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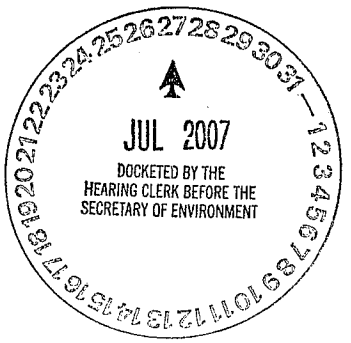
STATE OF NEW MEXICO
ENVIRONMENT DEPARTMENT

NEW MEXICO ENVIRONMENT DEPARTMENT,	)	
	)	
Complainant,	)	NO. HWB 07- 34 (CO)
	)	
v.	)	
	)	
SAN JUAN REFINING COMPANY, and	)	
GIANT INDUSTRIES ARIZONA, INC.	)	
	)	
Respondents.	)	



ORDER

July 27, 2007

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LIST OF ACRONYMS

AST	Above Ground Storage Tank
AOC	Area of Concern
ASTM	American Society for Testing and Materials
bbl	Barrel
BPD	Barrels Per Day
BGS	Below Ground Surface
BLM	U.S. Bureau of Land Management
BRC	Bloomfield Refining Company
BOD	Biological Oxygen Demand
BS/BSD	Blank Spike/Blank Spike Duplicate
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic Feet Per Second
CFR	Code of Federal Regulations
CMI	Corrective Measures Implementation
CME	Corrective Measures Evaluation
CLP	Contract Laboratory Program
COC	Chain of Custody
COD	Chemical Oxygen Demand
DTP	Depth to Product
DTW	Depth to Water
DNAPL	Dense Non-aqueous Phase Liquids
DOT	Department of Transportation

DRO	Diesel Range Organics
ECO-SSL	Ecological Soil Screening Level
EPA	U.S. Environmental Protection Agency
ft	Feet
GRO	Gasoline Range Organics
gpd	Gallons Per Day
gpm	Gallons Per Minute
GRCB	Giant Refining Company Bloomfield
GTI	Groundwater Technologies, Inc.
HDPE	High Density Polyethylene
HEB	Heat Exchanger Bundle
HI	Hazard Index
HHMSSL	Human Health Medium-Specific Screening Level
HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Amendments
HWA	New Mexico Hazardous Waste Act, NMSA 1978, 74-4-1 et seq.
IDW	Investigation-Derived Waste
IM	Interim Measures
K	Hydraulic Conductivity
K_d	Sorption Coefficient
kg	Kilogram
LPG	Liquid Propane Gas
m	Meter
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram

mg/L	Milligrams per Liter
mL	Milliliter
m/s	Meters per Second
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSL	Mean Sea Level
NAPL	Non-aqueous Phase Liquids
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NOWP	North Oily Water Pond
NPDES	National Pollutant Discharge Elimination System
OCD	New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division
ORO	Oil Range Organics
PAH's	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photo-ionization Detector
ppb	Parts per billion
ppm	Parts per million
ppmv	Parts per million of vapor
ppmw	Parts per million by weight
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RC	Remedy Completion
RCRA	Resource Conservation Recovery Act, 42 U.S.C. Section 6901 et seq.
RFI	RCRA Facility Investigation

SJRC	San Juan Refining Company – Bloomfield Refinery
SAP	Sampling and Analysis Plan
SAR	SWMU Assessment Report
SPH	Separate Phase Hydrocarbons
SOWP	South Oily Water Pond
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TSDF	Treatment, Storage, and Disposal Facility
UCL	Upper Confidence Level
USGS	United States Geological Survey
UTL	Upper Tolerance Level
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter

I. INTRODUCTION

Pursuant to the New Mexico Hazardous Waste Act, NMSA 1978, § 74-4-10(A) and (E), the New Mexico Environment Department hereby **ORDERS** the San Juan Refining Company and Giant Industries Arizona, Inc. (the Respondents) to comply with the terms and conditions hereinafter set forth in this Order.

The New Mexico Environment Department (the Department) issues this Order to the Respondents, the San Juan Refining Company, and Giant Industries Arizona, Inc., under the New Mexico Hazardous Waste Act (HWA), NMSA 1978, § 74-4-10(A) and (E), and the New Mexico Hazardous Waste Management Regulations 20.4 NMAC. This Order contains the investigation and corrective action requirements, including requirements under NMSA 1978, §§ 74-4-4.2(B) and 74-4-10(E), for the Respondents' petroleum refining facility (the Facility), owned by the San Juan Refining Company and operated by Giant Industries Arizona, Inc.

This Order is divided into 11 Sections. Section II of this Order sets forth the Department's findings of fact and conclusions of law in support of this Order. Section III contains general provisions, such as purposes, definitions, offsite access, entry and inspection, availability of information, reservation of rights, enforcement, and financial responsibility. Section IV sets forth the requirements for a detailed, comprehensive investigation of environmental contamination at the Facility. Section V provides for the monitoring of interim remediation systems. Section VI provides corrective measures that identify cleanup alternatives and the implementation of cleanup measures for the Facility. Section VII establishes screening and cleanup levels for contaminants at the Facility. Section VIII sets forth methods and procedures for investigation, sampling, and analysis. Section IX sets forth monitoring well construction requirements. Section X sets forth requirements for various reports to be submitted to the Department. Section XI sets forth a table of work plans and reports that the Respondents must submit to the Department.

The requirements of this Order apply to all interim status units, solid waste management units (SWMU's), and areas of concern (AOC's) identified in this Order or discovered after the effective date of this Order, and to all other places at the Facility where contaminants may have come to be located. The requirements of this Order also apply to all contaminants that have migrated from the Facility beyond the Facility boundary.

II. FINDINGS OF FACT AND CONCLUSIONS OF LAW

II.A. FINDINGS OF FACT

Based on the Administrative Record, the Department makes the following findings of fact.

II.A.1. Complainant

1. Complainant is the New Mexico Environment Department, the department within the executive branch of the New Mexico State government charged with administration and enforcement of the HWA, NMSA 1978, §§ 74-4-1 to 74-4-14, and the Hazardous Waste Regulations, 20.4.1 NMAC.

II.A.2. Respondents

2. The Respondents the San Juan Refining Company and Giant Industries Arizona, Inc. are respectively the owner and operator of the Facility.

II.A.3. Facility

3. The Facility is a crude oil refinery comprised of approximately 0.45 square miles (285 acres) located in northwestern New Mexico, within the San Juan Basin. The facility is situated in San Juan County approximately 0.5 miles east of U.S. Highway 550 on County Road 4990 (Sullivan Road), and approximately one mile south of the city of Bloomfield. The Facility is located on the south side of the San Juan River and the Hammond Irrigation Ditch (Hammond Ditch) and situated on a bluff approximately 120 feet above the river. The bluff itself is at an elevation of 5,540 feet above mean sea level. Property managed by the Bureau of Land Management (BLM) borders the Facility to the south. Undeveloped company property, and the San Juan River border the Facility to the north. Undeveloped private and public lands border the property to the east and several gravel pits border the property to the west. A large portion of the undeveloped land in the vicinity of the refinery is used for oil and gas production and as range for grazing. (GTI 1993, GTI 1994a, GRC 1996, SJRC 2005a, SJRC 2004)

4. The portion of the Facility located north of County Road 4990 includes an office area that consists of buildings, warehouse space and a storage yard, parking lots, a heavy oil loading station, the petroleum process area, API separator and wastewater treatment surface impoundments, the raw water ponds, the tank farm, a fenced-in equipment lay-down area utilized to store refinery equipment prior to use, the fire training area, and the solid waste disposal area. The Facility south of County Road 4990 includes the terminal office and parking areas, terminals for loading product and off-loading crude oil and gas, a hazardous waste storage area (less than 90-day), a high pressure storage bullet tank area, the regional office and parking area, the transportation maintenance facility and truck parking areas, the refinery wastewater holding ponds, and a class I injection well. (SJRC 2005b)

5. Running southwest through the center of the Facility are four utility pipelines operated by El Paso Natural Gas, Enterprise, Conoco-Phillips, and Giant. The Enterprise and Giant pipelines are currently not in service. (Robinson 2005)

6. Surface waters in the vicinity of the Facility include the San Juan River and the Hammond Irrigation Ditch. The San Juan River originates in the San Juan Mountains of Colorado approximately 100 miles northeast of Bloomfield and is located north of the Facility flowing west/southwest. The San Juan River is controlled upstream by the Navajo Dam and is used for potable drinking water for the city of Bloomfield and surrounding areas. Hammond Ditch is located on the bluff between the river and the process area of the Facility, flowing east to west across the site. Hammond Ditch is a man-made canal, lined with concrete in 2002, that transports water used for irrigation and watering livestock only. In addition, man-made surface water features at the Facility includes the wastewater holding ponds, raw water ponds, and the wastewater treatment surface impoundments. (GTI 1994a, GTI 1995b, SJRC 2005a)

7. Groundwater at the site is present at depths ranging from approximately 6 to 40 feet below ground surface (bgs), increasing in depth from west to east across the site. Groundwater flow direction is generally from the southeast to the northwest toward Hammond Ditch and the San Juan River. The shallow groundwater consists of an aquifer where groundwater migrates through the permeable glacial outwash deposits designated as the Jackson Lake Terrace overlying the less permeable Nacimiento Formation. A permanent shallow aquifer formed above the Nacimiento Formation likely as a result of site development, refinery operations, and leakage from the Hammond Ditch. This shallow aquifer is not currently used for drinking water. Below the Nacimiento Formation is the Ojo Alamo sandstone formation, a water-bearing unit used as a potable water source. (GTI 1993, Malcolm Pirnie, Inc. 2004)

8. The geologic units that underlie the Facility are as follows: the uppermost unit consists of unconsolidated surface soils, silts, and fine windblown sands forming loess deposits. The silty fine sand is underlain by the Jackson Lake Terrace deposit, approximately 10 to 15 feet thick. The Jackson Lake Terrace consists of well-rounded boulders, cobbles, gravels and sands exhibiting moderate to high permeability. Below the Jackson Lake Terrace is the Nacimiento Formation. The Nacimiento Formation is composed of interbedded, black carbonaceous mudstone, siltstone, and argillaceous sandstones. The Nacimiento Formation has been investigated at the Facility to a depth of approximately 100 feet; however, literature suggests the formation ranges up to 900 feet in total thickness. The Nacimiento Formation demonstrates low permeability and acts as a confining unit for the Jackson Lake Terrace. Below the Nacimiento Formation is the Ojo Alamo Sandstone, a water-bearing unit consisting of tertiary sandstones. Directly below the Ojo Alamo are the Cretaceous Kirtland Shale and the Fruitland Formation. The Nacimiento Formation acts as a confining layer to vertical migration of groundwater beneath the refinery, which does not infiltrate to the underlying Ojo Alamo Sandstone. (EPA 1987, GTI 1993, Malcolm Pirnie, Inc. 2004)

II.A.4. Facility Operations

9. Kimball Campbell Corporation constructed the Facility as a crude topping unit in the late 1950's. Ownership of the refinery has changed hands over the years. The Facility

is currently owned by the San Juan Refining Company and operated by Giant Industries Arizona, Inc. (GRC 2006, SJRC 2005b, http://www.giant.com/)

10. The Facility has a capacity to receive and process up to 18,000 barrels of crude oil per day. The main source of crude oil supply comes from the Four Corners area, and is transported by pipeline or tanker truck. The Facility operates the following process units: crude distillation, reforming, fluidized catalytic cracking, sulfur recovery, merox treater, catalytic polymerization, and diesel hydrotreating. Current and past operations produce leaded and unleaded gasoline, diesel fuels, Jet-A fuel, JP-4 jet fuel, kerosene, propane, butane, naphtha, residual fuel, heavy fuel oils, and liquefied petroleum gas. (GRC 1996; SJRC 2005a, SJRC 2005b, http://www.giant.com/

II.A.5. Waste Management and Releases of Hazardous Waste and Hazardous Constituents

11. Hazardous waste generated or handled at the Facility as part of normal operating procedures include: ignitable waste (D001), corrosive waste (D002), wastes toxic for arsenic (D004), mercury (D009), selenium (D010), and benzene (D018), heat exchanger bundle cleaning sludge (K050), API separator sludge (K051), crude oil tank sediment (K169), clarified slurry oil tank sediment (K170), spent hydrotreating catalyst (K171), primary oil/water/solids separation sludge (F037), and secondary (emulsified) oil/water/solids separation sludge (F038). (GTI 1993, GRC 1996, SJRC 2005b)

12. Hazardous wastes D001, D002, D004, D009, D010, D018, K050, K051, K170, K171 are disposed of offsite. Hazardous waste (D018) is treated in the North and South Aeration Lagoons, an interim status unit. The treated wastewater is either further treated by evaporation or injected in a Class I injection well permitted by the Oil Conservation Division of the New Mexico Energy, Minerals, and Natural Resources Department (OCD) under the New Mexico Water Quality Act.

13. Product releases from the refinery process areas, the above-ground storage tanks and associated piping, the loading and unloading areas, the waste storage and disposal areas, and other areas of the Facility have resulted in hazardous waste and hazardous waste constituents entering the environment during the years of the Facility's operation. Contaminants released at the Facility include: 1) organic contaminants such as benzene, toluene, ethylbenzene, xylenes (BTEX); other volatile organic compounds (VOCs); semi volatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAH's); separate phase hydrocarbons (SPH); diesel range organics (DRO); gasoline range organics (GRO); oil range organics (ORO); 2) metals such as arsenic, barium, cadmium, chromium, copper, lead, mercury, manganese, selenium, and zinc; and 3) other inorganic contaminants such as fluoride, chloride, nitrate, and sulfate. Most contaminants detected beneath the Facility are found in the northwest portion of the refinery and primarily consist of BTEX, GRO, DRO, and SPH. Surface water, groundwater, and soil have all been affected, to varying degrees, from the release of contaminants. (GTI 1993, GRC 1996, SJRC 2004)

14. On November 7, 1984, 880 barrels (one barrel equals 42 gallons) of naphtha spilled from an unspecified storage tank, of which 80 barrels were not recovered. The spill was contained by an earthen secondary containment berm. The recovered naphtha was collected and returned to the refining system. (GTI 1993, BR 2001.) Naphtha contains BTEX constituents.

15. On May 19, 1985, 140 barrels of diesel fuel spilled inside the dike of Tank 19, of which 80 barrels were not recovered. The product was removed from the tank and a vacuum truck was used to recover the product from inside the dike. (GTI 1993, BR 2001) Diesel fuel contains BTEX constituents and PAH's.

16. On April 8 and 9, 1986, 200 barrels of diesel fuel spilled near the crude unit, of which 150 barrels were not recovered. The spill resulted from leaking diesel rundown piping located in the lower pipe rack east of the crude unit. The diesel rundown was routed to a slop tank until the leak was repaired. A vacuum truck was used to recover the fuel and the area was covered with sand. This area has since been paved with concrete. (GTI 1993, BR 2001)

17. On February 24, 1987, 290 barrels of regular gasoline spilled during blending, of which five barrels were not recovered. The spill occurred inside an unspecified tank dike. The recovered gasoline was collected with a vacuum truck. (GTI 1993, BR 2001) Gasoline contains BTEX constituents.

18. On August 27, 1989, 100 barrels of gasoline blend/water mixture spilled, of which one barrel was not recovered. The spill occurred inside the dike of Tank 22. The recovered gasoline blend/water mixture was collected using a vacuum truck. (GTI 1993, BR 2001)

19. On March 8, 1991, 180 barrels of kerosene (Jet A) spilled during transfer inside the dike of Tank 26, of which 60 barrels were not recovered. The recovered kerosene was collected using a vacuum truck. (GTI 1993, BR 2001.) Kerosene contains BTEX constituents and PAH's.

20. On October 22, 1997, 100 barrels of crude spilled in the unloading area contained within a dike. Two barrels were not recovered. The soil was treated in place (BR 2001.) Crude petroleum contains BTEX, PAH's, and metals.

21. On January 20, 1998, 1,831 barrels of process wastewater leaked due to a line break, of which 10 barrels were not recovered. The leak occurred due west of the north lined evaporation pond. The leak was diverted to a constructed dike until the line was repaired. Process wastewater at refineries often contains listed hazardous wastes (F037 and F038) and characteristic hazardous waste, toxic for benzene (D018). (BR 2001)

22. From 1985 to 1992 inspections of product storage tanks located in the central tank farm detected leaks at the following tanks: 17, 18, 19, 20, 23, 24, 25, 26, 29, 30, and 31. The quantities released and product types are not known. (GTI 1993, BR 2001)

23. Petroleum and petroleum products including crude oil, naphtha, gasoline, kerosene, jet fuel, and diesel fuel, contain the hazardous constituents benzene, ethylbenzene, toluene, and xylenes (BTEX).

