status shall be included in this section. A brief description of the purpose of the investigation, the type of site investigation conducted, and the type of results presented in the report also shall be provided in this section.

7.3.5 Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of any subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background summary and labeled on the figure, as appropriate. In addition, this section shall include a brief summary of the possible sources of contamination, the history of releases or discharges of contamination, the known extent of contamination, and a general summary of the results of previous investigations including references to previous reports. The references to previous reports shall include page, table, and figure numbers for referenced information. A site plan, showing relevant investigation locations, and summary data tables shall be included in the Figures and Tables sections of the document, respectively.

7.3.6 Scope of Activities

A section on the scope of activities shall briefly describe all activities performed during the investigation event including background information research, implemented health and safety measures that affected or limited the completion of tasks, drilling, test pit or other excavation methods, well construction methods, field data collection, survey data collection, chemical analytical testing, aquifer testing, remediation system pilot tests, and IDW storage or disposal.

7.3.7 Field Investigation Results

A section shall provide a summary of the procedures used and the results of all field investigation activities conducted at the site including the dates that investigation activities were conducted, the type and purpose of field investigation activities performed, field screening measurements, logging and sampling results, pilot test results, construction details, and conditions observed. Field observations or conditions that altered the planned work or may have influenced the results of sampling, testing, and logging shall be reported in this section. The following sections shall be included.

7.3.7.a Surface conditions

A section on surface conditions shall describe current site topography, features, and structures including topographic drainages, man-made drainages, vegetation, and erosional features. It shall also include a description of current site uses and any operations at the site. In addition, descriptions of features located in surrounding sites that may have an impact on the subject site regarding sediment transport, surface water runoff, or contaminant transport shall be included in this subsection.

7.3.7.b Exploratory Drilling or Excavation Investigations

A section shall describe the locations, methods, and depths of subsurface explorations. The description shall include the types of equipment used, the logging procedures, the soil or rock classification system used to describe the observed materials, exploration equipment decontamination procedures, and conditions encountered that may have affected or limited the investigation.

A description of the site conditions observed during subsurface investigation activities shall be included in this section, including soil horizon and stratigraphic information. Site plans showing the locations of all borings and excavations shall be included in the Figures Section of the report. Boring and test pit logs for all exploratory borings and test pits shall be presented in an appendix or attachment to the report.

7.3.7.c Exploratory and Monitoring Well Boring Geophysical Logging

A section shall describe the methods, dates of measurement, depth intervals measured, and the results of geophysical logging. The relative merits and limitations of each geophysical logging method employed shall be discussed, along with any field conditions or instrument malfunctions that occurred that may have affected the results of the geophysical logging.

7.3.7.d Subsurface Conditions

A section on subsurface conditions shall describe known subsurface lithology and structures, based on observations made during the current and previous subsurface investigations, including interpretation of geophysical logs and as-built drawings of man-made structures. A description of any known locations of pipelines and utility lines and observed geologic structures shall also be included in this section. A site plan showing boring and excavation locations and the locations of the site's above- and below-ground structures shall be included in the Figures section of the report. In addition, cross-sections shall be constructed, if appropriate, to provide additional visual presentation of site or regional subsurface conditions.

7.3.7.e Monitoring Well Construction and Boring or Excavation Abandonment

A section shall describe the methods and details of monitoring well construction and the methods used to abandon or backfill exploratory borings and excavations. The description shall include the dates of well construction, boring abandonment, or excavation backfilling. In addition, well construction diagrams shall be included in an appendix or attachment with the associated boring logs for monitoring well borings. The Permittee may submit well abandonment reports as an appendix to the investigation report.

7.3.7.f Groundwater Conditions

A section shall describe groundwater conditions observed beneath the subject site and relate local groundwater conditions to regional groundwater conditions. A description of the depths to water, aquifer thickness, and groundwater flow directions shall be included in this section for alluvial groundwater, shallow perched groundwater, intermediate perched groundwater, and regional groundwater, as appropriate to the investigation. Figures showing well locations, surrounding area, and groundwater elevations and flow directions for each hydrologic zone shall be included in the Figures section of the report.

7.3.7.g Surface Water Conditions

A section shall describe surface water conditions and include a description of surface water runoff, drainage, surface water sediment transport, and contaminant transport in surface water as suspended load and as a dissolved phase in surface water via natural and man-made drainages, if applicable. A description of contaminant fate and transport shall be included, if appropriate.

7.3.7.h Surface Air and Subsurface Vapor Conditions

A section shall describe surface air and subsurface vapor monitoring and sampling methods used during the site investigation. It shall also describe observations made during the site investigation regarding subsurface flow pathways and the subsurface air-flow regime.

7.3.7.i Materials Testing Results

A section shall discuss the materials testing results, such as core permeability testing, grain size analysis, or other materials testing results. Sample collection methods, locations, and depths shall

also be included. Corresponding summary tables shall be included in the Tables section of the report.

7.3.7.j Pilot Testing Results

A section shall discuss the results of any pilot tests. Pilot tests are typically conducted after initial subsurface investigations are completed and the need for additional investigation or remediation has been evaluated. Pilot tests, including aquifer tests and remediation system pilot tests, shall be addressed through separate work plans and pilot test reports. The format for pilot test work plans and reports shall be approved by NMED prior to submittal.

7.3.8 Regulatory Criteria

A section shall set forth the cleanup standards, risk-based screening levels, and risk-based cleanup goals for each pertinent medium at the subject site. The appropriate cleanup levels for each site shall be included if site-specific levels have been established at separate Facility sites or units. A table summarizing the applicable cleanup standards or levels or inclusion of applicable cleanup standards or levels in the data tables shall be included as part of the document. The risk assessment, if conducted, shall be presented in a separate document or in an appendix to this report. If cleanup or screening levels calculated in a NMED-approved risk evaluation are employed, the risk evaluation document shall be referenced and shall include pertinent page numbers for referenced information.

7.3.9 Site Contamination

A section shall provide a description of sampling intervals and methods for detection of surface and subsurface contamination in soils, rock, sediments, groundwater, and surface water, and as vapor-phase contamination. Only factual information shall be included in this section. Interpretation of the data shall be reserved for the summary and conclusions sections of the report. Tables summarizing all sampling, testing, and screening results for detected contaminants shall be prepared in a format approved by NMED. The tables shall be presented in the Tables Section of the report.