24. Petroleum, and petroleum products including crude oil, naphtha, jet fuel, kerosene, and diesel fuel contain PAH's.

25. During May and June 1983, EPA personnel conducted inspections that revealed groundwater seeps from the contact of the Jackson Lake Terrace and the Nacimiento Formation at the face of the bluff above the San Juan River. Analyses of samples obtained from these seeps during a May 1984 inspection detected organic and inorganic contamination released from the Facility that reached the San Juan River. (EPA 1992)

26. In 1999, the Respondents installed sheet pilings and a bentonite slurry wall adjacent to the San Juan River that extends along the perimeter of the riverbank from the base of the bluff east of the refinery process area to the refinery river water supply inlet station. The sheet pilings and slurry wall were installed to prevent SPH and dissolved-phase hydrocarbons from migrating into the San Juan River. (SJRC 2005a, SJRC 2005b, GRCB 2005)

27. From 2001 to 2002, the Hammond Conservancy District and the Respondents lined the Hammond Irrigation Ditch with concrete. The ditch extends along the Facility's northern and western boundaries between the Facility and the San Juan River. The water present in the ditch acted as a hydraulic barrier prior to installation of the liner, confining the bulk of the contaminants to within the refinery boundaries. The Respondents also installed a recovery system with a French drain to preserve the integrity of the concrete liner. In January 2003, the Department required the Facility to install three monitoring wells (MW-45, MW-46, MW-47) on the north and west sides of the newly lined ditch to evaluate the effectiveness of the recovery system and to determine whether petroleum contamination was migrating beyond the irrigation ditch. In December 2003, the Respondents notified the Department of the discovery of SPH in groundwater monitoring well MW-47 located on the river side of the ditch opposite the process area. (BR 2002, GRC 2003, SJRC 2004, SJRC 2005a)

28. In October 2003, the Respondents informed the Department of the discovery of hydrocarbons in the #1 East Outfall located northeast of Tanks 13 and 14. Since the discovery of hydrocarbons, the Respondents have pumped the discharge from the #1 East Outfall to a collection tank (#38) where the water is then routed to a separator tank (#33), which separates emulsified hydrocarbons by gravitation. The underflow is then routed for discharge to the raw water ponds. During monthly sampling from November through March 2005, effluent from the #1 East Outfall entering the raw water ponds exceeded the Water Quality Control Commission (WQCC) standard for benzene of 10 micrograms per liter (μg/L) at concentrations ranging from 25 μg/L to 99.7 μg/L. (Schmaltz 2003a, Schmaltz 2003b, SJRC 2004)

29. Chemical analyses of groundwater samples collected in March and August 2003, revealed benzene and ethylbenzene in excess of the WQCC standards (10 μg/L and 750 μg/L respectively), in the following monitoring wells and piezometers: MW-47, MW-45, P-4, and P-5 which are located on the north side (downgradient) of Hammond Ditch. Benzene concentrations ranged from 160 μg/L to 4,400 μg/L and ethylbenzene concentrations ranged from 3,000 μg/L to 5,500 μg/L. Groundwater samples collected from MW-45, P-4, and P-5 exceeded the WQCC standards for toluene (750 μg/L) and total xylenes (620 μg/L) at concentrations ranging from 630 μg/L to 3,000 μg/L and 10,000 to 30,000 μg/L, respectively. (SJRC 2004)

30. Chemical analyses of groundwater samples collected in August 2003 revealed chloride concentrations exceeding the WQCC standard (250,000 μg/L) in monitoring wells MW-3, MW-13 (located in the southeastern portion of the facility), MW-27, MW-32, MW-33 (located southwestern portion of the Facility), and MW-47 (located on the north side of Hammond Ditch and east of the process area) at concentrations ranging from 360,000 μg/L to 1,400,000 μg/L. Sulfate exceeded the WQCC standard (600,000 μg/L) in groundwater samples collected from MW-3, MW-8, MW-12, MW-32, and MW-33 at concentrations ranging from 840,000 to1,900,000 μg/L. (SJRC 2004)

31. Various WQCC standards were exceeded during the August 2003 groundwater monitoring event in monitoring wells located south of the process area and south of Sullivan Road. Groundwater samples collected from MW-11 and MW-26 exceeded the WQCC standard for benzene (10 μg/L) at concentrations ranging from 1,400 μg/L to 2,700 μg/L. Analysis of dissolved metals exceeded the WQCC standard for manganese (200 μg/L) in MW-35, MW-37, and MW-38 at concentrations ranging from 1,400 μg/L to 3,300 μg/L. Selenium was detected in MW-34, MW-35, MW-37, and MW-38 at concentrations ranging from 110 μg/L to 150 μg/L exceeding the WQCC standard (50 μg/L). Groundwater samples collected from MW-37 and MW-38 exceeded the federal action level for lead (15 μg/L) at concentrations of 180 μg/L and 210 μg/L, respectively. (SJRC 2004)

32. Chemical analyses of groundwater samples collected in the March and August 2003 semi-annual and annual sampling events detected the gasoline additive methyl tertiary-butyl ether (MTBE) across the site in the following monitoring wells: MW-8, MW-11, MW-13, MW-20, MW-35, MW-37, MW-38 (located in the southwest portion of the facility south of Sullivan Road), MW-47 (located on the north side of Hammond Ditch), and in Outfall #1 (located in the northeast portion of the Facility) at concentrations ranging from 1 μg/L to 570 μg/L. The United States Environmental Protection Agency (EPA) Region 6 Tap Water Human Health Medium Specific Screening Level (EPA Region 6 HHMSSL) for MTBE is 6.2 μg/L. Groundwater monitoring indicates the migration of MTBE offsite. MTBE is a fast moving constituent that is an indicator for the movement of other hydrocarbon constituents. (SJRC 2004)

33. During March, May, and August 2003, SPH was detected across the site in the following areas: 1) the process area in monitoring and recovery wells MW-9, MW-20, MW-40, MW-41, RW-18, RW-28, RW-22, RW-23, RW-28, RW-42, and RW-43; 2) in the tank farm area in MW-21, RW-14, and RW-17; 3) north of Hammond Ditch in MW- 24,and MW-45,; and 4) the southern portion of the facility north of Sullivan Road in RW-1 and MW-4. The SPH measurements ranged in thickness from approximately 0.02 feet to 5.34 feet. (SJRC 2004)

34. During the March and August 2004 semi-annual and annual groundwater monitoring events, contaminant concentrations detected in groundwater samples collected from monitoring wells and piezometers MW-20, MW-45, MW-47, P-4, P-5, and P-6 exceeded the WQCC standard for benzene (10 μg/L) at concentrations ranging from 560 μg/L to 21,000 μg/L. Toluene exceeded the WQCC standard (750 μg/L) in samples collected from monitoring wells MW-20 and MW-45 at concentrations of 1,200 μg/L and 860 μg/L, respectively. Analytical results showed ethylbenzene exceeded the WQCC standard (750 μg/L) in MW-45, MW-47, P-4, P-5, and P-6 at concentrations ranging from 900 μg/L to 9,100 μg/L. Groundwater samples collected from MW-45, MW-47, P-4, P-5, and P-6 exceeded the WQCC standard for total xylenes (620 μg/L) at concentrations ranging from 7,900 μg/L to 32,000 μg/L. These wells are located on the north side (downgradient) of Hammond Ditch toward the San Juan River with the exception of MW-20, which is located on the south side (upgradient) of Hammond Ditch. (SJRC 2005a)

35. During the August 2004 annual groundwater sampling event, contaminant concentrations detected in groundwater samples collected from the following monitoring and recovery wells exceeded the WQCC standards for benzene (10 μg/L): MW-11, MW-26, and MW-31 (located south of Sullivan Road offsite), MW-21, MW-30, RW-14, RW-15, and RW-16 (located in the tank farm area), MW-39 and RW-3 (located in the vicinity of the Process area) at concentrations ranging from 130 μg/L to 9,400 μg/L. Contaminants in groundwater samples exceeded the WQCC standard for toluene (750 μg/L) in RW-14 and RW-15 at concentrations of 17,000 μg/L and 15,000 μg/L, respectively. The WQCC standard for ethylbenzene (750 μg/L) was exceeded in groundwater samples collected from MW-30, RW-14, and RW-15 at concentrations ranging from 1,900 μg/L to 3,200 μg/L. The WQCC standard for total xylenes (620 μg/L) was exceeded in groundwater samples collected from monitoring and recovery wells MW-30, MW-31, MW-39, RW-3, RW-14, RW-15, and RW-15 at concentrations ranging from 1,200 μg/L to 22,000 μg/L. (SJRC 2005a)

36. During the August 2004 groundwater monitoring event, chloride concentrations exceeded the WQCC standard (250,000 μg/L) at concentrations ranging from 250,000 μg/L to 840,000 μg/L in monitoring wells MW-8, MW-13 (located in the southeastern portion of the facility), MW-21, MW-27, MW-32, MW-33 (located southwestern portion of the Facility), and recovery wells RW-15 and RW-16 (located in the Tank Farm Area). Sulfate concentrations exceeded the WQCC standard (600,000 μg/L) at concentrations ranging from 680,000 μg/L to 5,100,000 μg/L in samples collected

from MW-7, MW-8, MW-12, MW-21, MW-30, MW-31, MW-33, MW-39, and MW-44. (SJRC 2005a)

37. Analyses of the March and August 2004 groundwater sampling events, detected MTBE in the following monitoring wells and piezometer: MW-13, MW-20, MW-21, MW-29, MW-35, MW-36, MW-37, MW-38, MW-44, and P-6 at concentrations ranging from 2.6 μg/L to 26,000 μg/L. These wells are located in the tank farm area, north of the process area, and south of Sullivan Road. The EPA Region 6 HHMSSL for MTBE is 6.2 μg/L. Detections in the wells in the southern and western portions of the refinery indicate migration of MTBE offsite. MTBE is a fast moving constituent that is an indicator for the movement of other hydrocarbon constituents. (SJRC 2005a)

38. During the August 2004 groundwater monitoring event, dissolved metals concentrations exceeded the WQCC standards for barium (1,000 μg/L) in monitoring and recovery wells MW-26, RW-14, and RW-15 at concentrations ranging from 1,200 μg/L to 1,800 μg/L. Manganese exceeded the WQCC standard (200 μg/L) at concentrations ranging from 260 μg/L to 4,300 μg/L in MW-7, MW-8, MW-11, MW-12, MW-13, MW-21, MW-26, MW-27, MW-29, MW-30, MW-31, MW-34, MW-35, MW-36, MW-37, MW-38, MW-39, MW-44, RW-03, RW-14, RW-15, RW-16, and P-5. Zinc exceeded the WQCC standard (10,000 μg/L) in MW-11 at a concentration of 63,000 μg/L. (SJRC 2005a)

39. During the August 2004 groundwater monitoring event, groundwater samples were analyzed for total metals. Groundwater samples collected from monitoring wells: MW-26 and MW-36 exceeded the EPA maximum contaminant level (MCL) for barium (2,000 μg/L) at concentrations of 2,000 μg/L and 2,600 μg/L, respectively. Groundwater samples collected from MW-8, MW-12, MW-39, and MW-44 exceeded the MCL and WQCC standards for chromium of (100 μg/L and 50 μg/L, respectively) at concentrations ranging from 110 μg/L to 1,900 μg/L. Groundwater samples analyzed from MW-12, MW-37, MW-38, MW-39, and MW-44 exceeded the federal action level and the WQCC standard for lead (15 μg/L and 50 μg/L, respectively) at concentrations ranging from 19 μg/L to 180 μg/L. (SJRC 2005a)

40. During the March and August 2004 groundwater sampling events, SPH was detected in the following monitoring and recovery wells: MW-20, MW-40, MW-41, RW-9, RW-18, RW-19, RW-22, RW-23, RW-28, RW- 42, RW-43 (located in the process area), MW-21, RW-14, RW-17 (located in the tank farm), MW-25 (located south of Sullivan Road offsite), MW-4, RW-01, RW-02, RW-03 (located slightly north of Sullivan Road), and MW-47 (located north side of Hammond Ditch, downgradient). Product level thickness ranged from approximately 0.1 to 6.53 feet. (SJRC 2005a.) Separate phase hydrocarbon was detected in MW-45 during March 2004. Water/product levels were not measured in August 2005 because the product was being recovered from the well.

41. In August 2004, the Department discovered two active releases of petroleum hydrocarbons to two drainages on the north side of the Facility. The drainages are

small tributaries to the San Juan River. The releases are identified as the Seep North of MW-45. During the inspection of the drainages, hydrocarbons had stained the soil and migrated down to the San Juan River. (SJRC 2005b)

42. In November and December 2004 the Respondents discovered two more active releases in arroyos northwest of the Facility. The releases are identified as the Seep North of MW-46 and Seep North of MW-47. These seeps exhibited hydrocarbon stained soil and dead vegetation. To assess contaminant migration from these releases, water samples were collected from the San Juan River from the following four locations: North of MW-45, North of MW-46, River Downstream of the Facility, and River Upstream of Facility. River water samples collected in August 2004 from sampling points identified as North of MW-45 and North of MW-46 (initially identified as Draw North of MW-47) exceeded the MCL for benzene (5 μg/L) at concentrations of 9.7 μg/L and 6.3 μg/L, respectively. (OCD 2004, Schmaltz 2004b, Schmaltz 2004c, SJRC 2005a)

43. In October 2004 and April 2005, the Respondents conducted an investigation at the river terrace landward of the sheet-pile barrier wall located along the river northeast of the refinery process area to evaluate for the presence and extent of hydrocarbons in groundwater. During the investigation two monitoring wells (MW-48 and MW-49) and 13 temporary well points (TP-1 through TP-13) were installed. Contaminants were detected in soil and groundwater samples collected from the borings. The highest concentrations of contaminants were detected near the sheet pilings and barrier wall (installed in 1999). Hydrocarbon contamination also extended to the east. In October of 2004, contaminant concentrations detected in groundwater samples collected from Temporary Wells TP-1, TP-2, TP-5, TP-6, and TP-8 exceeded the WQCC standard for benzene (10 μg/L) with concentrations ranging from 98 μg/L to 3,100 μg/L. The sample results also exceeded the WQCC standard for toluene (750 μg/L) in TP-2 with a concentration of 8,200 μg/L. Groundwater samples collected from TP-1, TP-2, TP-4, TP-5, TP-6, and TP-8 contained concentrations that exceeded the WQCC standard for ethylbenzene (750 μg/L) with concentrations ranging from 810 μg/L to 5,200 μg/L. The WQCC standard for xylenes (620 μg/L) was exceeded in TP-1, TP-2, TP-4, TP-5, TP-6, and TP-8 with concentrations ranging from 1,600 μg/L to 39,000 μg/L. (Schmaltz 2004a)

44. In August 2005, groundwater sampling revealed benzene concentrations above the WQCC standard (10 μg/L) in TP-1, TP-2, TP-5, TP-6, and TP-8, ranging from 280 μg/L to 6,100 μg/L. A groundwater sample collected from TP-2 exceeded the WQCC standard for toluene (750 μg/L) at a concentration of 8,700 μg/L. Contaminants detected in groundwater samples collected from TP-1, TP-2, TP-5, TP-6, and TP-8 exceeded the WQCC standard for ethylbenzene (750 μg/L) at concentrations ranging from 2,800 μg/L to 4,200 μg/L. Total xylenes detected in samples collected from TP-1, TP-2, TP-5, TP-6, and TP-8, exceeded the WQCC standard (620 μg/L) at concentrations ranging from 7,500 μg/L to 25,00 μg/L. (GBR 2005)

45. Monitoring wells MW-48 (located on the refinery side of sheet pile) and MW-49 (located on the river side of sheet pile) were installed on October 28, 2004. During the installation, soil samples were collected. The soil sample collected from MW-48 at 5.0 to 6.5 feet contained DRO and GRO concentrations of 140,000 micrograms per kilogram (μg/kg) and 1,500,000 μg/kg, respectively. The soil sample collected from MW-49 at a depth of 5.0 feet to 6.5 feet contained GRO at 550,000 μg/kg. (SJRC 2005a)

46. Monthly groundwater sampling was conducted at MW-48 during January through November 2005. The analytical results indicate exceedances of the WQCC standards for benzene (10 μg/L), ethylbenzene (750 μg/L), and xylene (620 μg/L) at concentrations ranging from 280 μg/L to 730 μg/L, 900 μg/L to 2,500 μg/L, and 3,700 μg/L to 11,000 μg/L, respectively. Samples collected from MW-48 also exceeded the WQCC standard for naphthalene (30 μg/L) at concentrations ranging from 86 μg/L to 620 μg/L during the months of May through October 2005. (Monthly sampling results)

47. During February through December 2005 (with the exception of June) benzene concentrations detected in monthly groundwater samples collected from MW-49 exceeded the WQCC standard (10 μg/L) at concentrations ranging from 13 to 93 μg/L. The November 2004 sampling event revealed manganese exceeding the WQCC standard (200 μg/L) at a concentration of 550 μg/L. (SJRC 2005a)

48. The groundwater sample collected on August 23, 2005 from dewatering well DW #2 exceeded the WQCC standard for naphthalene (30 μg/L) at a concentration of 140 μg/L. (GBR 2005)

49. TPH as DRO was detected in groundwater samples collected from TP-1, TP-2, TP-4, TP-5, TP-6, and TP-8 at concentrations ranging from 1,100 μg/L to 7,800 μg/L. (GBR 2005) These DRO concentrations exceed the Department's screening level of 200 μg/L for oil of unknown origin in potable groundwater. (*New Mexico Environment Department TPH Screening Guidelines,* Table 2a (November 2005)).

II.A.6. Facility Interim Status Units, Solid Waste Management Units, and Areas of Concern

50. The Department has identified the following interim status unit, solid waste management units (SWMU's) and areas of concern (AOC's) at the Facility.

II.A.6.a Interim Status Unit No. 1: North Aeration Lagoon and South Aeration Lagoon (North and South Oily Water Ponds)

51. The North and South Oily Water Ponds are surface impoundments now designated as the North Aeration Lagoon (NAL) and the South Aeration Lagoon (SAL). The NAL and SAL are located in the northwest portion of the Facility, north of the API Separator and south of Hammond Ditch. The NAL and SAL currently operate as hazardous waste treatment units and are regulated under the authority of the Hazardous Waste Act

due to the treatment of benzene (hazardous waste Code D018). The NAL and SAL are utilized to treat refinery wastewater effluent discharged from the API Separator by aggressive biological treatment as defined in 20.4.1.200 NMAC (incorporating 40 CFR 261.31 (b)). (GRC 1996, GRCB 2003) F037 and F038 waste are generated if the aeration system ceases to operate for any reason and there is a cessation of lateral particle movement in any part of the wastewater treatment system. Pursuant to a Consent Agreement and Final Order entered by EPA on May 18, 2006, Giant is required to treat the wastewater to render it non-hazardous before it is discharged into the NAL and SAL. Giant must begin such treatment by October 18, 2007. (EPA 2006; EPA 2007)

II.A.6.b SWMU No. 2: The Drum Storage Area North Bone Yard

52. The North Bone Yard was identified as a SWMU during an RFA conducted in June 1987 by EPA and is located north of the former evaporation ponds (raw water ponds) on the northeast corner of the Facility. In July 1987, drums were removed from the North Bone Yard to the Warehouse Yard. The number and contents of the drums moved is not clear. Monitoring well MW-1, located in the North Bone Yard, was sampled during both of the Phase III RFA events, and no targeted VOC's and SVOC's were detected. Currently, the North Bone Yard stores empty drums. It is not known if the North Bone Yard was used for waste storage in the past and it is not known whether any of these drums leaked. (GTI 1993, GTI 1994a, GRCB 2003)

II.A.6.c SWMU No. 3: Underground Piping Currently in Use

53. Several underground piping systems exist at the Facility. Due to the age of the refinery, operating activities, and age of piping at the Facility, it is likely the piping has leaked hazardous constituents into the environment in the past. Most of the current underground piping is associated with the transport and loading product areas, the Above Ground Storage Tank (AST) Farm, and the wastewater treatment system. The wastewater treatment system includes a network of curbing, paving, catch basins, and refinery sumps associated with the storm water collection system, loading terminal sumps, drains, and underground piping that collects rainwater and other effluent from various process areas within the refinery. The wastewater is conveyed to the API separator. Underground piping is a potential source of contamination due to the nature of activities conducted at the Facility since operations began in the 1950's. The GTI 1993 Report states, "[f]rom previous investigations, a separate-phase hydrocarbon (SPH) plume has been partially delineated at the BRC site, extending from the western area of the site (near the offices) to the eastern portion of the AST Farm. The sources of this plume are believed to be product releases which have occurred from AST's and associated piping over many years of the facility's operation as a petroleum refinery." Underground lines are locations of known or suspected releases. (GTI 1993, GTI 1994a, NMED 1999, BR 2001, GRCB 2003)

II.A.6.d SWMU No. 4: Transportation Terminal Sump

54. The Transportation Terminal Sump (TTS) is located in the southern portion of the refinery, south of Sullivan Road and south of the liquid propane gas (LPG) bullet tanks. The TTS was an earthen sump used as a truck cleaning area. There is potential for petroleum-related contamination in the vicinity of the TTS because there is no documentation of liners or containment structures in this area. Surface and subsurface contamination may be present as a result of incidental spills associated with truck loading and cleaning operations. In 1986, the sump was backfilled with soil. (GTI 1993, NMED 1999, GRCB 2003)

II.A.6.e SWMU No. 5: Heat Exchanger Bundle Cleaning Area

55. The Heat Exchanger Bundle Cleaning Area (HEB) is located in the southern portion of the Facility. The HEB is used to clean scale deposits from heat exchangers. Historically, this area was used as an empty container storage area and the heat exchangers were cleaned in the process area of an abandoned truck terminal. The west portion of the old abandoned truck terminal has been converted to the Auxiliary Warehouse, and the east portion has been converted to the 90-Day Storage Area. The heat exchanger hydro blast pad is attached to the 90-day storage area. The HEB cleaning takes place in a fully enclosed room with sheet metal walls, a concrete floor, and an attached outdoor concrete pad. Attached to the concrete pad is a sump approximately four feet wide, 50 feet long, four feet deep, and covered by perforated steel plates. The sump collects the sludge generated during the cleaning bundle process. An asphalt curb was installed around the perimeter of the concrete pad in 2001. After each use, the bundle cleaning pad and sump are cleaned and the generated sludge (listed waste K050) is shipped offsite for disposal. (BR 2001, GRCB 2003)

II.A.6.f SWMU No. 6: Abandoned Underground Piping

56. Several networks of abandoned underground piping exist at the Facility, and may have leaked hazardous constituents into the environment. Underground piping is a potential source of contamination due to the nature of activities conducted at the Facility over the years. The precise locations of the abandoned underground piping is not certain. (NMED 1999, GRCB 2003)

II.A.6.g SWMU No. 7: Raw Water Ponds (Fresh Water Ponds)

57. Historically, SWMU No. 7 was known as the North and South Evaporation Ponds (N & S EP). Currently the ponds are referred to as the Raw Water Ponds or the Fresh Water Ponds. The Ponds are located northeast of the process area and west of the Fire Training Area. The Raw Water Ponds are lined with four to six inches of bentonite clay and estimated to have a seepage rate of approximately 10 to 20 gallons per minute (gpm). Historically, treated wastewater from the North Oily Water Pond (North aeration lagoon) was transferred to the Raw Water Ponds. From the Raw Water Ponds, the water was evaporated or transferred to the spray irrigation area to enhance evaporation. The Raw Water Ponds were decommissioned in 1994 or 1995 after the

construction of the Class I injection well, which currently receives treated refinery wastewater. Upon decommissioning, the Evaporation Ponds were converted to the Raw Water Ponds for storage of river water pumped from the San Juan River prior to treatment for use in refinery operations.

58. In July 2003, hydrocarbons were found in the #1 East Outfall located northwest of the Raw Water Ponds on the north side of Hammond Ditch. In order to prevent hydrocarbon constituents from entering into the San Juan River, the Respondents installed a recovery system that employed a collection tank and a pump at the #1 East outfall. The water/hydrocarbon mixture from #1 East outfall is routed to Tank #38. The effluent from Tank #38 is routed to a separator tank set up for gravitational separation of the mixed hydrocarbon effluent. The recovered oil is routed to a 25,000-gallon vessel (V-610) and the water underflow is routed to the refinery's Raw Water Ponds. The effluent entering the Raw Water Ponds has exceeded the WQCC and MCL standards for benzene. Due to benzene exceedances and historical use of the ponds, petroleum contamination may be present in the pond water and pond sediments. (GRCB 2003, Schmaltz 2003a, Schmaltz 2003b, SJRC 2004)

II.A.6.h SWMU No. 8: Inactive Landfill

59. The Inactive Landfill (formally called the Landfill) is a low-lying area located east of the Tank Farm and south of the Fire Training Area; its dimensions are unknown. The Inactive Landfill is currently not in use. It is unlined and does not have a waterproof cover, although it has been covered with soil. In October of 1984, visually contaminated soil from the aeration ponds (classified as K051 API separator sludge) was removed and disposed of in the Inactive Landfill; it was assumed, based on testing, that the soil was not hazardous. In November 1989, approximately 2,000 cubic yards of contaminated soil was excavated and stockpiled at the landfill area. In April 1991, the refinery operators petitioned EPA for a delisting determination, which was granted by EPA. The Facility later obtained permission from OCD to use the soil as fill in a low-lying area near the Facility's naphtha loading rack. The actual date of landfill closure is unclear. (GTI 1993, GTI 1994a, NMED 1999, BR 2001, GRCB 2003)

II.A.6.i SWMU No. 9: Landfill Pond

60. The Landfill Pond was an unlined, low-lying natural depression that resulted from blockage of an existing arroyo during the construction of the Hammond Ditch. The Landfill Pond was located east of the Fire Training Area and northeast of MW-8. The Landfill Pond collected water from Hammond Ditch, storm water drainage from the surrounding area, and possibly other fluids associated with the Inactive Landfill. In 1985, 13 surface soil samples were collected during closure activities. Benzene was detected at 1, 300 μg/kg. The low-lying area was filled in with no protective cover and the site has been graded to conform to the general contours of the surrounding arroyo. The Landfill Pond no longer exists. The precise closure date is unknown, but appears to have occurred in January or February of 1994. (NMED 1999, GRCB 2003)

II.A.6.j SWMU No. 10: Fire Training Area

61. The Fire Training Area is located in the northeast portion of the Facility, north of the Inactive Landfill and east of the Raw Water Ponds. The Fire Training Area is utilized to train employees to fight fires that may occur at the Facility. This area stores holding tanks that contain diesel, gasoline, and other fuels used to set fires for training purposes. In the 1987 RCRA Facility Assessment (RFA), black oily stains were noted on the ground around several of the fuel holding tanks. Investigations conducted at the site have detected diesel–range hydrocarbon contamination in surface and subsurface soils. Petroleum compounds used during training exercises have been, and could potentially continue to be, released to soils and groundwater in the vicinity of the site. (GTI 1993, GTI 1994a, NMED 1999, GRCB 2003)

II.A.6.k SWMU No. 11: Spray Irrigation Area

62. The Spray Irrigation Area is a 10-acre parcel of land located in the southeast portion of the refinery. The 1984 Discharge Plan submitted to OCD identified the Spray Irrigation Area as an area bordered by an earthen berm to prevent surface drainage into nearby drainage channels. It was used to dispose of refinery wastewater by evaporation. A four-inch aluminum pipe was used to carry wastewater from the evaporation ponds (Raw Water Ponds) to sprinkler heads located across the 10-acre parcel. Spray irrigation took place primarily between the months of March and October. OCD required the Facility to conduct soil sampling at the unit and to install a groundwater monitoring well (MW-5) as part of a site investigation. Petroleum contamination was not detected during the investigation. MW-5 is located in the irrigation plot and is currently dry. Use of the Spray Irrigation Area was discontinued in 1994. An office building and an asphalt parking lot currently occupy the site. (EPA 1987, NMED 1999, GRCB 2003)

II.A.6.l SWMU No. 12: API Separator

63. The API Separator is located in the process area of the refinery, south of the aeration lagoons. Fluids from the Facility's wastewater collection system, tank farm sumps, and sewer lines within the process areas are sent to the API separator. The API separator generates API separator sludge, which is removed annually. Such sludge is K051 hazardous waste unless the sludge is recycled by direct insertion into a petroleum refining process, which qualifies the waste for an exemption under 40 CFR 261.4(a)(12)(i). The API separator is a large double chambered steel-reinforced concrete tank that uses gravity to separate the wastewater into three components: a sludge layer that sinks to the bottom of the separator; a scum layer containing oil that floats to the top and is returned back to the refinery process; and a clarified effluent in the middle that contains hazardous waste (D018). This last component is discharged from the API separator and is currently sent directly to the aeration lagoons for treatment by aggressive biologic treatment. In April 1994, a floating roof was installed on the API separator consisting of a liquid mounted primary seal and secondary wiper

seal. Pursuant to a Consent Agreement and Final Order entered by EPA on May 18, 2006, Giant is required to treat the effluent to render it non-hazardous before it is discharged into the NAL and SAL. Although the Consent Agreement and Final Order states that Giant must begin such treatment by July 17, 2007, EPA has extended the deadline until October 18, 2007. (GTI 1993, GTI 1994a, GRCB 2003, EPA 2006, EPA 2007)

II.A.6.m SWMU No. 13: Process Area

64. The Process Area is located in the northwest portion of the refinery and houses most of the refinery's process units. The Process Area includes the crude unit, reforming unit, fluidized catalytic cracking unit, sulfur recovery unit, poly unit, merox treater unit, diesel hydrotreating unit, and the wastewater treatment system, including the API Separator and aeration lagoons (surface impoundments). The Process Area also incorporates pumps, valves, and piping systems used throughout the Facility to transfer various liquids among tanks and process units. The Process Area is documented as a suspected spill area. The crude unit is the site of a documented spill that occurred in 1986. Tanks 3, 4, and 5 are considered probable source areas of petroleum contamination. Bordering the process area to the north is Hammond Ditch and monitoring wells MW-45 and MW-47. SPH has collected in the French Drain system constructed beneath the ditch and discovered in substantial quantities in the monitoring wells. The Process Area is a probable source of the SPH. (GTI 1994a, SJRC 2005b)

II.A.6.n SWMU No. 14: Tank 3, 4, and 5

65. Tanks 3, 4, and 5 are located in the Process Area, south of recovery well (RW-9) and north of the merox treater unit. In March 2000, 500 barrels of reformate spilled from the tanks and was contained by berms in the vicinity of the tanks. Currently, Tanks 3 and 4 contain mid- grade gasoline; Tank 5 contains isomerate. (BR 2001, Schmaltz 2005)

II.A.6.o SWMU No. 15: Tank Farm Area

66. The Tank Farm Area is located east of the El Paso Pipeline and north of Sullivan Road in the central portion of the Facility. The Tank Farm Area consists of above ground storage tanks that store crude oil, intermediate feedstocks, finished-products, chemicals, and water. The tank sizes range from 1,000 barrels to 110,000 barrels. Over the years of operation, various releases have occurred due to spills and leaks from the tanks. Tanks 19, 22, and 26 have historically released diesel, gasoline, and kerosene of which an estimated 141 barrels were not recovered. The following tanks have documented leak repairs: 17, 18, 19, 20, 23, 24, 25, 26, 29, 30, and 31. The volume and type of product released to the environment from leaking tanks is not documented. (BR 2001, SJRC 2005b)

II.A.6.p SWMU No. 16: Active Landfill

67. The Active Landfill is located east of the Fire Training Area. The Active Landfill is unlined and the dimensions and volume are unknown. The Active Landfill operation is regulated by OCD and used to dispose of fluidized catalytic cracking fines and sulfur. (NMED 2005)

II.A.6.q SWMU No. 17: River Terrace Area

68. The River Terrace Area is located adjacent to the San Juan River north of the refinery process units. In 1999, the Respondents installed sheet pilings and a bentonite slurry wall adjacent to the San Juan River. The bentonite slurry and sheet pile barrier wall extends around the perimeter of the riverbank from the base of the bluff east of the refinery process area to the refinery river water supply inlet station. The bentonite slurry and sheet pile barrier wall was installed to prevent SPH and dissolved-phased hydrocarbons from migrating into the San Juan River. Between October 2004 and April 2005, the Respondents completed another investigation in the riverbank area to evaluate the presence of petroleum contamination in groundwater on the refinery side of the bentonite slurry and sheet pile barrier wall. The investigation determined that petroleum contamination is present in the vicinity of the sheet pile/bentonite slurry wall barrier adjacent to the San Juan River and extending toward the refinery to the temporary wells east of the river inlet station. The hydrocarbon concentrations decrease eastward toward TP-13. (Schmaltz 2004a)