7.3.9.a Soil, Rock, and Sediment Sampling

A section shall describe the sampling of soil, rock, and sediment. It shall include the dates, locations and methods of sample collection; sampling intervals; sample logging methods; screening sample selection methods; and laboratory sample selection methods including the collection depths for samples submitted for laboratory analyses. A site plan showing the sample locations shall be included in the Figures Section of the report.

7.3.9.b Soil, Rock, and Sediment Sample Field Screening Results

A section shall describe the field screening methods used during the investigation and the field screening results. Field screening results also shall be presented in summary tables in the Tables section of the document. The limitations of field screening instrumentation and any conditions that influenced the results of field screening shall be discussed in this section.

7.3.9.c Soil, Rock, and Sediment Sampling Analytical Results

A section shall summarize the results of laboratory analysis for soil, rock, and sediment samples. It shall also describe the analytical methods used and provide a comparison of the analytical results to background levels, cleanup standards, or established cleanup levels for the site. The laboratory results also shall be presented in summary tables in the Tables section of the document. Field conditions and sample collection methods that could potentially affect the analytical results shall be described in this section. If appropriate, soil analytical data shall be presented with sample locations on a site plan and included in the Figures section of the report.

7.3.9.d Groundwater Sampling

A section on groundwater sampling shall describe the dates, locations, depths, and methods of sample collection; methods for sample logging; and methods for screening and laboratory sample selection. A map showing all site and surrounding area well locations shall be included in the Figures section of the report.

7.3.9.e Groundwater General Chemistry

A section on the general groundwater chemistry shall describe the results of measurement of field purging parameters and field analytical measurements. Field parameter measurements and field analytical results also shall be presented in summary tables in the Tables section of the document. The limitations of field measurement instrumentation and any conditions that may have influenced the results of field screening shall be discussed in this section. As determined by the Permittee and NMED, relevant water chemistry concentrations shall be presented as data tables or as isoconcentration contours on a map included in the Figures section of the report.

7.3.9.f Groundwater Chemical Analytical Results

A section shall summarize the results of groundwater chemical analyses. It shall describe the groundwater chemical analytical methods and analytical results. It shall also provide a comparison of the data to cleanup standards or established cleanup levels for the site. The rationale or purpose for altering or modifying the groundwater sampling program outlined in the site investigation work plan shall also be provided in this section. Field conditions shall be described in this section that may have affected the analytical results during sample collection. Tables summarizing the groundwater laboratory, field, and field sample QA/QC chemical analytical data; applicable cleanup levels; and modifications to the groundwater sampling program shall be provided in the Tables Section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations, data tables, or as isoconcentration contours on a map included in the Figures Section of the report.

7.3.9.g Surface Water Sampling

A section shall describe the surface water sampling and shall include the dates, times, locations, depths, and methods of sample collection. It shall also describe methods for sample logging, sample-screening methods, and laboratory sample selection methods. A map showing all surface-water sampling locations shall be included in the Figures section of the report.

7.3.9.h Surface Water General Chemistry

A section on the surface water general chemistry shall describe the results of measurement of field parameters and field analytical measurements. Field parameter measurements and field analytical results also shall be presented in summary tables in the Tables section of the document. The limitations of field measurement instrumentation and any conditions that influenced the results of field screening shall be discussed in this section. Relevant water chemistry concentrations shall be presented as data tables on a map included in the Figures section of the report.

7.3.9.i Surface Water Chemical Analytical Results

A section shall summarize the results of surface water chemical analyses. It shall describe the analytical methods and analytical results, and provide a comparison of the data to the cleanup standards or established background or cleanup levels for the site. The rationale or purpose for altering or modifying the surface-water sampling program outlined in the site investigation work plan also shall be provided in this section. Field conditions that may have affected the analytical results during sample collection shall be described in this section. Tables summarizing the surface water laboratory, field, and analytical field sample QA/QC analytical data; applicable cleanup levels; and modifications to the surface-water sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations or as data tables on a map included in the Figures section of the report.

7.3.9.j Air and Subsurface Vapor Sampling

A section shall describe the air and subsurface vapor sampling. It shall describe the dates, locations, depths or elevations above ground surface, methods of sample collection, methods for sample logging, and methods for laboratory sample selection. A map showing all air sampling locations shall be provided in the Figures section of the report.

7.3.9.k Air and Subsurface Vapor Field Screening Results

A section shall describe the air and subsurface vapor field screening results. It shall describe the field screening methods used for ambient air and subsurface vapors during the investigation. Field screening results shall also be presented in summary tables in the Tables section of the report. The locations of ambient air and subsurface vapor screening sample collection shall be presented on a site plan included in the Figures section of the report. The limitations of field screening instrumentation and any conditions that influenced the results of field screening shall be discussed in this section.

7.3.9.l Air and Subsurface Vapor Laboratory Analytical Results

A section shall describe the results of air and subsurface vapor laboratory analysis. It shall describe the air sampling laboratory analytical methods and analytical results, and provide a comparison of the data to emissions standards or established cleanup or emissions levels for the site. The rationale or purpose for altering or modifying the air monitoring or sampling program outlined in the site investigation work plan also shall be provided in this section. Field conditions that may have affected the analytical results during sample collection shall be described in this section. Tables summarizing the air sample laboratory, field, and analytical field sample QA/QC data; applicable

cleanup levels or emissions standards; and modifications to the air sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations, data tables, or as isoconcentration contours on a map included in the Figures section of the report.

7.3.10 Conclusions

A section shall provide a brief summary of the investigation activities and a discussion of the conclusions of the investigation conducted at the site. In addition, this section shall provide a comparison of the results to applicable cleanup or screening levels, and to relevant historical investigation results and analytical data. Potential receptors, including groundwater, shall be identified and discussed. An explanation shall be provided with regard to data gaps. A risk assessment may be included as an appendix to the investigation report; however, the risk assessment shall be presented in the Risk Assessment format described in Section 7.5 of this Attachment. References to the risk assessment shall be presented only in the summary and conclusions sections of the Investigation Report.