II.A.6.r SWMU No: 18 Warehouse Yard

69. The Warehouse Yard is a fenced-in area situated west of the refinery offices and identified as a SWMU during the June 1987 RFA. The Warehouse Yard was used for the storage of solvents and oils used in the refinery processes since the 1980's. Monitoring data indicates that contaminants have been released into the environment at or near the Warehouse Yard. The *RCRA Facility Investigation/Corrective Measure Study Report,* dated November 8, 1994, Section 3, page 25-26, contains the following information. RW-1 is located in the Warehouse Yard and was sampled during both events of the Phase III RCRA Facility Investigation. The May sampling event detected VOCs concentrations of benzene (2,800 µg/L), ethylbenzene (80 µg/L), and m,p-xylene (40 µg/L). The following SVOC constituents were also detected: Naphthalene, 2-methylnapthalene, chrysene, and phenanthrene. During the August sampling event, benzene was the only targeted VOC detected at a concentration of 3,300 µg/L and detected SVOCs included Naphthalene, 2-methylnapthalene and bis-(2-ethylhexyl)phthalate. (GTI 1994a, Section 3, Pages 25, 26)

70. The Warehouse Yard was upgraded in 1988 to include a metal frame storage shed with concrete flooring, curbing, and a collection trench. Currently the Warehouse Yard stores drums containing lube oils and other products used in refinery processes. Historically, the Warehouse Yard was not used for waste storage and there is no knowledge that any of these drums have leaked. Recovery well #1 is located in the

Warehouse Yard, where SPH has been detected historically; it is unclear if the SPH is a result of leaking drums. (GTI 1993, GRCB 2003)

II.A.6.s AOC No. 19: Seep North of MW-45

71. The Seep North of MW-45 is located north of monitoring well MW-45 and was discovered in August 2004 during a site visit by the Department. SPH was discovered seeping from the bluff and migrating toward the San Juan River. (GRC 2004, OCD 2004, SJRC 2005b, Schmaltz 2004b, Schmaltz 2004c)

II.A.6.t AOC No. 20: Seep North of MW-46

72. The Seep North of MW-46 was discovered in November 2004. SPH and a water/hydrocarbon mixture were discovered seeping from the bluff and migrating toward the San Juan River. A containment structure was installed and the contaminated water was sent back through the wastewater treatment system. (GRC 2004, Schmaltz 2004d)

II.A.6.u AOC No. 21: Seep North of MW-47

73. The Seep North of MW-47 was discovered in December 2004. SPH and a water/hydrocarbon mixture were discovered seeping from the bluff and migrating toward the San Juan River. A containment structure was installed and the contaminated water was sent back through the wastewater treatment system. (GRC 2004, Schmaltz 2004b)

II.A.6.v AOC No. 22: Product Loading Rack and Crude Receiving Loading Racks

74. The Product Loading Rack and Crude Receiving Rack are located in the southeastern portion of the Facility south of Sullivan Road. The loading and receiving racks are the location of known and suspected releases. The crude loading area was the site of a spill in April 1986, in which 200 barrels of diesel fuel spilled near the crude unit; 150 barrels were not recovered. The product loading rack and underground piping are potential sources of contamination. Monitoring wells located directly downgradient of the Product Loading Rack and Crude Receiving Rack exhibit contamination. In August 2004, MW-25 contained 0.97 feet of SPH and samples from MW- 26 and MW-31 contained benzene concentrations of 740 µg/L and 3,700 µg/L, respectively. (GTI 1994a, SJRC 2005a)

II.A.6.w AOC No. 23: Southeast Holding Ponds

75. The Southeast Holding Ponds are located in the far southeast portion of the Facility south of Sullivan Road. The Southeast Holding Ponds are double lined constructed with 60-milimeter high density polyethylene (mm HDPE) and a leak detection system. The ponds are used as a holding basin for excess treated wastewater; however, the ponds are reportedly only utilized when the injection well is under repair or at capacity. (SJRC 2005b)

II.A.6.x AOC No. 24: Tank Area 41 and 43

76. Tanks 41 and 43 are located in the southeastern portion of the Facility south of Sullivan Road and contain crude oil. This is an area of suspected releases. Monitoring wells located northwest of the tanks in the general groundwater flow direction from Tanks 41 and 43 exhibit contamination. In August 2004, MW-25 contained 0.97 feet of SPH and samples from MW- 26 and MW-31 contained benzene concentrations at 740 µg/L and 3,700 µg/L, respectively. (SJRC 2005a)

II.A.6.y AOC No. 25: Auxiliary Warehouse and 90-DayStorage Area

77. The Auxiliary Warehouse and 90-Day Storage Area are located in the southern portion of the Facility abutting the Heat Exchange Bundle Cleaning Area to the west. The Auxiliary Warehouse and 90-Day Storage Area were constructed from a metal building that used to be the abandoned truck terminal. This is an area of concern due to its close proximity to the Heat Exchange Bundle Cleaning Area, 90-Day Storage Area, and historical use as a truck terminal. (GR 2005)

II.A.6.z AOC No. 26: Tank Area 44 and 45

78. Tanks 44 and 45 are located west of MW-5 in the southern portion of the facility, south of Sullivan Road. Tanks 44 and 45 store MTBE and naphtha. The area of Tanks 44 and 45 may be a source of petroleum contamination detected nearby. MTBE is detected in a majority of the monitoring wells at the Facility indicating that a release may have occurred from Tank 44 or its ancillary equipment. A documented spill of naphtha occurred in November of 1984 from an unspecified storage tank. (BR 2001, SJRC 2005a)

II.A.6.aa SWMU No. 27 Wastewater Collection System

79. The Wastewater Collection System is comprised of concrete paving and curbing, concrete catch basins, and trenches, and buried concrete and carbon steel piping. The process wastewater flows by gravity to the API Separator where solid, sludge and floating scum are removed, and the effluent then flows to the aeration lagoons. There may not always be continuous flow in all parts of the wastewater collection system at all times, which would result in the generation of F037 and F038 waste. (SJRC 2005b)

II.A.7. Pathways and Receptors

80. The Facility is situated on a bluff approximately 100 feet above the San Juan River. The general direction of groundwater flow at the Facility is northwest, toward the San Juan River. The San Juan River flows in a south/southwest direction.

81. The San Juan River basin is an essential habitat for a variety of fish and wildlife. Some key habitats include aquatic, riparian, grassland, and desert shrub. Permanently

residing in the San Juan River Basin are 34 species of reptiles, fourteen species of amphibians and a variety of aquatic invertebrates. (Bristol 1993)

82. The San Juan River in the vicinity of the Facility is part of the Upper Colorado River Basin. There are 14 species of native fish fauna in the Upper Colorado River Basin. Four species: the razorback sucker, Colorado squawfish, humpback chub, and bonytail are on the federal endangered species list. (GTI 1994a)

83. The Lee Acres Water Users Association has a water supply intake approximately 1/4 to 1/2 mile downstream of the Facility that supplies surrounding communities with drinking water. (NMED 2006)

84. Benzene has been detected in the San Juan River north of the Facility at concentrations in excess of the MCL of 5 µg/L (9.7 µg/L and 6.3 µg/L). (Schmaltz 2004c.)

85. BTEX constituents have been detected at the River Terrace Area riverbank in groundwater samples obtained from MW-49 with benzene exceeding the WQCC standard (10 µg/L) at concentrations ranging from 13 µg/L to 93 µg/L. (SJRC 2005a)

86. The migration of hazardous constituents into the San Juan River is a potential exposure pathway for aquatic life, riparian life, and humans.

87. Hammond Irrigation Ditch is a source of water used for irrigation and watering of livestock. (GTI 1994a)

88. The Ojo Alamo Sandstone is a water bearing formation extending beneath the Facility that is used regionally as a potable water source. (GTI 1993)

II.A.8. Toxicity of Contaminants

The contaminants listed below have been detected in groundwater or soil at the refinery. These contaminants are toxic, carcinogenic, mutagenic, or teratogenic to humans. Many of these contaminants are also toxic or otherwise harmful to aquatic life.

89. *Arsenic.* Arsenic is a known human carcinogen. Human exposure routes are through inhalation and ingestion. Health effects from the ingestion of low levels of inorganic arsenic include: stomach and intestine irritation, nausea, vomiting, and diarrhea, a decreased production of red and white blood cells and occurrences of skin and organ cancers (e.g.: liver, kidney, and bladder). Studies have indicated incidences of lung cancer through inhalation. "Adverse effects of arsenicals on aquatic organisms have been reported at concentrations of 19 to 48 µg/L in water, 120 mg/kg in diets, and 1.3 to 5 mg/kg fresh weight in tissues (Table 4). The most sensitive aquatic species tested showing adverse effects were three species of marine algae, which showed reduced growth in the range of 19-22 µg As $^{+3/l}$; developing embryos of the narrow-mouthed toad (*Gastrophryne carolinensis*), of which 50 % were dead or malformed in 7 days at 40 µg As $^{+3/l}$; and a fresh water algae (*Scenedesmus obliquus*), in which growth

inhibited 50 % in 14 days µg As $^{+5/l}$ (Table 4). Chronic studies with mass cultures of natural phytoplankton communities exposed to low levels of arsenate (1.0 to 15.2 µg/L) showed that As^{+5} differentially inhibits certain plants causing a marked changed in species composition, succession, and predator-prey relations;…… Rainbow trout (*Salmo gairdneri*) fed diets containing up to 90 mg As^{+5} kg were only slightly affected, but those given diets containing 120 mg As/kg (as As^{+3} or As^{+5}) and higher, grew poorly, avoided food, and failed to metabolize food efficiently….." (ATSDR Sept. 2005, Eisler 1988)

90. *Barium.* Subchronic and chronic studies on rats and mice have shown kidney damage in response to oral doses of barium. Hypertension has been observed in humans who ingested high doses of barium under occupational exposure conditions. Ingestion of high levels of barium compounds over the short term has resulted in difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach irritation, brain swelling, muscle weakness, and damage to the liver, kidney, heart, and spleen. (EPA 2002a, ATSDR Sept. 2005a)

91. *Benzene.* Benzene is a known human carcinogen. This data is also supported by animal studies. Benzene exposure is known to cause blood diseases and leukemia. Benzene is also considered a skin irritant. The EPA states that acute toxicity of benzene to freshwater life occurs at concentrations as low as 5,300 µg/l. (ATSDR Sept. 2005b, Abell 1994, IRIS 2000)

92. *Cadmium*. Cadmium can cause kidney damage through both ingestion and inhalation exposures. Cadmium has been linked to damage to the intestinal tract through ingestion and to damage to the lungs through inhalation. Cadmium is also considered to be a probable (class B) human carcinogen. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones. (ATSDR June 1999, EPA 2002a)

93. *Chromium (III).* Chromium (III) has caused reduced liver and spleen weights in animals and allergic contact dermatitis in exposed workers. Chromium III has a much lower bioavailability than chromium (VI) and is therefore much less toxic than chromium (VI). (EPA 2002a)

94. *Chromium (VI).* Inhaled chromium (VI) is a carcinogen that acts as a mutagen on DNA. Breathing high levels of chromium (VI) can cause irritation to the nose, such as nosebleeds, and ulcers and holes in the nasal septum. Ingesting large amounts of chromium (VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with certain chromium (VI) compounds can cause skin ulcers. Among sensitive species of freshwater teleosts, Chromium (VI) concentration of 16 to 21 ppb in the medium resulted in growth reduction of rainbow trout and Chinook salmon fingerlings during exposure to 14 to 16 weeks, and altered plasma cortisol metabolism in rainbow trout after 7 days; locomotor activity in bluegills increased after 2 weeks in 50 ppb Chromium (VI). (Eisler 1986, ATSDR 2001a)

95. *Copper*. Ingestion of high levels of copper exposure may cause nausea, vomiting, and diarrhea. This type of exposure may also cause liver and kidney damage in children and adults. Animals exposed to copper in drinking water or food showed liver and kidney damage. (ATSDR 2004)

96. *Ethylbenzene*. Ethylbenzene has low acute and chronic toxicity for humans and animals. Exposure occurs most commonly through inhalation. Human health effects include dizziness, irritation to the skin, eye, and upper respiratory tract, and potentially toxic to the central nervous system. (ATSDR-ToxFAQs 1999)

97. *Lead*. Lead adversely affects children's neurobehavioral development by affecting the central nervous system. Lead also damages kidneys and the reproductive system. The effects are the same whether it is inhaled or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. Aquatic biota, both invertebrate and vertebrate, bioconcentrate lead at levels greater than in water, although fish do not appear to accumulate lead as readily as the invertebrates they may eat. (EPA 2002a, ATSDR 2005, (http://toxnet.nlm.nih.gov/)

98. *Gasoline*. Gasoline contains benzene, toluene, ethylbenzene, and xylenes, all of which are toxic. Some major components of gasoline have the potential to bioaccumulate. Some higher molecular weight components (e.g., naphthalene and substituted naphthalenes) may be taken up by fish and domestic animals and bioconcentrated if they persist in environmental media. (http://toxnet.nlm.nih.gov/)

99. *Manganese.* Inhalation of high concentrations of manganese causes profound neurological dysfunction in humans; exposure to lower levels of manganese may decrease neurological performance, such as eye-hand coordination and motor skills. Inhalation of manganese particulates can lead to lung inflammation that may cause coughing, bronchitis, pneumonia, or decreased lung function. Decreased fertility, impotence, and abnormal sperm have also been observed in male humans exposed to manganese particulates. Neuronal degeneration and altered brain enzyme function were seen in test animals exposed to manganese. (ATSDR 2001, EPA 2002a)

100. *Mercury*. Inorganic and methylated mercury primarily adversely affects the nervous system. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, as well as development of human fetuses. (ATSDR April 1999, EPA 2002a)

101. *Methyl Tertiary-Butyl Ether (MTBE).* Little data is available for known health effects on humans drinking MTBE contaminated water. However, laboratory animal tests have demonstrated cancer at high levels of exposure through inhalation or ingestion of the chemical into the stomach. (EPA 1997)

102. *Naphthalenes.* Ingestion of this chemical caused weight loss, diarrhea and lethargy in rats even though the animals ate normal amounts of food. (EPA 2002a.) Mice that inhaled naphthalene showed inflammatory lesions in the lung; the inflammation increased with larger doses. Exposure of humans to naphthalene vapors caused nausea, vomiting, and abdominal pain. Hemolytic anemia has been repeatedly documented in humans, particularly infants, exposed to naphthalene vapors and through naphthalene ingestion. It has also been reported that ingestion of naphthalene by humans has resulted in toxic effects to the kidney. EPA states that "acute and chronic toxicity of naphthalene occurs at concentrations as low as 2,300 µg/L and 620 µg/L, respectively, and could occur at lower concentrations among sensitive species." (EPA 2002a, ATSDR August 2005, Abell 1994)

103. *Nickel*. Inhalation of nickel compounds in rats and mice have observed damage to the lung and nasal cavity. The most common reaction to nickel in humans is a skin rash at the site of contact. Occupational exposure can result in chronic bronchitis and reduced lung function. Workers ingesting water containing high amounts of nickel can experience stomachaches and adverse effects to their blood and kidneys. (ATSDR August 2005b)

104. *Nitrate*. Exposure to nitrate has been shown to cause methemoglobinemia resulting in cyanosis ("blue baby syndrome") in infants under 3 months of age. (EPA 2002a)

105. *Polycyclic Aromatic Hydrocarbons (PAH's).* Some PAH's may be carcinogenic. Laboratory animals have developed lung and stomach cancer due to inhalation and injection. Routes of entry include inhalation, ingestion, or through breast milk. PAH's do not dissolve easily in water and attach to solid particles and settle to the bottom of lakes or rivers. PAH contents of plants and animals may be higher than PAH contents of soil or water in which they live through bioaccumulation or biomagnification processes. High incidences of tumors and other abnormalities have been documented in areas of PAH contamination. High incidences of eye cataracts and blindness have been documented in fish species exposed to sediment contaminated with PAH's. PAH studies of fish within the San Juan River basin have been limited. However, bile from 9 fish from the lower Animas River was sampled. Five of the fish had open sores and lesions. These five fish when tested showed evidence of exposure to PAH's. (Abell 1994, ATSDR 1996)

106. *Selenium*. Short-term exposure to high levels to selenium can cause nausea, vomiting, and diarrhea. Chronic oral exposures to high concentrations of selenium can generate a disease called selenosis. Selenium is not considered a human carcinogen. "Lemly (in press) recommends that waterborne selenium concentrations of 2 µg/L or greater be considered highly hazardous to the health and long-term survival of fish and wildlife. The EPA's acute criterion for selenium is 20 µg/L." (ATSDR-ToxFAQs 2003, Abell 1994)

107. *Toluene*. Toluene adversely affects liver and kidney function through the ingestion pathway by causing significant increases in the weights of these organs. Inhalation of toluene results in adverse neurological effects in humans. Exposure to low to moderate

levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and hearing and color vision loss. Toluene has been linked to birth defects in children of exposed mothers. The EPA states that acute toxicity of toluene to freshwater life occurs at concentrations as low as 17,500 µg/l. (ATSDR 2001b, Abell 1994)

108. *Xylenes*. Common xylene exposure routes are inhalation and absorption. Short term and long term exposure to high levels of xylenes can cause the following human health effects: headaches, lack of muscle coordination, dizziness, confusion, irritation to the skin, eyes, nose, and throat, and lung problems. (ATSDR Sept. 2005c)

109. *Zinc*. The short-term effects of ingesting zinc are stomach cramps, nausea, and vomiting. Long-term exposure may cause anemia, damage to the pancreas, and may decrease levels of high-density lipoprotein (HDL) cholesterol. (ATSDR August 2005a)

II.A.9. Regulation of the Facility

110. In August 1980 Plateau, Inc., a predecessor of the Respondents, notified EPA of its hazardous waste activity and identified itself as a generator of hazardous waste, and a hazardous waste treatment, storage, and disposal facility. (EPA 1992; GTI 1993)

111. On November 19, 1980, the Plateau, Inc. applied for a Resource Conservation Recovery Act (RCRA) permit and notified the Administrator of EPA and the New Mexico Environmental Improvement Division, the predecessor of the Department, that it was engaged in the generation and storage of hazardous wastes identified in 40 CFR Part 261 and that it used surface impoundments for the treatment, storage, or disposal of hazardous waste at the Facility. Plateau, Inc. also noted on the application that the surface impoundments may have received hazardous materials in the past, but the contents had not been adequately characterized. (EPA 1992; GTI 1993)

112. On April 16, 1982 Plateau, Inc. modified the Part A Permit Application to reflect its status as a generator of hazardous waste, not a treatment, storage, or disposal facility, and asked that interim status be withdrawn. (GTI 1993)

113. On July 15, 1982, May 10, 1983, June 7-8, 1983, March 19-23, 1984, and May 4, 1984, EPA conducted Compliance Evaluation Inspections (CEIs) to assess the Facility's compliance with the RCRA Hazardous Waste Management regulations. (EPA 1992)

114. On January 25, 1985, the State of New Mexico received from EPA authorization to implement its hazardous waste program under the HWA in lieu of the Federal program (50 Fed. Reg. 1515 (Jan. 11, 1985)). Subsequent program revisions were authorized by EPA effective on April 10, 1990, July 25, 1990, December 4, 1992, August 23, 1994, December 21, 1994, July 10, 1995, January 2, 1996, March 10, 1997, and October 9, 2001 (40 CFR 272.1601).

115. On November 26, 1985, EPA issued an administrative order pursuant to Section 3008(a) of RCRA requiring Bloomfield Refining Company (a predecessor of the Respondents) to pay a fine of $5,700 for failure to make timely ownership transfer notices. This order also required that a closure plan be developed for North Oily Water Pond, and the South Oily Water Pond, the Landfill, and the Landfill Pond. (GTI 1993)

116. On March 29, 1990, EPA promulgated as a final rule the Toxicity Characteristic Leaching Procedure, which revised the procedure for determining the toxicity characteristic of a waste, and listed 25 additional toxic constituents, including benzene, for which a waste may exhibit the toxicity characteristic. The rule went into effect on September 25, 1990. In response to this new regulation, the Facility operators submitted to EPA an Amended Notification of Regulated Waste Activity and a revised Part A Permit Application, identifying the Facility as a hazardous waste treatment, storage, and disposal facility. The Facility operators identified the North Oily Waste Pond and the South Oily Waste Pond as hazardous waste aeration surface impoundments regulated under RCRA as a consequence of the new toxicity characteristic rule. The ponds managed wastes exhibiting the toxicity characteristic for benzene (D018). (EPA 1992)

117. In September 1991, Bloomfield Refining Company submitted to EPA and the Department a Part B Operating Permit Application for the North Oily Water Pond and the South Oily Water Pond. The Part B Operating Permit Application was amended and resubmitted in 1994 and 1996. (GTI 1993, GRC 1996) These units were authorized to continue operating under interim status.

118. In September 1991, Bloomfield Refining Company submitted a Discharge Plan Approval application for the facilities wastewater treatment system and underground disposal well to OCD under the New Mexico Water Quality Act. (GTI 1993)

119. On December 18, 1992 Bloomfield Refining Company, submitted to the Department an Air Quality Permit Application to modify its existing permit to reduce emissions by adding a hydrodesulfurization unit, a sulfur recovery unit, and cover to the API Separator. (GTI 1993)

120. On December 31, 1992 EPA issued an Administrative Order on Consent (Administrative Order) pursuant to Section 3008(h) of RCRA requiring the Bloomfield Refining Company to mitigate potential threats to human health and the environment. The Administrative Order also required the Bloomfield Refining Company to perform a RCRA Facility Investigation (RFI) and submit a Corrective Measure Study (CMS) to fully determine the nature and extent of any releases and identify and evaluate alternatives for corrective actions to prevent migration of releases of hazardous wastes or constituents at or from the Facility. (EPA 1992)

121. On August 13, 2004 OCD ordered an Emergency Action Directive due to the discovery of releases of hydrocarbons in two small tributary drainages to the San Juan River on the north side of the refinery. (OCD 2004)

122. Pursuant to a Consent Agreement and Final Order entered by EPA on May 18, 2006, Giant is required to install benzene strippers to treat the wastewater from the API separator to render it non-hazardous before it is discharged into the NAL and SAL. The air strippers will remove the benzene from the wastewater so that it is no longer characteristic hazardous waste (D018). Under the EPA Final Order, Giant must begin operation of the air strippers by October 18, 2007. (EPA 2006; EPA 2007)

123. On June 21, 2006, the Department released a draft of the order and published a public notice stating that it would accept comments on the draft order from the public for a period of sixty days, until August 21, 2006. The notice was published in the *Albuquerque Journal*, and the Department sent copies of the notice to all interested parties including the Respondents.

124. During the public comment period, the Department received comments on the draft order from the Respondents, but from no other parties. The Department met with the Respondents on March 27, 2007 and on June 28, 2007 to discuss the comments.

125. On July 20, 2007, the Respondents signed an Agreement not to appeal this Order if the final Order was issued in the form attached to the Agreement.

126. On this date, the Department is responding in writing to all the comments received on the draft order.

127. The Respondents have not taken adequate corrective action to address the releases of hazardous waste and hazardous constituents from their Facility.

128. Based on the release of hazardous waste or hazardous waste constituents into the environment from the Respondents' Facility, the actions ordered below are necessary to protect human health or the environment.

II.B. CONCLUSIONS OF LAW

Based on the Administrative Record, the Department makes the following conclusions of law:

1. Each of the Respondents, the San Juan Refining Company and Giant Industries Arizona, Inc., is a "person" within the meaning of section 74-4-3(M) of the HWA, and the Hazardous Waste Management Regulations at section 20.4.1.100 NMAC (incorporating 40 CFR 260.10).

2. The Giant Bloomfield Refinery (the Facility) is a "facility" within the meaning of the Hazardous Waste Management Regulations at 4.1.100 (incorporating 40 CFR 260.10).

3. The Respondent San Juan Refining Company. is the "owner" of the Facility within the meaning of the Hazardous Waste Management Regulations at section 20.4.1.100 NMAC (incorporating 40 CFR 260.10).

4. The Respondent Giant Industries Arizona, Inc. is the "operator" of the Facility within the

meaning of the Hazardous Waste Management Regulations at section 20.4.1.100 NMAC (incorporating 40 CFR 260.10).

5. The Respondents have engaged in, and are currently engaged in, the "storage," "treatment," and "disposal" of "hazardous waste" at the Facility within the meaning of section 74-4-3(P), (T), (E), (O), and (K) of the HWA and the Hazardous Waste Management Regulations at section 20.4.1.100 NMAC (incorporating 40 CFR 260.10).

6. As the result of the Respondents' storage, treatment, and disposal of hazardous waste, various "contaminants," as defined herein, have been released into the environment, including soil, surface water, and groundwater, at the Facility. Such contaminants include arsenic, barium, benzene, cadmium, chromium, ethylbenzene, lead, mercury, manganese, methyl butyl tertiary ether (MBTE), nitrate, toluene, and xylenes.

7. Arsenic, barium, benzene, cadmium, chromium, ethylbenzene, lead, manganese, mercury, MTBE, nitrate, toluene, and xylenes are "hazardous wastes" within the meaning of section 74-4-3(K) of the HWA.

8. Arsenic, barium, benzene, cadmium, chromium, lead, mercury, and toluene, are hazardous waste constituents listed in the Hazardous Waste Management Regulations at section 20.4.1.200 (incorporating 40 CFR pt. 261, app. VIII).

9. Petroleum and petroleum products, including crude oil, jet fuel, naphtha, gasoline, kerosene, and diesel fuel, that have been spilled or leaked into the environment are "hazardous waste" within the meaning of section 74-4-3(K) of the HWA.

10. Soil and groundwater are part of the "environment" within the meaning of section 74-4-10(E) of the HWA.

11. The San Juan River is part of the "environment" within the meaning of section 74-4-10(E) of the HWA.

12. A hazardous waste permit is required for the Facility pursuant to the Hazardous Waste Management Regulations, 20.4.1.900 NMAC (incorporating 40 CFR § 270.1(b)).

13. There has been a release of hazardous waste or hazardous waste constituents into the environment from the Facility.

14. The Secretary of the Department has determined that there is or has been a release of hazardous waste or hazardous waste constituents into the environment from units at the Facility authorized to operate under interim status (under section 74-4-9 of the HWA), within the meaning of 74-4-10(E) of the HWA.

15. Corrective action is required at the Facility pursuant to section 74-4-4.2(B) of the HWA.

16. Pursuant to section 74-4-10(A) of the HWA, the Department has determined that the

Respondents have violated, are violating, or threaten to violate the HWA and the Hazardous Waste Management Regulations.

17. Corrective action as required by this Order is necessary to protect human health and the environment within the meaning of section 74-4-10(E) of the HWA.

18. This Order is necessary to protect health and the environment within the meaning of section 74-4-10(A) and (E) of the HWA.

19. The Respondents are jointly and severally liable to carry out each of the requirements of this Order.

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III. GENERAL PROVISIONS

III.A. PURPOSES

The purposes of this Order are: 1) to perform interim measures at the Facility to mitigate any potential threats to human health or the environment from the release of hazardous waste or hazardous constituents; 2) to fully determine the nature and extent of releases of hazardous waste and hazardous constituents at or from the Facility; 3) to identify and evaluate alternatives for corrective measures to clean up contaminants in the environment, and to prevent or mitigate the migration of hazardous waste or hazardous constituents at or from the Facility; and 4) to implement such corrective measures.

III.B. DEFINITIONS

Unless otherwise expressly provided herein, the terms used in this Order shall have the meanings set forth in the HWA, RCRA, and their implementing regulations.

"Administrative Record" means the administrative record supporting and otherwise relating to the requirements of this Order, compiled as of the effective date of this Order, which forms the basis for the terms of this Order. The Administrative Record includes the full record and those documents submitted in writing by the Department, the Respondents, EPA or the public, as of the effective date of the Order for inclusion in the Administrative Record. The Administrative Record is available for review at the New Mexico Environment Department Hazardous Waste Bureau.

"Area of Concern" or "AOC" means any area that may have or had a release of hazardous waste or hazardous constituents, which is not a Solid Waste Management Unit, and which the Department determines may pose a threat to human health or the environment.

"Contaminant" means any hazardous constituent listed in 40 CFR Part 261, appendix VIII (incorporated by 20.4.1.200 NMAC) and 40 CFR Part 264, appendix IX (incorporated by 20.4.1.500 NMAC); any groundwater contaminant listed in the New Mexico WQCC Regulations at 20.6.2.3103 NMAC; any toxic pollutant listed in the WQCC Regulations at 20.6.2.7.WW NMAC; methyl tertiary-butyl ether; polychlorinated biphenyls; and any other substance present in soil, sediment, rock, surface water, groundwater, or air for which the Department determines that monitoring, other investigation, or a remedy is necessary to carry out the purposes of this Order.

"Corrective action" means any activity related to site assessment, investigation, remediation, characterization or monitoring including reporting and submittal of documents.

"Day" means a calendar day, unless specified as a business day. "Business day" means Monday through Friday, excluding all federal and New Mexico State holidays.

"Department" means the New Mexico Environment Department, and any successor departments or agencies.

"EPA" means the United States Environmental Protection Agency, and any successor departments or agencies.

"Facility" means the Giant Refining Company, Bloomfield Refinery site owned by San Juan Refining Company and operated by Giant Industries Arizona, Inc., and located in San Juan County in northwest New Mexico, comprised of approximately 0.45 square miles, located approximately one mile south of the City of Bloomfield, New Mexico and approximately 200 miles northwest of Santa Fe.

"Groundwater" means interstitial water, which occurs in saturated earth material.

"Hazard Index" or "HI" means the sum of more than one hazard quotient for multiple substances or multiple exposure pathways. The HI is calculated separately for chronic, subchronic, and shorter-duration exposures.

"Hazard Quotient" or "HQ" means the ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.

"Hazardous waste constituent" or "hazardous constituent" means any constituent identified in 20.4.1.200 NMAC (incorporating 40 CFR Part 261, Appendix VIII), or any constituent identified in 20.4.1.500 NMAC (incorporating 40 CFR Part 264, Appendix IX).

"Hazardous waste" means any solid waste or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics meets the description set forth in NMSA 1978, § 74-4-3(K). The term includes but is not limited to any waste that is listed as a hazardous waste or exhibits a hazardous waste characteristic under 40 CFR Part 261 (incorporated by 20.4.1.200 NMAC).

"HWA" means the New Mexico Hazardous Waste Act, NMSA 1978, §§ 74-4-1 to 74-4-14.

"Hazardous Waste Regulations" means the New Mexico Hazardous Waste Management Regulations 20.4.1 NMAC.

"Interim Measures" or "IM" means actions that can be implemented to minimize or prevent migration of contaminants and to minimize or prevent actual or potential human or ecological exposure to contaminants while long-term, final corrective action remedies are evaluated and, if necessary, implemented.

"Landfill" means a disposal facility or part of a facility where hazardous waste is placed in or on the land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit.

"Maximum Contaminant Level" or "MCL" means a maximum contaminant level under the Federal Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-26, and the drinking water regulations promulgated thereunder.

"Parties" means collectively the New Mexico Environment Department, San Juan Refining Company, and Giant Industries Arizona, Inc., and the term "Party" shall refer to one of these three entities.

"RCRA" means the federal Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 to 6992k, also known as the Solid Waste Disposal Act.

"Respondents" means San Juan Refining Company and Giant Industries Arizona, Inc.

"Secretary" means the Secretary of the New Mexico Environment Department or designated representative.

"Solid Waste Management Unit" or "SWMU" means any discernible unit at which solid waste has been placed at any time, and from which the Department determines there may be a risk of a release of hazardous waste or hazardous waste constituents, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at the Facility at which solid wastes have been routinely and systematically released.

"State of New Mexico" or "State" means the State of New Mexico, including all of its departments, agencies, and instrumentalities.

"Surface impoundment" means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen material (although it may be lined with man-made materials), which is designed to hold an accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well. Examples of surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons

"TAL metals" means the list of 23 inorganic target analytes defined by the EPA Contract Laboratory Program Statement of Work. The list consists of the following: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

"UCL" means the 95 percent upper confidence limit of the mean value. The UCL shall be calculated following the methodology in EPA (1992) *Supplemental Guidance to RAGS: Calculating the Concentration Term.*

"UTL" means the upper tolerance limit, which is a statistical estimate of the maximum concentration. The UTL shall be calculated in accordance with the Hazardous Waste Bureau Position Paper (March 2000) *Use of Tolerance Intervals for Determining Inorganic Background Concentrations.*

"WQCC" means the New Mexico Water Quality Control Commission, and any successor agencies, boards, or commissions.