7.3.11 Recommendations

A section shall discuss the need for further investigation, corrective measures, risk assessment and monitoring, or recommendations for corrective action completed, based on the conclusions provided in the Conclusions section. It shall include explanations regarding additional sampling, monitoring, and site closure. A corresponding schedule for further action regarding the site shall also be provided. No action recommendations shall include the anticipated schedule for submittal of a petition for a permit modification.

7.3.12 Tables

A section shall provide the following summary tables as applicable. With prior approval from NMED, the Permittee may combine one or more of the tables. Data presented in the tables shall include the current data, dates of data collection, analytical methods, detection limits, and significant data quality exceptions. The summary analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. Tables summarizing regulatory criteria, background levels, and applicable cleanup levels (this information may be included in the analytical data tables instead of as separate tables).
2. Tables summarizing field survey location data. Separate tables shall be prepared for well locations and individual medium sampling locations except where the locations are the same for more than one medium.
3. Tables summarizing field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.
4. A table summarizing soil, rock, and/or sediment laboratory analytical data. It shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
5. A table summarizing the groundwater elevations and depths to groundwater. The table shall include the monitoring well depths and the screened intervals in each well.

6. A table summarizing the groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
7. A table summarizing the surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
8. A table summarizing the air sample screening and laboratory analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
9. Tables summarizing the pilot test data, if applicable, including units of measurement and types of instruments used to obtain measurements.
10. A table summarizing any materials test data.

7.3.13 Figures

A section shall provide the following figures as applicable. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All maps shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features and properties.
2. A site plan that presents any pertinent site features and structures, underground utilities, well locations, and remediation system location(s) and details. Off-site well locations and other relevant features shall be included on the site plan. Additional site plans may be required to present the locations of relevant off-site well locations, structures and features.
3. Figures showing boring or excavation locations and sampling locations.
4. Figures presenting soil sample field screening and laboratory analytical data.
5. Figures displaying the locations of all newly installed and existing wells and borings.
6. Figures presenting monitoring well and piezometer locations, groundwater elevation data, and groundwater flow directions.
7. Figures presenting groundwater laboratory analytical data, including any past data requested by NMED. The laboratory analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map.
8. Figures presenting surface water sample locations and field measurement data including any past data requested by NMED.
9. Figures presenting surface water laboratory analytical data including any past data requested by NMED. The laboratory analytical data corresponding to each sampling location may be presented in table form on the figure.
10. Figures showing air sampling locations and presenting air quality. The field screening or laboratory analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map.

11. Figures presenting geologic cross-sections based on outcrop and borehole data.
12. Figures presenting pilot test locations and data, where applicable, including site plans or graphic data presentation.

7.3.14 Appendices

Each investigation report shall include the following appendices. Additional appendices may be necessary to present data or documentation not listed below.

7.3.14.a Field Methods

An appendix shall provide detailed descriptions of the methods used to acquire field measurements of each medium that was surveyed or tested during the investigation. This appendix shall include exploratory drilling or excavation methods, the methods and types of instruments used to obtain field screening, field analytical or field parameter measurements, instrument calibration procedures, sampling methods for each medium investigated, decontamination procedures, sample handling procedures, documentation procedures, and a description of field conditions that affected procedural or sample testing results. Methods of measuring and sampling during pilot tests shall be reported in this appendix, if applicable. Geophysical logging methods shall be discussed in a separate section of this appendix. IDW storage and disposal methods shall also be discussed in this appendix. Copies of IDW disposal documentation shall be provided in a separate appendix.

7.3.14.b Boring/test Pit Logs and Well Construction Diagrams

An appendix shall provide boring logs, test pit logs, or other excavation logs, and well construction details. In addition, a key to symbols and a soil or rock classification system shall be included in this appendix. Geophysical logs shall be provided in a separate section of this appendix.

7.3.14.c Analytical Program

An appendix shall discuss the analytical methods, a summary of data quality objectives, and the data quality review procedures. A summary of data quality exceptions and their effect on the acceptability of the field and laboratory analytical data with regard to the investigation and the site status shall be included in this appendix along with references to the case narratives provided in the laboratory reports.

7.3.14.d Analytical Reports

An appendix shall provide the contract laboratory final analytical data reports generated for the investigation. The reports shall include all chain-of-custody records and Level II QA/QC results provided by the laboratory. The final laboratory reports and data tables shall be provided electronically in a format approved by NMED. Paper copies (or electronically scanned in PDF format) of all chain-of-custody records shall be provided with the reports.

7.3.14.e Other Appendices

Other appendices containing additional information shall be included as required by NMED or as otherwise appropriate.

7.4 PERIODIC MONITORING REPORT

The Permittee shall use the following guidance for preparing periodic monitoring reports. The reports shall present the reporting of periodic groundwater, surface water, vapor, and remediation system monitoring at the Facility. The following sections provide a general outline for monitoring reports, and also provide the minimum requirements for reporting for specific Facility sites, areas, and regional monitoring. All data collected during each monitoring and sampling event in the reporting period shall be included in the reports. In general, interpretation of data shall be presented only in the background, conclusions, and recommendations sections of the reports. The other text sections of the reports shall be reserved for presentation of facts and data without interpretation or qualifications.

7.4.1 Title Page

The title page shall include the type of document; Facility name; Area designation; SWMU or AOC name, site, watershed, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible WSMR representatives shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

7.4.2 Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose, scope, and results of the monitoring conducted at the subject site during the reporting period. The area (e.g., Plume-front, Facility-wide) SWMU, AOC and site name, location, and/or Area designation shall be included in the executive summary. In addition, this section shall include a brief summary of conclusions based on the monitoring data collected.

7.4.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the report. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

7.4.4 Introduction

The introduction section shall include the Facility name, Area designation physical area and/or, unit location, and unit status as applicable (e.g. closed, corrective action). General information on the site usage and status shall be included in this section. A brief description of the purpose of the monitoring, type of monitoring conducted, and the type of results presented in the report also shall be provided in this section.

7.4.5 Scope of Activities

A section on the scope of activities shall briefly describe all activities performed during the monitoring event or reporting period including field data collection, analytical testing, remediation system monitoring, if applicable, and purge/decontamination water storage and disposal.