"Water Quality Control Commission Regulations" means the regulations at 20.6.2 NMAC promulgated by the New Mexico Water Quality Control Commission governing the quality of groundwater and surface water in New Mexico.

III.C. JURISDICTION

This Order is issued to San Juan Refining Company and Giant Industries Arizona, Inc., (hereinafter referred to as the Respondents) pursuant to section 74-4-10(A) and (E) of the HWA, NMSA 1978,§§ 74-4-1 to 74-4-14. (Repl. Pamp. 1993).

III.D. TERM OF ORDER

The effective date of this Order is the date the final Order, signed by the Secretary of the Department, is received by the San Juan Refining Company and Giant Industries Arizona, Inc.

This Order shall remain in effect until the Department determines in writing that all the requirements of the Order have been met.

III.E. BINDING EFFECT

This Order shall apply to and bind each of the Respondents, its officers, directors, employees, agents, trustees, receivers, successors, and assigns.

No change in ownership, corporate, or partnership status relating to the Facility will in any way alter the Respondents responsibilities under this Order. The Respondents shall be responsible jointly and severally for and liable for any failure to carry out all activities required of the Respondents by the terms and conditions of this Order, irrespective of their use of employees, agents, or consultants to perform any such tasks.

The Respondents shall give notice of this Order to any successor in interest prior to transfer of ownership or operation of the Facility and shall notify the Department in writing at least thirty (30) working days prior to such transfer.

The Respondents shall require all contractors, subcontractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed pursuant to this Order to comply with and abide by the terms of this Order.

III.F. NOTICES

Any plan, report, notice, or other document or communication required under this Order shall comply with the reporting requirements of Section X of this Order, and shall be sent or directed to:

Bureau Chief
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Copies of all plans and reports should be forwarded to EPA Region 6.

III.G. WORK PLANS AND SCHEDULES

All work plans, including monitoring plans, implementation plans, and evaluation reports, and associated schedules approved pursuant to this Order are incorporated into this Order and become enforceable under the terms of this Order, and under the HWA and RCRA, as of the date of receipt by the Respondents of the Department's approval.

The Respondents shall comply with all applicable federal, State, and local laws or regulations, and shall obtain all necessary approvals or permits to conduct the activities required by this Order and perform their obligations required hereunder. The Department makes no representation with respect to approvals and permits required by federal, State, and local laws or regulations other than those required under the HWA or Hazardous Waste Regulations.

III.G.1. Work Plan Review and Approval

All work plans, including monitoring plans, implementation plans, and evaluation reports, and associated schedules that the Respondents are required to prepare under this Order shall be submitted to the Department for review and approval. Upon review of the work plan or evaluation report, the Department will send the Respondents a written notice of approval, approval with modifications, or disapproval. The Department will state in writing any required modifications or if the document is disapproved, the deficiencies and other reasons for the disapproval. A notice of disapproval may also include modifications to the work plan or schedule necessary for the Department's approval, or other written comments. Upon receipt of a notice of disapproval, the Respondents shall revise the work plan or schedule to incorporate all modifications and comments, and otherwise correct all deficiencies that gave rise to the disapproval. Within 30 days after receipt of a written disapproval, or other period of time defined by the Department, the Respondents shall re-submit the revised work plan or schedule to the Department for approval.

III.G.2. Additional work

If the Department determines that additional corrective action is necessary at any location at the Facility, to protect human health or the environment, the Department will notify the Respondents in writing of the required additional work and specify a due date for submittal of a site-specific work plan to address the required corrective action. The Respondents may, at their own initiative, propose additional corrective action at the Facility. Such additional corrective action must be proposed in work plans submitted to the Department a minimum of 90 days prior to implementation of the proposed plan. The Respondents shall prepare all work plans in accordance with Section X and approval of the plans shall be subject to the provisions of Section III.G.1.

III.G.3. Extensions of Time

If the Respondents fail to complete any requirement of this Order by the date specified by the Department, the Respondents will be in violation of this Order. The Respondents may seek an extension of time in which to perform a requirement of this Order, for good cause such as a force majeure, by sending a written request for extension of time and proposed revised schedule to the Department. The request shall state the length of the requested extension and describe the basis for the request. The Department will respond in writing to any request for extension following receipt

of the request. If the Department denies the request for extension, it will state the reasons for the denial.

III.H. OFFSITE ACCESS

To the extent any requirement of this Order, including any work plan approved under this Order, requires access to property not owned or controlled by the Respondents, the Respondents shall use their best efforts to obtain access from the present owners of such property to conduct the required activities, and to allow the Department access to such property to oversee such activities. In the event that access is not obtained when necessary, the Respondents shall notify the Department in writing regarding their best efforts and their failure to obtain such access.

III.I. ENTRY AND INSPECTION

In accordance with section 74-4-4.3 of the HWA, and section 3007(a) of RCRA, 42 U.S.C 6927(a), the Respondents shall allow any authorized representative of the Department to enter the Facility at reasonable times to inspect the Facility and all Facility work sites; to oversee all work being performed under this Order; to conduct any tests necessary to ensure compliance with this Order and to verify the data submitted by the Respondents; to obtain samples of waste, soil, air, surface water, or groundwater; to inspect and copy documents relating to this Order or any requirement of this Order, including operating and field logs, monitoring data, contracts, manifests, shipping records, and other relevant records and documents; and to interview the Respondents personnel and contractors performing work required by this Order.

The Respondents shall notify the Department in writing of any field sampling activities undertaken pursuant to any plan or requirement of this Order a minimum of 20 business days prior to the sampling being conducted as required in Section VIII this Order, and shall provide split samples to the Department upon request.

The Respondents shall notify the Department in writing of any excavation, construction (including the construction of monitoring wells), or other corrective action activities undertaken pursuant to any plan or requirement of this Order a minimum of 20 days prior to beginning the excavation, construction, or other corrective action activity. The Respondents shall provide the Department any blue print, diagram, or construction or other permits for any construction activity undertaken pursuant to this Order upon request.

Nothing in this Section (III.I) shall be construed to limit or impair in any way the inspection and entry authority of the Department under the HWA, the Hazardous Waste Regulations, RCRA, or any other applicable law or regulations.

III.J. AVAILABILITY OF INFORMATION

In accordance with Section 74-4-4.3 of the HWA, and section 3007(a) of RCRA, 42 U.S.C. 6927(a), the Respondents shall, within a reasonable time after a request from any authorized representative of the Department, furnish information to the Department relating to hazardous wastes that are or have been managed at the Facility.

Nothing in this Section (III.J) shall be construed to limit or impair in any way the information gathering authority of the Department under the HWA, the Hazardous Waste Regulations, RCRA, or any other applicable law or regulations.

III.K. RECORD PRESERVATION

The Respondents shall maintain all documents, data, and other information required to be prepared under this Order for at least ten years after the completion of the corrective action for the entire Facility or three years after cessation of all business activities, whichever is later. At the end of the record preservation period and before any such document or information is destroyed, the Respondents shall notify the Department, EPA, and OCD that such non-privileged documents and information are available to the Department, EPA, and OCD for inspection, and upon request, shall provide the original or copies.

III.L. RESERVATION OF RIGHTS AND OBLIGATIONS

Nothing in this Order shall be construed to preclude or in any way limit any powers, authorities, rights, or remedies that the Department has under the HWA or any other statute or regulation or under common law. Nothing in this Order shall constitute an express or implied waiver of immunity otherwise applicable to the Department, its employees, agents, or representatives.

The Department reserves all of the powers, authorities, rights, and remedies, whether administrative or judicial, civil or criminal, legal or equitable, that the Department has for any failure of the Respondents to comply with any of the requirements of this Order, including the right to bring any civil or administrative enforcement action for penalties or injunctive relief or both.

This Order shall not be construed to preclude or in any way limit the authority of the Department to take additional enforcement action pursuant to sections 74-4-10, 74-4-10.1, or 74-4-13 of the HWA, or other applicable legal authorities, should the Department determine that such actions are warranted.

The Department reserves all of the powers, authorities, rights, and remedies, whether administrative or judicial, civil or criminal, legal or equitable, that the Department has for any past, present, or future violations of the HWA or the Hazardous Waste Regulations, including the right to bring any civil or administrative enforcement action for penalties or injunctive relief or both.

The Department reserves the right both to disapprove of work performed by the Respondents that is not in compliance with this Order and to require that the Respondents perform tasks in addition to those required by this Order.

This Order is not a permit, and compliance by the Respondents with the terms of this Order shall not in any way relieve the Respondents of its obligation to comply with the HWA, the Hazardous Waste Regulations, and all other applicable State, federal, and local laws, regulations, and permits. The Respondents are subject to the requirements included in 20.4.2 NMAC.

III.M. ENFORCEMENT

Any violation of the requirements of this Order may subject the Respondents, and their officers, directors, employees, successors, and assigns, to a compliance order under section 74-4-10 of the HWA or section 3008(a) of RCRA, 42 U.S.C. § 6928(a); to an injunction under sections 74-4-10, 74-4-10.1(E), or 74-4-13(B) of the HWA, section 3008(a) of RCRA, 42 U.S.C. § 6928(a), or section 7002(a) of RCRA, 42 U.S.C. § 6972(a); to civil penalties under section 74-4-10of the HWA, section 3008(a) and (g) of RCRA, 42 U.S.C. § 6928(a) and (g), or Section 7002(a) of RCRA, 42 U.S.C. § 6972(a); to criminal penalties under Section 74-4-11 of the HWA or Section 3008(d), (e), and (f) of RCRA, 42 U.S.C. § 6928(d), (e), and (f); or to some combination of the foregoing.

Each requirement of this Order is an enforceable "requirement" of the HWA within the meaning of section 74-4-10; an enforceable "requirement" of subchapter C of RCRA within the meaning of section 3008(a)(1) of RCRA, 42 U.S.C. § 6928(a)(1); and an enforceable "condition, requirement, [or] prohibition" which has become effective pursuant to RCRA within the meaning of section 7002(a)(1)(A) of RCRA, 42 U.S.C. § 6972(a)(1)(A).

III.N. RELATIONSHIP TO WORK COMPLETED

This Order shall be construed to avoid duplication of work already satisfactorily completed. Investigations and other work that has been satisfactorily completed prior to the effective date of this Order, and that fulfills the substantive requirements of this Order, may be used to comply with this Order.

III.O. SEVERABILITY

If any provision or authority of this Order is held by a court of competent jurisdiction to be invalid, the remainder of the Order shall remain in force and shall not be affected thereby. Additionally, if the application of this Order to any party or circumstance is held by a court of competent jurisdiction to be invalid, the application of this Order to other parties or circumstances shall remain in force and shall not be affected thereby.

III.P. FINANCIAL ASSURANCE

III.P.1. Cost Estimates for Corrective Action

Within 180 days of the effective date of this Order, the Respondents shall submit to the Department for approval a detailed written estimate, in current dollars, of the cost of hiring a third party to perform a cleanup of contaminant releases at or migrating from the Facility in accordance with this Order (hereafter "Estimated Cost of the Work"). The initial Estimated Cost of the Work shall account for the total costs of operating and monitoring the bioventing system at the River Terrace Area for a period of five years, operating and monitoring the North Barrier Wall and Fluids Collection System for a period of 15 years, and conducting the Facility Wide Groundwater Monitoring for a period of 15 years. The initial Estimated Cost of Work shall include all necessary costs, including operation and maintenance of any other in situ remediation systems, treatment and disposal of contaminated soil and groundwater, and sampling, analysis, and other monitoring costs. The Estimated Cost of Work shall include the costs of the remedy for a solid waste management unit

or area of concern if the Department has selected the remedy for that unit or area. A third party is a party who (i) is neither a parent nor a subsidiary of either of the Respondents; and (ii) does not share a common parent or subsidiary with either of the Respondents. The Estimated Cost of Work shall not be reduced by the amount of any salvage value that may be realized from the sale of Facility real property, structures, equipment, vehicles, product, materials, or other assets associated with the Facility. The Estimated Cost of Work shall be prepared in accordance with 40 CFR 264.101 and substantially in compliance with the requirements of 40 CFR 264.142 and 264.144.

III.P.2. Adjustments to Cost Estimates

The Respondents shall adjust the Estimated Cost of Work annually to add the costs of any remedy selected under Section VI.C.7 during the previous year; to subtract the costs of any work completed during the previous year; and to reflect any other changes in estimated costs based on the Department's selection of any remedies, approved changes to the investigations or the remedies, data generated during investigations, inflation, and other factors. Each adjusted Estimated Cost of Work shall include all necessary costs. The Respondents shall submit to the Department for approval an adjusted Estimated Cost of Work by January 31 of each year. Upon Department approval, the annual date may be changed to coincide with the close of the fiscal year for either of the Respondents. The annual adjustments to the Estimated Cost of Work shall be prepared substantially in compliance with the requirements of 40 CFR 264.142(b) and 264.144(b).

In addition to the Annual Adjustment to the Estimated Cost of Work, the Respondents may petition the Department for an interim reduction in the Estimated Cost of Work based on substantial work completed since the last annual adjustment. Any such petition shall include all supporting documentation, such as receipts and other cost documents.

III.P.3. Records of Cost Estimates

The Respondents shall keep records of the latest Estimated Cost of Work at the Facility for the duration of operation of the Facility, and for such additional time that offices are maintained at the Facility after closure as described in 40 CFR 264.142(d) and 264.144(d).

III.P.4. Financial Assurance for Corrective Action

Within 90 days after the approval of the cost estimate, the Respondents shall establish, and shall thereafter continuously maintain, financial assurance for corrective action at the Facility in an amount equivalent to the current Estimated Cost of Work. The Respondents shall use one or more of the mechanisms set forth in 40 CFR 264.143 and 264.145 to establish financial assurance. The Respondents shall establish and maintain such financial assurance substantially in compliance with 40 CFR 264.143, 264.145, and 264.151, except that there shall be no "pay-in period" unless a required change in the cost estimate will result in an increase of at least one million dollars and the Respondents propose a pay-in-period that the Department approves in writing. Changes in financial assurance mechanisms must be approved by the Department.

The Respondents shall submit a signed copy of each financial assurance document to the Department within thirty days after the document is executed.

III.P.5. Incapacity of Respondents, Guarantors, or Financial Institutions

The Respondents shall notify the Department by mail of the commencement of a voluntary or involuntary proceeding under Title 11 (Bankruptcy), U.S. Code, naming either of the Respondents as debtor, within 10 days after commencement of the proceeding. The Respondents shall make such notification if the trustee of a trust fund, the guarantor of a corporate guarantee, or the institution issuing a surety bond, a letter of credit, or an insurance policy is named as debtor. The Respondents shall make such notification in substantial compliance with 40 CFR 264.148.

III.Q. DISPUTE RESOLUTION

Any dispute that arises under this Order shall in the first instance be the subject of informal negotiations between the Department and the Respondents (collectively the Parties). The period for informal negotiations shall not exceed ten (10) business days from the date the dispute arises, unless the period is extended by written agreement of the Parties. A dispute shall be deemed to arise when one Party sends the other a written notice describing the issue or issues in dispute and that the dispute resolution procedures of this Section (III.R) are being invoked.

If the Parties are unable to resolve a dispute by informal negotiation under the preceding paragraph, the dispute shall be elevated to the Department Director of the Water and Waste Management Division, and the President of Giant Industries Arizona, Inc. (the Managers). Within fifteen (15) business days after the expiration of the informal dispute resolution period, the Department and the Respondents shall submit a written statement of position to the Managers. The Managers shall review the written statements of position and shall meet and confer in an attempt to resolve the dispute. The period for Manager negotiations shall not exceed ten (10) business days from the date the Managers receive the Parties' statements of position, unless the period is extended by written agreement of the Parties.

If the Managers are unable to resolve a dispute under the preceding paragraph, the Parties may pursue any available legal remedy to resolve the dispute, which may include bringing an enforcement action or, if authorized by law, seeking judicial review of the matter. Whether a disputed decision is final for purposes of judicial review shall be determined according to established principles of administrative law.

IV. FACILITY INVESTIGATION

The Respondents shall investigate the Facility to determine and evaluate the presence, nature, extent, fate, and transport of contaminants that have been released into the environment, including air, soil, surface water, and groundwater, as a result of Facility operations.

The Respondents have already begun such investigations prior to the effective date of this Order. However, these investigations are not complete, and additional investigations are necessary to fully characterize the nature, extent, fate, and transport of contaminants at the Facility. The Respondents may use the results of investigation work conducted previously to satisfy the requirements of this Order.