7.4.6 Regulatory Criteria

A section on regulatory criteria shall provide information regarding applicable cleanup standards, risk-based screening levels and risk-based cleanup goals for the subject site. A separate table summarizing the applicable screening levels or standards or inclusion of the applicable cleanup standards or screening levels in the data tables can be substituted for this section. The appropriate cleanup or screening levels for each site shall be included, if site-specific levels have been established at separate sites. Risk-based evaluation procedures, if used to calculate cleanup or screening levels, must either be included as an attachment or referenced. The specific document and page numbers must be included for all referenced materials.

7.4.7 Monitoring Results

A section shall provide a summary of the results of monitoring conducted at the site. This section shall include the dates and times that monitoring was conducted, the measured depths to groundwater, directions of groundwater flow, field air and water quality measurements, contaminant surveys, static pressures, field measurements, and a comparison to previous monitoring results. Field observations or conditions that may influence the results of monitoring shall be reported in this section. Tables summarizing vapor-monitoring parameters, groundwater elevations, depths to groundwater measurements, and other field measurements can be substituted for this section. The tables shall include all information required in Section 7.4.11 of this attachment.

7.4.8 Analytical Data Results

A section shall discuss the results of the chemical analyses. It shall provide the dates of sampling, the analytical methods, and the analytical results. It shall also provide a comparison of the data to previous results and to background levels, cleanup standards, or established cleanup levels for the site. The rationale or purpose for altering or modifying the monitoring and sampling program shall be provided in this section. A table summarizing the laboratory analytical data, QA/QC data, applicable cleanup levels, and modifications to the sampling program can be substituted for this section. The tables shall include all information required in Section 7.4.11 of this attachment.

7.4.9 Remediation System Monitoring

A section shall discuss the remediation system monitoring. It shall summarize the remediation system's capabilities and performance. It shall also provide monitoring data, treatment system discharge sampling requirements, and system influent and effluent sample analytical results. The dates of operation, system failures, and modifications made to the remediation system during the reporting period shall also be included in this section. A summary table may be substituted for this section. The tables shall include all information required in Section 7.4.11 of this attachment.

7.4.10 Summary

A summary section shall provide a discussion and conclusions of the monitoring conducted at the site. In addition, this section shall provide a comparison of the results to applicable cleanup levels, and to relevant historical monitoring and laboratory analytical data. An explanation shall be provided with regard to data gaps. A discussion of remediation system performance, monitoring results, modifications, if applicable, and compliance with discharge requirements shall be provided

in this section. Recommendations and explanations regarding future monitoring, remedial actions, or site closure, if applicable, shall also be included in this section.

7.4.11 Tables

A section shall provide the following summary tables for the media sampled. With prior approval from NMED, the Permittee may combine one or more of the tables. Data presented in the tables shall include the current sampling and monitoring data plus data from the three previous monitoring events or, if data from less than three monitoring events is available, data acquired during previous investigations. Remediation system monitoring data also shall be presented. The dates of data collection shall be included in the tables. Summary tables may be substituted for portions of the text. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table summarizing the regulatory criteria (a Regulatory Criteria text section may be substituted for this table or the applicable cleanup levels may be included in the analytical data tables).
2. A table summarizing groundwater elevations and depths to groundwater data. The table shall include the monitoring well depths, the screened intervals in each well, and the dates and times of measurements.
3. A table summarizing field measurements of surface water quality data.
4. A table summarizing field measurements of vapor monitoring data (must include historical vapor monitoring data as described above).
5. A table summarizing field measurements of groundwater quality data (must include historical water quality data as described above).
6. A table summarizing vapor sample analytical data (must include historical vapor sample analytical data as described above).
7. A table summarizing surface water analytical data (must include historical surface water analytical data as described above).
8. A table summarizing groundwater analytical data (must include historical groundwater analytical data as described above).
9. A table summarizing remediation system monitoring data, if applicable (must include historical remediation system monitoring data as described above).

7.4.12 Figures

The section shall include the following figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All figures shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.

2. A site plan that presents pertinent site features and structures, well and piezometer locations, and remediation system location(s) and features. Off-site well locations and pertinent features shall be included on the site plan, if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. Figures presenting the locations of piezometer, monitoring and other well locations, groundwater elevation data, and groundwater flow directions.
4. Figures presenting groundwater analytical data for the current monitoring event. The analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure or as an isoconcentration map.
5. Figures presenting surface water sampling locations and analytical data for the current monitoring period if applicable.
6. Figures presenting vapor sampling locations and analytical data for the current monitoring event if applicable. The analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure or as an isoconcentration map.
7. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.

7.4.13 Appendices

Each monitoring report shall include the following appendices. Additional appendices may be necessary to present data or documentation not listed below.

7.4.13.a Field Methods

An appendix shall include the methods used to acquire field measurements of groundwater elevations, vapor and water quality data, and vapor, surface water and groundwater samples. It shall include the methods and types of instruments used to measure depths to water, air or headspace parameters, flow measurements, and water quality parameters. In addition, decontamination, well purging techniques, well sampling techniques, and sample handling procedures shall be provided in this appendix. Methods of measuring and sampling remediation systems shall be reported in this appendix, if applicable. Purge and decontamination water storage and disposal methods shall also be presented in this appendix. Copies of purge and decontamination water disposal documentation shall be provided in a separate appendix, if applicable.

7.4.13.b Analytical Program

An appendix shall discuss the analytical program. It shall include the analytical methods, a summary of data quality objectives, and data quality review procedures. A summary of data quality exceptions and their effect on the acceptability of the analytical data with regard to the monitoring event and the site status shall be included in this appendix along with references to case narratives provided in the laboratory reports.

7.4.13.c Analytical Reports

An appendix shall provide the analytical reports and shall include the contract laboratory final chemical analytical data reports generated during this reporting period. The reports must include all chain-of-custody records and Level II QA/QC results provided by the laboratory. The laboratory final reports and data tables shall be provided electronically in a format approved by NMED. Paper copies (or electronically scanned in PDF format) of all chain-of-custody records shall be provided with the reports.

7.5 RISK ASSESSMENT REPORT

The Permittee shall prepare risk assessment reports for sites requiring corrective action at the Facility using the format listed below. This section (7.5) provides a general outline for risk assessments and also lists the minimum requirements for describing risk assessment elements. In general, interpretation of data shall be presented only in the Background, Conceptual Site Model, and Conclusions and Recommendations Sections of the reports. The other text sections of the Risk Assessment report shall be reserved for presentation of sampling results from all investigations, conceptual and mathematical elements of the risk assessment, and presentations of toxicity information and screening values used in the risk assessment. Section 7.5.8 of this attachment and subsequent sections should be presented in separate sections for the human health and ecological risk assessments, but the general risk assessment outline applicable to both sections is provided below.

7.5.1 Title Page

The title page shall include the type of document; Facility name; Area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible WSMR representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

7.5.2 Executive Summary (Abstract)

The executive summary or abstract section shall provide a brief summary of the purpose and scope of the risk assessment of the subject site. The Executive Summary shall also briefly summarize the conclusions of the risk assessment. The Facility, SWMU, AOC, and site names; location; and Area designation shall be included in the executive summary.

7.5.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the risk assessment. The corresponding page numbers for the titles of each unit of the report shall be included in the table of contents.

7.5.4 Introduction

The introduction section shall include the Facility name, Area designation, unit location, and unit status (e.g., closed, corrective action). General information on the current site usage and status shall be included in this section.

7.5.5 Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features.

7.5.5.a Site Description

A section shall describe current site topography, features and structures including topographic drainages, man-made drainages, erosional features, current site uses, and other data relevant to assessing risk at the site. Depth to groundwater and direction of groundwater flow shall be included in this section. The presence and location of surface water bodies such as any springs or wetlands shall be noted in this section. Photographs of the site may be incorporated into this section. Ecological features of the site shall be described here, including type and amount of vegetative cover, observed and expected wildlife receptors, and level of disturbance of the site. A topographical map of the site and vicinity of the site showing habitat types, boundaries of each habitat, and any surface water features shall be included in the Figures section of the document.

7.5.5.b Sampling Results

A section shall discuss the results of the sampling at the site. It shall include a description of the history of releases of contaminants, the known and possible sources of contamination, and the vertical and lateral extent of contamination present in each medium. This section shall include summaries of sampling results of all investigations including site plans (included in the Figures section of the report) showing locations of detected contaminants. This section shall reference pertinent figures, data summary tables, and references in previous reports. References to previous reports shall include page, table, and figure numbers for referenced information. Summaries of sampling data shall include for each constituent: the maximum value detected, the detection limit, the 95 percent upper confidence level (UCL) of the mean value detected (if applicable to the data set), and whether the 95 percent UCL of the mean was calculated based on a normal or lognormal distribution. Background values used for comparison to inorganic constituents at the site shall be presented here. The table of background values should appear in the Tables section of the document and include actual values used as well as the origin of the values (e.g. Facility-wide, UCL, upper tolerance level (UTL)). This section shall also include a discussion of how "non-detect" sample results were handled in the averaging of data.

7.5.6 Conceptual Site Model

A section shall present the conceptual site model. It shall include information on the expected fate and transport of contaminants detected at the site. This section shall provide a list of all sources of contamination at the site. Sources that are no longer considered to be ongoing but represent the point of origination for contaminants transported to other locations shall be included. The discussion of fate and transport shall address potential migration of each contaminant in each medium, potential breakdown products and their migration, and anticipated pathways of exposure for human or ecological receptors. Diagrammatic representations of the conceptual site model shall appear in the Figures section of the document.

For human health risk assessments, the conceptual site model shall include the current and reasonably foreseeable future land use and residential land use for all risk assessments. All values for exposure parameters and the source of those values shall be included in table format and presented in the Tables section of the document.

Conceptual site models presented for ecological risk assessments shall identify assessment endpoints and measurement receptors for the site. The discussion of the model shall explain how the measurement receptors for the site are protective of the wildlife receptors identified by the Permittee in the Site Description section (see Section 7.5.5.a).

7.5.7 Risk Screening Levels

A section shall present the actual screening values used for each contaminant for comparison to all human health and ecological risk screening levels. NMED's Soil Screening Levels (SSLs) for residential and industrial soil shall be used to screen soil for human health using EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume I, Part A, 1989* as updated. For those contaminants not appearing on NMED's SSL table, the EPA Region 6 soil screening value adjusted to meet NMED's risk goal of 10^{-5} for total risk for carcinogens shall be used to screen the site for human health risks. Screening for ecological risk shall be conducted using U.S. EPA's ECO-SSLs, or derive a screening level using the methodology in NMED's "*Guidance for Assessing Ecological Risks Posed by Chemicals: Screening –Level Ecological Risk Assessment"*. If no valid toxicological studies exist for a particular receptor or contaminant, the contaminant/receptor combination shall be addressed using qualitative methods. If a NMED approved site-specific risk scenario is used for the human health risk assessment, this section shall include all toxicity information and exposure assessment equations used for the site-specific scenario as well as the sources for that information. Other regulatory levels applicable to screening the site, such as drinking water Maximum Contaminant Levels (MCLs), shall also be included in this section.

7.5.8 Risk Assessment Results

A section shall present all risk values, hazard quotients (HQ), and HIs for human health based on current and reasonably foreseeable future land use. Where the current or reasonably foreseeable future land use is not residential, risk values, HQs, and HIs for a residential land use scenario shall also be calculated and reported. The residential scenario shall be used for comparison purposes only, unless the land use becomes residential. This section shall also present the HQ and HI for each contaminant for each ecological receptor.

7.5.8.a Uncertainty analysis

A section shall include discussion of qualitative, semi-quantitative, and quantitative uncertainty in the risk assessment and estimate the potential impact of the various uncertainties.

7.5.9 Conclusions and Recommendations

A section shall include the interpretation of the results of the risk assessment and any recommendations for future disposition of the site. This section may include additional information and considerations that the Permittee believes are relevant to the analysis of the site.