IV.A. FACILITY-WIDE GROUNDWATER MONITORING

The Respondents shall conduct facility-wide groundwater monitoring. The monitoring plan must include proposed monitoring and sampling of the North Barrier Wall containment system and the River Terrace area and remediation system.

IV.A.1. Facility-Wide Groundwater Monitoring Plan

By July 31, 2007, the Respondents shall submit to the Department for approval an updated facility-wide groundwater monitoring plan to fully characterize the nature and extent of groundwater contamination at, and migrating from the Facility, and to monitor the effectiveness of interim containment and remediation systems. The groundwater monitoring plan shall be prepared in accordance with the format described in Section X.B of this Order. The groundwater monitoring plan shall provide for the acquisition of adequate data to establish background groundwater quality. The groundwater monitoring plan shall include, at a minimum:

1. A general description of the hydrogeologic system beneath the Facility,

2. An identification of all groundwater and discharge sampling locations including, as applicable, all seeps, all temporary wells, all on- and off-site monitoring wells, including observation wells associated with the north barrier wall; all recovery wells, including collection wells associated with the north barrier wall, all wells associated with the River Terrace Area; and the discharge points to the raw water ponds and outfalls;

3. A section that provides a description of all existing temporary wells, monitoring wells (including observation wells), recovery wells (including collection wells), bioventing wells, and dewatering wells specifying their exact location, depth, and well casing diameter, including well construction diagrams, if applicable;

4. The proposed sampling regime, including frequency of sampling, sampling methodology, analytical parameters, and analytical methods, as defined in Section VIII of this Order;

5. A Facility map showing the location of all existing temporary wells, monitoring wells (including observation wells), recovery wells (including collection wells), bioventing wells,

dewatering wells, and abandoned wells, which shall be revised to reflect any well additions and abandonment of wells that occurred during the year.

The groundwater-monitoring plan shall be revised as investigations are completed and remedies are selected and implemented. The Department may require additional monitoring, including the installation of additional monitoring wells or monitoring for additional parameters, as investigations proceed.

IV.A.2. Facility-Wide Groundwater Monitoring Reports

By April 15, 2008, and by April 15 of each subsequent year, the Respondents shall submit to the Department a Facility-Wide Groundwater Monitoring Report that describes all the groundwater monitoring activities, including all well-abandonment procedures and activities, conducted in the previous year. The Report shall be prepared in accordance with the format described in Section X.D of this Order.

IV.B. INVESTIGATION OF INTERIM STATUS UNITS, SWMU'S, AND AOC'S

IV.B.1. Introduction

This Section (IV.B) provides requirements for the investigation of environmental contamination at all interim status units, all other SWMU's and all other AOC's at the Facility, including any SWMU's or AOC's that may be discovered or reported after the effective date of this Order.

IV.B.2. General Requirements

The Respondents shall investigate each interim status unit, each SWMU, and each AOC at the Facility, which are listed in Section IV.B.3, to determine and evaluate the presence, nature, and extent of releases of contaminants in accordance with 20.4.1.500 NMAC incorporating 40 CFR 264.101.

IV.B.3. List of Interim Status Units, SWMU's, and AOC's

The following interim status units, other SWMU's, and AOC's shall be investigated in accordance with this Section (IV.B):

1. Interim Status Unit No. 1: North Aeration Lagoon and South Aeration Lagoon

2. SWMU No. 2: Drum Storage Area North Bone Yard

3. SWMU No. 3: Underground Piping Currently in Use

4. SWMU No. 4: Transport Terminal Sump

5. SWMU No. 5: Heat Exchanger Bundle Cleaning Area

6. SWMU No. 6: Abandoned Underground Piping

7. SWMU No. 7: Raw Water Ponds (Fresh Water Ponds)
8. SWMU No. 8: Inactive Landfill
9. SWMU No. 9: Landfill Pond
10. SWMU No. 10: Fire Training Area
11. SWMU No. 11: Spray Irrigation Area
12. SWMU No. 12: API Separator
13. SWMU No. 13: Process Area
14. SWMU No. 14: Tanks 3, 4, and 5
15. SWMU No. 15: Tank Farm Area
16. SWMU No. 16: Active Landfill
17. SWMU No. 17: River Terrace Area
18. SWMU No. 18: Warehouse Yard
19. AOC No. 19: Seep North of MW-45
20. AOC No. 20: Seep North of MW-46
21. AOC No. 21: Seep North of MW 47
22. AOC No. 22: Product Loading Rack and Crude Receiving Loading Racks
23. AOC No. 23: Southeast Holding Ponds
24. AOC No. 24: Tank Areas 41 and 43
25. AOC No. 25: Auxiliary Warehouse and 90-Day Storage Area
26. AOC No. 26: Tank Areas 44 and 45
27. SWMU No. 27: Wastewater Collection System

This list shall be modified if any additional SWMU's or AOC's are discovered or reported after the effective date of this Order, and the Department determines that additional investigation of such SWMU or AOC is necessary.

IV.B.4. Investigation Work Plan

For each interim status unit, each SWMU, and each AOC listed in Section IV.B.3, including any newly discovered or newly reported SWMU's or AOC's for which the Department determines that additional investigation is necessary, the Respondents shall submit to the Department for approval an investigation work plan prepared in accordance with the investigation work plan format set forth in Section X.B of this Order. Each investigation work plan shall include, at a minimum:

1. An identification of all wastes, including all hazardous constituents, that have been managed at or in the interim status unit, SWMU, or AOC,

2. A description of all investigation, sampling, and monitoring activities proposed for the interim status unit, SWMU, or AOC, and

3. A proposed schedule for implementation and completion of the investigation and submittal to the Department of an investigation report.

The Respondents shall submit each investigation work plan by the date specified in Section XI, Table I of this Order. All monitoring, sampling, and analysis shall be conducted in accordance with the investigation methods and procedures set forth in Section VIII of this Order.

IV.B.5. Investigation Work Plan and Remedy Completion Report Schedule

The Respondents shall submit to the Department a Closure Plan for the interim status unit, and investigation work plans for SWMU's, and AOC's at the Facility according to the schedule in Section XI, Table I. The units are grouped as follows:

Group 1: The Closure Plan for Interim Status Unit No. 1: North Aeration Lagoon and the South Aeration Lagoon will require initial closure measures to remove sludge, inspect the liner, and as necessary, repair the impoundment liner, conduct corrective action, and identify monitoring requirements.

Group 2: The investigation work plan for SWMU No. 2 Drum Storage Area North Bone Yard; SWMU No. 8 Inactive Landfill; SWMU No. 9 Landfill Pond; SWMU No. 11 Spray Irrigation Area; and SWMU No. 18 Warehouse Yard.

Group 3: The investigation work plan for SWMU No. 4 Transportation Terminal Sump; SWMU No. 5 Heat Exchanger Bundle Cleaning Area; AOC No. 22 Product Loading Rack and Crude Receiving Loading Racks; AOC No. 23 Southeast Holding Ponds; AOC No. 24 Tank Areas 41 and 43; AOC No. 25 Auxiliary Warehouse and 90-Day Storage Area; and AOC No. 26 Tank Area 44 and 45.

Group 4: The investigation work plan for SWMU No. 7 Raw Water Ponds; SWMU No. 10 Fire Training Area and SWMU No. 16 Active Landfill.

Group 5: The investigation work plan for SWMU No. 15 Tank Farm Area.

Group 6: The investigation work plan for AOC No. 19 Seep North of MW-45; AOC No. 20 Seep North of MW-46 and AOC No. 21 Seep North of MW-47.

Group 7: The remedy completion report for SWMU No. 17 River Terrace Area.

Group 8: The investigation work plan for SWMU No. 3 Underground Piping Currently in Use and SWMU No. 6 Abandoned Underground Piping.

Group 9: The investigation work plan for SWMU No. 13 Process Area, SWMU No. 14 Tanks 3, 4, and 5 and SWMU No. 12 API Separator.

This schedule shall be modified if any additional SWMU's or AOC's are discovered or reported after the effective date of this Order, and the Department determines that additional investigation of such SWMU or AOC is necessary.

IV.B.6. Site Investigation

For each interim status unit, SWMU, and AOC listed in Section IV.B.3, the Respondents shall perform the site investigation in accordance with the approved investigation work plan. The Respondents shall notify the Department a minimum of 20 days prior to the commencement of any field activities under the approved investigation work plan.

IV.B.7. Investigation Report

By the date specified in the approved investigation work plan, the Respondents shall submit to the Department an investigation report that presents the results of field activities, summarizes the data collected, and states the recommendations and conclusions of the investigation for each interim status unit, SWMU, and AOC. An individual report may cover more than one interim status unit, SWMU, or AOC. The reports shall be prepared in accordance with Section X.C of this Order. The Department will review the investigation report and determine if the investigation has been satisfactorily completed, or if additional investigation is necessary.

IV.B.8. Newly Discovered SWMU's and AOC's

Within fifteen (15) days after the discovery of any previously unknown or unreported SWMU or AOC, or suspected SWMU or AOC, the Respondents shall notify the Department in writing of such discovery. The notification shall include, at a minimum, the location of the SWMU or AOC and all available information on the nature and extent of any release of contaminants into the environment from the SWMU or AOC, including an identification of the contaminants released, the magnitude of the release, the approximate date of the release, and the media affected by the release.

Within sixty days after submitting such notification, the Respondents shall submit to the Department for approval a SWMU (or AOC) Assessment Report for the SWMU or AOC. The report shall include, at a minimum:

1. The location of the SWMU or AOC on a topographic map of appropriate scale,

2. A designation of the type and function of the SWMU or AOC,

3. The dimensions, capacity, and structural description of the SWMU or AOC, including any available plans or drawings,

4. The dates of operation of the SWMU or AOC,

5. An identification of all wastes, including all hazardous constituents that have been managed at or in the SWMU or AOC, and

6. All available information on the nature and extent of any release of contaminants into the environment from the SWMU or AOC, including an identification of the contaminants released, the magnitude of the release, the approximate date of the release, and the media affected by the release, and including all groundwater, surface water, soil, and air analytical or monitoring data.

Based on this report, and any other information available to the Department, the Department will determine if additional investigation of the newly discovered or reported SWMU or AOC is necessary. If the Department determines that additional investigation is necessary, the Department will notify the Respondents in writing, and this Order will be modified to add the SWMU or AOC to the list in Section IV.B.3 and to establish a schedule for its investigation in Section IV.B.5, and Section XI, Table 1.

IV.B.9. Newly Discovered Releases from Interim Status Units, SWMU's, and AOC's

Within fifteen (15) days after the discovery of any previously unknown or unreported release of a contaminant from an interim status unit, a SWMU, or an AOC, the Respondents shall notify the Department in writing of such release. The notification shall include, at a minimum, the identification of the SWMU or AOC from which the release occurred, and all available information on the nature and extent of the release, including an identification of the contaminants released, the magnitude of the release, the approximate date of the release, and the media affected by the release. The Department will determine if additional investigation of the newly discovered or reported release is necessary. If the Department determines that additional investigation is necessary, the Department will notify the Respondents in writing.

V. MONITORING OF INTERIM REMEDIATION SYSTEMS

The Respondents have installed interim remediation and containment systems to prevent the migration of contaminants from the Facility property.

V.A. NORTH BARRIER WALL AND COLLECTION SYSTEM

To mitigate off-site migration of petroleum hydrocarbons along the north property boundary of the Facility, the Respondents installed a soil-bentonite slurry containment barrier wall and a total fluids collection and observation well system between January and April 2005. The barrier wall extends approximately 8 to 28 feet below the ground surface in depth**,** and approximately 2,600 feet in length along the north refinery boundary on the north side of Hammond Ditch, from County Road 4990 to approximately 200 feet east of El Paso pipeline corridor. The fluid collection system consists of 15 "collection" or recovery wells located between the refinery and the barrier wall and 14 monitoring or "observation" wells located between the San Juan River and the barrier wall.

V.A.1. Interim Measures Implementation Report

The Respondents submitted an outline to the Department for a corrective measures implementation report on October 28, 2005 (submitted). The Respondents shall submit to the Department an Interim Measures Implementation Report that follows the outline, describing the north barrier wall and collection system on or before July 3, 2006 (submitted). The reporting requirements have been established in previous correspondence between the Department and the Respondents.

V.A.2. Monitoring

To monitor the effectiveness of the north barrier wall and collection system, the Respondents shall:

1. Include monitoring of the "collection" wells and "observation" wells in the facility-wide groundwater monitoring plan required under Section IV.A of this Order, and

2. Submit an annual report summarizing system monitoring to the Department on or before June 30, 2006 (submitted). The Annual Report shall summarize monitoring data from the previous months (May 2005 through April 2006). The Annual Report shall be prepared in accordance with the periodic monitoring report format set forth in Section X.D of this Order.

3. The monitoring requirements of the barrier wall observation and collection wells shall be revised upon review of the data collected during the first year of installation.

V.B. RIVER TERRACE BENTONITE SLURRY AND SHEET PILE BARRIER WALL

The River Terrace Area is located adjacent to the San Juan River north of the refinery process units. In 1999 the Respondents installed a bentonite slurry and sheet pile barrier wall adjacent to the San Juan River that extends approximately thirty feet below the ground surface, and extends around the perimeter of the riverbank from the bluff opposite the west end of the process area to the river inlet station. The bentonite slurry and sheet pile barrier wall were installed to prevent separate-phase

hydrocarbons and dissolved-phased hydrocarbons from migrating into the San Juan River. Between October 2004 and April 2005, the Respondents completed a second investigation in the river terrace area. The investigation included the installation of two permanent groundwater-monitoring wells (MW-48 and MW-49) to replace two piezometers (P-4 and P-5) and the installation of 13 temporary well points (TP-1 through TP-13) to determine the extent of petroleum contamination in groundwater on the refinery side of the bentonite slurry wall and sheet pile barrier. The investigation showed that petroleum contamination is present in the vicinity of the barrier wall adjacent to the San Juan River extending toward the refinery to the temporary wells east of the river inlet station. The hydrocarbon concentrations decrease eastward toward TP-13. To reduce hydrocarbon concentrations in this area, the Respondents installed a bioventing remediation system at the river terrace area. The bioventing system is comprised of 13 bioventing wells (BV-1 to BV-13) and three dewatering wells (MW-48 serving as a dual purpose well, DW-1 and DW-2). (SJRC 2004; Schmaltz 2004a; 2005).

V.B.1. Monitoring

The Respondents shall monitor the effectiveness of the river terrace bentonite slurry and sheet pile barrier wall, and bioventing systems. The Respondents shall conduct such monitoring in accordance with the *Bioventing Monitoring Plan (Revised): River Terrace Voluntary Corrective Measures,* dated October 28, 2005, which is incorporated herein in accordance with Section III.G. Any revisions or modifications to the Plan shall be approved by the Department in accordance with Section III.G. In addition, the Respondents shall

1. Include monitoring of monitoring wells (MW-48 and MW-49) and temporary wells (TP-1 through TP-13) in the facility-wide groundwater monitoring work plan required under Section IV.A of this Order.

2. Submit to the Department a Six-Month System Start-up Report that summarizes the results of the remediation system monitoring and evaluates the progress of the bioventing system at the River Terrace Area. The report must describe all sampling activities and all monitoring data gathered during the first six-months of operation. The Six-Month Report is due August 28, 2006 (submitted). The Six-Month Start-up report shall be prepared in accordance with the periodic monitoring report format set forth in Section X.D of this Order.

3. Submit to the Department annual monitoring reports that summarize the results of the remediation system monitoring and evaluate the progress of the bioventing system at the River Terrace Area. The reports must describe all sampling activities and include all monitoring data gathered during the first 12-months of operation and annually thereafter. The first annual report is due on or before January 27, 2007 (submitted) and no later than March 1 of every year of subsequent system operation. The annual reports shall be prepared in accordance with the periodic monitoring report format set forth in Section X.D of this Order.

V.C. DIVERSION AND TREATMENT OF #1 EAST OUTFALL DISCHARGE

In July 2003, petroleum hydrocarbons were detected in water discharging from the #1 East Outfall, which discharges into a small drainage**,** located northwest of the Raw Water Ponds on the north side of Hammond Ditch. Subsequently, the Respondents began diverting this discharge. The effluent from the #1 East Outfall is collected and routed to a collection tank (Tank #38), and then routed to a separator tank (Tank #33) designed for the gravitational separation of fluids. The effluent water is then discharged to the Raw Water Ponds that serve as a source of refinery process water. The effluent discharge to the Raw Water Ponds has periodically exceeded the WQCC water quality standards and MCL's for benzene; some exceedences have occurred after the installation of the north barrier wall.