7.5.10 Tables

A section shall provide the following summary tables, as appropriate. With prior approval from NMED, the Permittee may combine one or more of the tables. Data presented in the summary tables shall include information on detection limits and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table presenting background values used for comparison to inorganic constituents at the site. The table shall include actual values used as well as the origin of the values (Facility-wide, UCL, UTL, or maximum).
2. A table summarizing sampling data shall include, for each constituent, all detected values above background, the maximum value detected, the 95 percent UCL of the mean value detected (if applicable to the data set), and whether that 95 percent UCL of the mean was calculated based on a normal or lognormal distribution.
3. A table of all screening values used and the sources of those values.
4. A table presenting all risk values, HQs, and HIs under current and reasonably foreseeable future land use for human health.
5. If residential use is not a current or reasonably foreseeable future land use, a table presenting all risk values, HQs, and HIs under a residential land use scenario for human health shall be included for comparison purposes.
6. A table presenting the HQ and HI for each contaminant for each ecological receptor.
7. A table presenting values for exposure parameters and the source of the values.

7.5.11 Figures

A section shall present the following figures for each site, as appropriate. With prior approval from NMED, the Permittee may combine one or more of the figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.
2. For human health risk assessments, a site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system location(s) and its details. Off-site well locations and other relevant features shall be included on the site plan if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. For ecological risk assessments, a topographical map of the site and vicinity of the site showing habitat types, boundaries of each habitat, and any surface water features.
4. Conceptual site model diagrams for both human health and ecological risk assessments.

7.5.12 Appendices

Each risk assessment report shall include appendices containing supporting data. Appendices may include the results of statistical analyses of data sets and comparisons of data, full sets of results of all sampling investigations at the site, or other data as appropriate.

7.6 CORRECTIVE MEASURES EVALUATION REPORT

The Permittee shall prepare corrective measures evaluations for sites requiring corrective measures using the format listed below. This section (7.6) provides a general outline for corrective measures evaluations and also lists the minimum requirements for describing corrective measures when preparing these documents. All investigation summaries, site condition descriptions, corrective action goals, corrective action options, remedial options selection criteria, and schedules shall be included in the corrective measures evaluations. In general, interpretation of historical investigation data and discussions of prior interim activities shall be presented only in the background sections of the corrective measures evaluations. At a minimum, detections of contaminants encountered during previous site investigations shall be presented in the corrective measures evaluations in table format with an accompanying site plan showing sample locations. The other text sections of the corrective measures evaluations shall be reserved for presentation of corrective action-related information regarding anticipated or potential site-specific corrective action options and methods relevant to the project. The general corrective measures evaluation outline is provided below.

7.6.1 Title Page

The title page shall include the type of document; Facility name; Area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible WSMR representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 C.F.R. 270.11(d)(1).

7.6.2 Executive Summary (Abstract)

This executive summary or abstract shall provide a brief summary of the purpose and scope of the corrective measures evaluation to be conducted at the subject site. The executive summary or abstract shall also briefly summarize the conclusions of the evaluation. The SWMU, AOC, and site names, location, and Area designation shall be included in the executive summary.

7.6.3 Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the corrective measures evaluation. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

7.6.4 Introduction

The Introduction section shall include the Facility name, Area designation, site location, and site status (e.g. closed, corrective action). General information on the current site usage and status shall be included in this section. A brief description of the purpose of the corrective measures evaluation and the corrective action objectives for the project also shall be provided in this section.

7.6.5 Background

The Background section shall describe the relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of any subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in this section and labeled on the site plan, as appropriate.

This section shall include contaminant and waste characteristics, a brief summary of the history of contaminant releases, known and possible sources of contamination, and the vertical and lateral extent of contamination present in each medium. This section shall include brief summaries of results of previous investigations, including references to pertinent figures, data summary tables, and text in previous reports. References to previous reports shall include page, table, and figure numbers for referenced information. Summary tables and site plans showing relevant investigation locations shall be referenced and included in the Tables and Figures sections of the document, respectively.

7.6.6 Site Conditions

7.6.6.a Surface Conditions

A section on surface conditions shall describe current and historic site topography, features, and structures, including a description of topographic drainages, man-made drainages, vegetation, and erosional features. It shall also include a description of current uses of the site and any current operations at the site. This section shall also include a description of those features that could potentially influence corrective action option selection or implementation such as archeological sites, wetlands, or other features that may affect remedial activities. In addition, descriptions of features located in surrounding sites that may have an effect on the subject site regarding sediment transport, surface water runoff or contaminant transport shall be included in this section. A site plan displaying the locations of all pertinent surface features and structures shall be included in the Figures section of the corrective measures evaluation.

7.6.6.b Subsurface Conditions

A section on subsurface conditions shall describe the site conditions observed during previous subsurface investigations. It shall include relevant soil horizon and stratigraphic information, groundwater conditions, fracture data, and subsurface vapor information. A site plan displaying the locations of all borings and excavations advanced during previous investigations shall be included in the Figures section of the corrective measures evaluation. A brief description of the stratigraphic units anticipated to be present beneath the site may be included in this section if stratigraphic information is not available from previous investigations conducted at the site.

7.6.7 Potential Receptors

7.6.7.a Sources

A section shall provide a list of all sources of contamination at the subject site where corrective measures are to be considered or required. Sources that are no longer considered to be releasing

contaminants at the site, but may be the point of origination for contaminants transported to other locations, shall be included in this section.

7.6.7.b Pathways

A section shall describe potential migration pathways that could result in either acute or chronic exposures to contaminants. It shall include such pathways as utility trenches, paleochannels, surface exposures, surface drainages, stratigraphic units, fractures, structures, and other features. The migration pathways for each contaminant and each relevant medium should be tied to the potential receptors for each pathway. A discussion of contaminant characteristics relating to fate and transport of contaminants through each pathway shall also be included in this section.

7.6.7.c Receptors

A section shall provide a listing and description of all anticipated potential receptors that could possibly be affected by the contamination present at the site. Potential receptors shall include human and ecological receptors, groundwater, and other features such as pathways that could divert or accelerate the transport of contamination to human receptors, ecological receptors, and groundwater.

7.6.8 Regulatory Criteria

A section shall set forth the applicable cleanup standards, risk-based screening levels, and risk-based cleanup goals for each pertinent medium at the subject site. The appropriate cleanup levels for each site shall be included, if site-specific levels have been established at separate sites or units. A table summarizing the applicable cleanup standards or levels, or inclusion of applicable cleanup standards or levels in the summary data tables shall be included in the Tables section of the document. The risk assessment shall be presented in a separate document or in an appendix to this report. If cleanup or screening levels calculated in a risk evaluation are employed, the risk evaluation document shall be referenced including pertinent page numbers for referenced information.

7.6.9 Identification of Corrective Measures Options

A section shall identify and describe potential corrective measures for source, pathway, and receptor controls. Corrective measures options shall include the range of available options including, but not limited to, a no action alternative, institutional controls, engineering controls, in-situ and on-site remediation alternatives, complete removal, and any combination of alternatives that would potentially achieve cleanup goals.

7.6.10 Evaluation of Corrective Measures Options

A section shall provide an evaluation of the corrective measures options identified in Section 7.6.9 of this Attachment (7). The evaluation shall be based on the applicability, technical feasibility, effectiveness, implementability, impacts to human health and the environment, and cost of each option. A table summarizing the corrective measures alternatives and the criteria listed below shall be included in the Tables section of this document. The general basis for evaluation of corrective measures options is defined below.

7.6.10.a Applicability

Applicability addresses the overall suitability for the corrective action option for containment or remediation of the contaminants in the subject medium for protection of human health and the environment.

7.6.10.b Technical Practicability

Technical practicability describes the uncertainty in designing, constructing, and operating a specific remedial alternative. The description shall include an evaluation of historical applications of the remedial alternative including performance, reliability, and minimization of hazards.

7.6.10.c Effectiveness

Effectiveness assesses the ability of the corrective measure to mitigate the measured or potential impact of contamination in a medium under the current and projected site conditions. The assessment also shall include the anticipated duration for the technology to attain regulatory compliance. In general, all corrective measures described above will have the ability to mitigate the impacts of contamination at the site, but not all remedial options will be equally effective at achieving the desired cleanup goals to the degree and within the same time frame as other options. Each remedy shall be evaluated for both short-term and long-term effectiveness.

7.6.10.d Implementability

Implementability characterizes the degree of difficulty involved during the installation, construction, and operation of the corrective measure. Operation and maintenance of the alternative shall be addressed in this section.

7.6.10.e Human Health and Ecological Protectiveness

This category evaluates the short-term (remedy installation-related) and long-term (remedy operation-related) hazards to human health and the environment of implementing the corrective measure. The assessment shall include whether the technology will create a hazard or increase existing hazards and the possible methods of hazard reduction.

7.6.10.f Cost

This section shall discuss the anticipated cost of implementing the corrective measure. The costs shall be divided into: 1) capital costs associated with construction, installation, pilot testing, evaluation, permitting, and reporting of the effectiveness of the alternative; and 2) continuing costs associated with operating, maintaining, monitoring, testing, and reporting on the use and effectiveness of the technology.

7.6.11 Selection of Preferred Corrective Measure

The Permittee shall propose the preferred corrective measure(s) at the site and provide a justification for the selection in this section. The proposal shall be based upon the ability of the remedial alternative to: 1) achieve cleanup objectives in a timely manner; 2) protect human and ecological

receptors; 3) control or eliminate the sources of contamination; 4) control migration of released contaminants; and 5) manage remediation waste in accordance with State and Federal regulations. The justification shall include the supporting rationale for the remedy selection, based on the factors listed in Section 7.6.10 and a discussion of short- and long-term objectives for the site. The benefits and possible hazards of each potential corrective measure alternative shall be included in this section.

7.6.12 Design Criteria To Meet Cleanup Objectives

The Permittee shall present descriptions of the preliminary design for the selected corrective measures in this section. The description shall include appropriate preliminary plans and specifications to effectively illustrate the technology and the anticipated implementation of the remedial option at the subject area. The preliminary design shall include a discussion of the design life of the alternative and provide engineering calculations for proposed remediation systems.

7.6.13 Schedule

A section shall set forth a proposed schedule for completion of remedy-related activities such as bench tests, pilot tests, construction, installation, remedial excavation, cap construction, installation of monitoring points, and other remedial actions. The anticipated duration of corrective action operations and the schedule for conducting monitoring and sampling activities shall also be presented. In addition, this section shall provide a schedule for submittal of reports and data to NMED, including a schedule for submitting all status reports and preliminary data.

7.6.14 Tables

A section shall present the following summary tables, as appropriate. With prior approval of NMED, the Permittee may combine one or more of the tables. Data presented in the summary tables shall include information on dates of sample collection, analytical methods, detection limits, and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table summarizing regulatory criteria, background, and/or the applicable cleanup standards.
2. A table summarizing historical field survey location data.
3. Tables summarizing historical field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.
4. Tables summarizing historical soil, rock, or sediment laboratory analytical data. The summary tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
5. A table summarizing historical groundwater elevation and depth to groundwater data. The table shall include the monitoring well depths and the screened intervals in each well.
6. Tables summarizing historical groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

7. Tables summarizing historical surface water laboratory analytical data if applicable. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
8. Tables summarizing historical air sample screening and analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.
9. Tables summarizing historical pilot or other test data, if applicable, including units of measurement and types of instruments used to obtain measurements.
10. A table summarizing the corrective measures alternatives and evaluation criteria.
11. A table presenting the schedule for installation, construction, implementation, and reporting of selected corrective measures.

7.6.15 Figures

A section shall present the following figures for each site, as appropriate. All figures must include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All figures shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.
2. A unit site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system locations and details. Off-site well locations and other relevant features shall be included on the site plan if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.
3. Figures showing historical soil boring or excavation locations and sampling locations.
4. Figures presenting historical soil sample field screening and laboratory analytical data, if appropriate.
5. Figures showing all existing wells including vapor monitoring wells and piezometers. The figures shall present historical groundwater elevation data and indicate groundwater flow directions.
6. Figures presenting historical groundwater laboratory analytical data including past data, if applicable. The analytical data corresponding to each sampling location may be presented as individual concentrations, in table form on the figure or as an isoconcentration map.
7. Figures presenting historical surface water sample locations and analytical data including past data, if applicable. The laboratory analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure.
8. Figures presenting historical air sampling locations and presenting air quality data. The field screening or laboratory analytical data corresponding to each sampling location may be presented as individual concentrations, in table form on the figure or as an isoconcentration map.
9. Figures presenting historical pilot or other test locations and data, where applicable, including site plans or graphic data presentation.

10. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.
11. Figures presenting the locations of existing and proposed remediation systems.
12. Figures presenting existing remedial system design and construction details.
13. Figures presenting preliminary design and construction details for preferred corrective measures.

7.6.16 Appendices

Each corrective measures evaluation shall include, as appropriate, as an appendix, the management plan for waste, including investigation derived waste, generated as a result of construction, installation, or operation of remedial systems or activities conducted. Each corrective measures evaluation shall include additional appendices presenting relevant additional data, such as pilot or other test or investigation data, remediation system design specifications, system performance data, or cost analyses as necessary**.**

APPENDIX 8
CLOSURE PLAN SUBMITTAL SCHEDULE

Table 8-1
Closure Plan Submittal Schedule

Unit ID Number and Description	Due Date
Closure Plan for the Former Oscura Range Landfill (SWMU 158)	Clean Closure Complete
Closure Plan for the Tula Peak Burial Sites and Incinerator (SWMUs 57 and 61)	Clean Closure Plan for Tula Peak Ordinance Disposal Site WSMR February 2008. NMED Approval in April 2008. Execution in progress.
Post Closure care plan of the OB/OD at the HTA (SWMUs 55, 56, and 56A)	December 15, 2012
Closure Plan for the Former STP Ditches (SWMU 82)	December 15, 2012
Closure Plan for the Former Main Post Landfill #3 at Scrap Yard (SWMU 65)	March 15, 2011
Closure Plan for the Discharge Pipe at TTF (SWMU 106)	September 15, 2012
Closure Plan for the HELSTF Landfills (SWMUs 38 and 39)	March 15, 2012
Closure Plan for the HELSTF Cleaning Facility Sump (SWMU 142)	September 15, 2013
Closure Plan for the Acid Neutralization Pit (SWMU 101)	March 15, 2013
Closure Plan for the Liquid Propellant Evaporation/Neutralization Pits (SWMUs 92A, 92B, and 93 - 100)	November 15, 2013
Closure Plan for the Former Acid Neutralization Unit at the HWSF (SWM 89)	May 15, 2014
Closure Plan for the Red Rio Munitions Landfills (SWMUs 50 and 155)	Deferred. Active
Closure Plan for Oscura Munitions Landfills (SWMUs 41 - 46)	Deferred. Active

Table 8-2

SWMUs & AOCs Requiring Corrective Action

SWMUs and AOCs where Corrective Action is in Progress are listed in Appendix 4

Unit ID Number (SWMU & AOC#)	Unit Description	Work Plan Submittal Date
	SWMUs 167, 168 and AOC V	May 1, 2011 Release Assessment
AOC V	HELSTF Pressure Recovery System	
219	Main Post POL	May 15, 2010
132	Orogrande Waste Stabilization Pond	September 1, 2011
162	Stallion Range Center Former Fire Fighting Area	November 1, 2011
164	AMRAD Facility	January 1, 2011
165	LC - 34 Contaminated Soils @ Buildings 23104 & 23106	June 1, 2012
198	LC - 38 Diesel Fuel Oil Release	December 1, 2012
	SWMUs 40, 47, 48, 81, 102, 116	July 1, 2013 Release Assessment
40	Waste Oil Accumulation Drum	
81	Boiler at the STP	
102	Burn Pan	
116	Rhodes Subgrade Asphalt Tanks	
	SWMUs 107 - 113	May 1, 2013 Release Assessment
107	Storage Tank at Temperature Test Facility (TTF)	
108	Vapor Extraction Well at TTF	
109	Drum Storage Area (Splash Pan) at TTF	
110	Methylene Chloride Catchment System at TTF	
111	Methylene Chloride Separation System at TTF	
112	Methylene Chloride Separation System at TTF	
	SWMUs 121 - 131 and 133, 134	August 1, 2014 Release Assessment
121	Stallion Asphalt Tank	
122	Stallion Asphalt Tank	
123	Stallion Asphalt Tank	
124	Waste Oil Storage Tank @ Stallion	
125	Veterinary Clinic @ McAffee Clinic Incinderators	

126	**Veterinary Clinic @ McAffee Clinic Incinderators**	
127	**Autoclave at McAffee Clinic**	
128	**Silver Recovery System Tailing Tank**	
129	**Cyanide Treatment Unit at Building 1512**	
130	**Former Spent Developer Storage Tank / Acetic Acid Spill Containment Tank**	
131	**Former Spent Developer Storage Tank / Acetic Acid Spill Containment Tank**	
133	**NOMTS Machine Shop Accumulation Area**	
134	**NOMTS Outdoor Accumulation Area**	
	SWMUs 1 - 7 and 135	**December 1, 2014**
1	**Floor Drain for Building 1621**	
2	**Bleach and Fixer Collection Containers**	
3	**Bleach and Fixer Collection Containers**	
4	**Bleach and Fixer Collection Containers**	
5	**Bleach and Fixer Collection Containers**	**December 1, 2014**
6	**Bleach and Fixer Collection Containers**	
7	**Silver Recovery Unit Tailing Tank**	
135	**Paint Shop Accumulation Area**	
	SWMUs 136 - 138, 153, 163, 216 **AOCs A, B, D, E, G, H - L, P, S, W - Z**	**July 1, 2015** **Release Assessment**
136	**Paint Shop Spray Booth**	
137	**Paint Shop Sump**	
138	**Waste Accumulation Area @ RATSCAT**	
153	**Vandal Burial Site**	
163	**Abandoned Disposal Trench @ New Commissary**	
AOC A	**Sink & Drain System @ Building 1621**	
AOC B	**Battery accumulation Area @ North Oscura**	
AOC D	**Drum Storage Area @ STP**	
AOC E	**Pesticide Storage Area**	
AOC G	**Brine (MeCl) Storage Tank**	
AOC H,I, J, K,L	**Methylene Chloride Tanks (five tanks)**	
AOC P	**Chemistry Laboratory Drains at Building 1530**	

AOC S	**Septic Tanks with Leach Fields**	
AOC W	**Davies Tank**	
AOC X	**Stallion Range Desalinization/Sewage Lagoons**	
AOC Y	**Storm Water Drainage Ditches**	
AOC Z	**Abandoned Underground Storage Tank**	
AOC AB	**Sewage Lagoon**	**October 1, 2015**
AOC AD	**Main Contonment Area**	**January 1, 2015**
218	**LC - 38 Building 23626**	**March 1, 2015**