The Respondents shall collect a sample of effluent water discharged to the Raw Water Ponds in accordance with the time frame specified in Section XI, Table I. The sample shall be analyzed for BTEX and MTBE using methods approved by the Department. The Department may modify the sampling schedule if contaminant concentrations exceed the lower of the WQCC standards or the MCL's. If any contaminants are detected at concentrations that exceed applicable standards, the Respondents shall notify the Department within five (5) days of receiving the analytical data.

The Respondents shall report the quarterly analytical data to the Department within 7 days of receipt of the associated final laboratory report.

VI. CORRECTIVE MEASURES

The Respondents shall implement corrective measures at the Facility, as necessary, in accordance with the requirements of this Section (VI).

The results of the investigations required in Section IV of this Order, and other information available to the Department, will be used as the basis for determining whether further investigation and corrective measures are necessary under this Order. The general procedures for implementing corrective measures are described in this Section (VI).

VI.A. INTERIM MEASURES

VI.A.1. General

The Department will require interim measures, if the Department determines that such measures are necessary, to reduce or prevent migration of contaminants that have or may result in an unacceptable exposure of human or environmental receptors to contaminants while long-term corrective action remedies are evaluated and implemented. To the extent practicable, the Department will select interim measures that are consistent with the long-term corrective action. Upon making a determination that interim measures are necessary, the Department will notify the Respondents.

VI.A.2. Interim Measures Work Plan

Within 90 days after receiving notification from the Department that interim measures are required or proposed interim measures have been approved, the Respondents shall submit to the Department for review and written approval an Interim Measures Work Plan. The Interim Measures Work Plan shall include a proposed schedule for implementation and completion of the interim measures and for submittal to the Department of an Interim Measures Report.

VI.A.3. Approval of Interim Measures Work Plan

The Department will review the Interim Measures Work Plan and notify the Respondents in writing of approval, approval with modifications, or disapproval of the plan in accordance with Section III.G of this Order.

VI.A.4. Interim Measures Implementation

The Respondents shall implement the interim measures in accordance with the approved Interim Measures Work Plan and implementation schedule.

VI.A.5. Emergency Interim Measures

The Respondents may determine, during implementation of site investigation activities, that emergency interim measures are necessary to address an immediate threat of harm to human health or the environment. The Respondents shall notify the Department within two business days of discovery of the facts giving rise to the threat, and shall propose emergency interim measures to address the threat. If the Department approves the emergency interim measures in writing, the

Respondents may implement the emergency interim measures without submitting an interim measures work plan.

VI.A.6. Interim Measures Report

Within 90 days, or other period approved by Department, after completion of interim measures, the Respondents shall submit to the Department an Interim Measures Report summarizing the results of the interim measures, that shall include copies of the results of all field screening, monitoring, sampling, analysis, and other data generated as part of the interim measures implementation.

VI.B. RISK ANALYSIS

VI.B.1. General

The Respondents shall evaluate human health and ecological risk at every interim status unit, SMWU, and AOC that is investigated pursuant to this Order to determine if further action is necessary to protect human health or the environment. Such evaluation will not necessarily require preparation of a site specific risk assessment to develop cleanup levels for contaminated media. The Respondents shall attain the cleanup levels set forth in Section VII of this Order for all media at each site for which the Department determines, under Section VI.C.1, that corrective measures are necessary to protect human health or the environment. The Respondents may propose to demonstrate to the Department that achievement of a cleanup goal at a particular site is impracticable (as defined in Section VII.E of this Order). The Respondents shall have the burden of making such demonstration to the Department's satisfaction. If the Respondents propose to demonstrate the impracticability of achievement of a groundwater cleanup goal that is a WQCC standard, the applicable requirements of the WQCC Regulations, 20.6.2.4103.E and 4103.F NMAC, shall be followed. If the Department approves the impracticability demonstration, the Respondents shall prepare a site-specific risk assessment for that site to identify alternate cleanup goals or, if the WQCC Regulations apply, alternate abatement standards. The risk assessment shall include both a human health risk assessment and an ecological risk assessment.

VI.B.2. Risk Assessment Report

Within 90 days after receiving from the Department a written determination that an impracticability demonstration has been approved, the Respondents shall submit to the Department for approval a Risk Analysis Report for that site. The Respondents shall prepare the Risk Assessment Report in accordance with the format in Section X.E of this Order.

VI.C. CORRECTIVE MEASURES EVALUATION

VI.C.1. General

The Department will require corrective measures at a site if the Department determines, based on the Investigation Report and other information available to the Department, that there has been a release of contaminants into the environment at the site and that corrective action is necessary to protect human health or the environment. Upon making such a determination, the Department will notify

the Respondents in writing and specify a due date for the submittal of a Corrective Measures Evaluation.

VI.C.2. Corrective Measures Evaluation Report

Following written notification from the Department that a corrective measures evaluation is required, the Respondents shall submit to the Department for approval a Corrective Measures Evaluation Report. The Respondents shall prepare the Corrective Measures Evaluation Report in accordance with the format outlined in Section X.F of this Order. The corrective measures evaluation shall evaluate potential remedial alternatives and shall recommend a preferred remedy that will be protective of human health and the environment and attain the appropriate cleanup levels. The Corrective Measures Evaluation Report shall, at a minimum, include:

1. A description of the location, status, and current use of the site,

2. A description of the history of site operations and the history of releases of contaminants,

3. A description of site surface conditions,

4. A description of site subsurface conditions,

5. A description of on- and off-site contamination in all affected media,

6. An identification and description of all sources of contaminants,

7. An identification and description of contaminant migration pathways,

8. An identification and description of potential receptors,

9. A description of cleanup standards or other regulatory criteria,

10. An identification and description of a range of remedy alternatives,

11. Remedial alternative pilot or bench scale testing results,

12. A detailed evaluation and rating of each of the remedy alternatives, applying the criteria set forth in Section VI.C.4,

13. An identification of a proposed preferred remedy or remedies,

14. Design criteria of the selected remedy or remedies, and

15. A proposed schedule for implementation of the preferred remedy.

VI.C.3. Cleanup Standards

The Respondents shall select corrective measures that are capable of achieving the cleanup standards and goals outlined in Section VII of this Order. If the cleanup standards or levels cannot be achieved, approved risk-based cleanup levels established by a risk analysis may be used.

VI.C.4. Remedy Evaluation Criteria

VI.C.4.a Threshold Criteria

The Respondents shall evaluate each of the remedy alternatives for the following threshold criteria. To be selected, the remedy alternative must:

1. Be protective of human health and the environment,

2. Attain media cleanup standards,

3. Control the source or sources of releases of contaminants so as to reduce or eliminate, to the extent practicable, further releases of contaminants that may pose a threat to human health and the environment, and

4. Comply with standards for management of wastes.

VI.C.4.b Remedial Alternative Evaluation Criteria

The Respondents shall evaluate each of the remedy alternatives for the factors described in this Section (VI.C.4). These factors shall be balanced in proposing a preferred alternative.

VI.C.4.c Long-Term Reliability and Effectiveness

The remedy shall be evaluated for long-term reliability and effectiveness. This factor includes consideration of the magnitude of risks that will remain after implementation of the remedy; the extent of long-term monitoring, or other management that will be required after implementation of the remedy; the uncertainties associated with leaving contaminants in place; and the potential for failure of the remedy. A remedy that reduces risks with little long-term management, and that has proven effective under similar conditions, shall be preferred.

VI.C.4.d Reduction of Toxicity, Mobility, or Volume

The remedy shall be evaluated for its reduction in the toxicity, mobility, and volume of contaminants. A remedy that uses treatment to more completely and permanently reduce the toxicity, mobility, and volume of contaminants shall be preferred.

VI.C.4.e Short-Term Effectiveness

The remedy shall be evaluated for its short-term effectiveness. This factor includes consideration of the short-term reduction in existing risks that the remedy would achieve; the time needed to achieve that reduction; and the short-term risks that might be posed to the community, workers, and the environment during implementation of the remedy. A remedy that quickly reduces short-term risks, without creating significant additional risks, shall be preferred.

VI.C.4.f Implementability

The remedy shall be evaluated for its implementability or the difficulty of implementing the remedy. This factor includes consideration of installation and construction difficulties; operation and maintenance difficulties; difficulties with cleanup technology; and the availability of necessary equipment, services, expertise, and storage and disposal capacity. A remedy that can be implemented quickly and easily, and poses fewer and lesser difficulties, shall be preferred.

VI.C.4.g Cost

The remedy shall be evaluated for its cost. This factor includes a consideration of both capital costs, and operation and maintenance costs. Capital costs shall include, without limitation, construction and installation costs; equipment costs; land development costs; and indirect costs including engineering costs, legal fees, permitting fees, startup and shakedown costs, and contingency allowances. Operation and maintenance costs shall include, without limitation, operating labor and materials costs; maintenance labor and materials costs; replacement costs; utilities; monitoring and reporting costs; administrative costs; indirect costs; and contingency allowances. All costs shall be calculated based on their net present value. A remedy that is less costly, but does not sacrifice protection of health and the environment, shall be preferred.

VI.C.5. Approval of Corrective Measures Evaluation Report

The Department will review the Corrective Measures Evaluation Report and notify the Respondents in writing of approval, approval with modifications, or disapproval of the plan in accordance with Section III.G of this Order. The Department's approval of the Corrective Measures Evaluation Report shall not be construed to mean that the Department agrees with the recommended preferred remedy.

VI.C.6. Relationship to Corrective Measures Requirements

The Corrective Measures Evaluation shall serve as a Corrective Measures Study for the purposes of compliance with the corrective action requirements of the HWA.

VI.C.7. Statement of Basis

Upon approval of the Corrective Measures Evaluation and remedy selection, the Department will select a remedy or remedies for the site. The Department will issue a Statement of Basis for selection of the proposed remedy, and will receive public comment on the remedy. The public comment period will extend for at least 60 days from the date of the public notice of the Statement of Basis. The Department will select a final remedy and issue a response to public comments, after the end of the public comment period. In selecting a remedy, the Department will follow the public participation requirements applicable to remedy selection under sections 20.4.1.900 NMAC incorporating 40 CFR 270.41 and 20.4.1.901 NMAC.

The administrative record for the Facility will be made available to the public for review at the Department's offices in the Santa Fe, New Mexico. All significant written and signed comments,

including emailed comments, will be considered by the Department prior to approving a final remedy or remedies.

The Department's decision on the final remedy or remedies shall follow the requirements under section 20.4.1.901.G NMAC, Secretary's Decision. The Department will issue a response to public comments at the time of the Department's final decision.

VI.D. CORRECTIVE MEASURES IMPLEMENTATION

VI.D.1. General

The Respondents shall implement the final remedy selected by the Department.

VI.D.2. Corrective Measures Implementation Plan

Within 120 days after the Department's selection of a final remedy, or such other time as the Department determines, the Respondents shall submit to the Department for approval a Corrective Measures Implementation Plan outlining the design, construction, operation, maintenance, and performance monitoring for the selected remedy, and a schedule for its implementation. The Corrective Measures Implementation Plan shall, at a minimum, include:

1. A description of the selected final remedy,

2. A description of the cleanup goals and remediation system objectives,

3. An identification and description of the qualifications of all persons, consultants, and contractors that will be implementing the remedy,

4. Detailed engineering design drawings and systems specifications for all elements of the remedy,

5. A construction work plan,

6. An operation and maintenance plan,

7. The results of any pilot tests,

8. A plan for monitoring the performance of the remedy, including sampling and laboratory analysis of all affected media,

9. A waste management plan,

10. A proposed schedule for submission to the Department of periodic progress reports, and

11. A proposed schedule for implementation of the remedy.

VI.D.3. Approval of Corrective Measures Implementation Plan

The Department will review the Corrective Measures Implementation Plan and notify the Respondents in writing of approval, approval with modifications, or disapproval of the plan in accordance with Section III.G of this Order.

VI.D.4. Health and Safety Plan

The Respondents shall conduct all activities in accordance with a site-specific or Facility-wide Health and Safety Plan during all construction, operation, maintenance, and monitoring activities conducted during corrective measures implementation.

VI.D.5. Progress Reports

The Respondents shall submit to the Department progress reports in accordance with the schedule approved in the Corrective Measures Implementation Plan. The progress reports shall, at a minimum, include the following information:

1. A description of the work completed during the reporting period,

2. A summary of all problems, potential problems, or delays encountered during the reporting period,

3. A description of all actions taken to eliminate or mitigate the problems, potential problems, or delays,

4. A discussion of the work projected for the next reporting period, including all sampling events,

5. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the reporting period, and

6. Copies of all waste disposal records generated during the reporting period.

VI.D.6. Remedy Completion Report

Within 90 days after completion of the remedy, the Respondents shall submit to the Department a Remedy Completion Report. The report shall, at a minimum, include:

1. A summary of the work completed,

2. A statement, signed by a registered professional engineer, that the remedy has been completed in full satisfaction of the terms of this Order,

3. As-built drawings and specifications signed and stamped by a registered professional engineer,

4. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the remedy implementation, if not already submitted in a progress report,

5. Copies of all waste disposal records, if not already submitted in a progress report, and

6. A certification, signed by a responsible official of the Respondents stating: "To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this report is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

VI.D.6.a Certification of Completion

Upon receipt of the Remedy Completion Report, the Department will determine whether the remedy has been completed in full satisfaction of the terms of this Order. The Department may conduct an inspection of the site, or request additional information from the Respondents, to make this determination. If the Department determines that the remedy has not been satisfactorily completed, it will notify the Respondents in writing of the actions that are necessary to complete the remedy. The Respondents shall implement such actions in accordance with the notification. If the Department determines that the remedy has been satisfactorily completed, it will issue to the Respondents a written Certification of Completion of the remedy for that site.

VI.E. ACCELERATED CLEANUP PROCESS

If the Respondents identify a corrective measure that, if implemented voluntarily, will reduce risks to human health and the environment to levels acceptable to the Department, will reduce cost or will achieve cleanup of a SWMU or AOC ahead of schedule, the Respondents may implement the corrective measure as provided in this Section (VI.E), in lieu of the process established in Sections VI.A through VI.D. The accelerated cleanup process shall be used at sites to implement presumptive remedies at small-scale and relatively simple sites where groundwater contamination is not a component of the accelerated cleanup, where the remedy is considered to be the final remedy for the site, and where the field work will be accomplished within 180 days of the commencement of field activities. The proposed accelerated cleanup shall be documented in an Accelerated Corrective Measure Work Plan, which shall include: (1) a description of the proposed remedial action, including details of the unit or activity that is subject to the requirements of this Order; (2) an explanation of how the proposed cleanup action is consistent with the overall corrective action objectives and requirements of this Order, (3) the methods and procedures for characterization and remediation sample collection and analyses, and (4) a schedule for implementation and reporting on the proposed cleanup action. The Respondents shall notify the Department of the planned accelerated corrective measure a minimum of 20 days prior to the commencement of any accelerated field activity. The notification shall include the submittal of the Plan if not already submitted to the Department.

VI.E.1. Accelerated Corrective Measures Work Plan

The Respondents shall obtain approval of an Accelerated Corrective Measures Work Plan prior to implementation. The Respondents shall prepare the Work Plan in accordance with the requirements

of Section X.B of this Order. The Respondents shall submit the Work Plan to the Department for review and approval in accordance with Section III.G of this Order. If the Department disapproves the Accelerated Corrective Measures Work Plan, the Department will notify the Respondents in writing of the Plan's deficiencies and specify a due date for submission of a revised Accelerated Corrective Measures Work Plan. The Respondents shall include an implementation schedule in the revised Accelerated Corrective Measures Work Plan.

VI.E.2. Accelerated Corrective Measure Implementation

The Respondents shall implement the accelerated corrective measures in accordance with the approved Accelerated Corrective Measures Work Plan. Within 90 days of completion of the accelerated corrective measures, the Respondents shall submit to the Department for approval a Remedy Completion Report. The report shall be submitted in a format approved by the Department in accordance with Section X.A of this Order. If upon review, the Department identifies any deficiencies in the Remedy Completion Report, the Department will notify the Respondents in writing.

VII. CLEANUP AND SCREENING LEVELS

The Department and the WQCC have separately specified certain cleanup levels and methods of calculating cleanup levels. The WQCC's and the Department's cleanup levels for protection of human health are based on excess lifetime cancer risk levels and hazard index levels that are consistent with the EPA's National Oil and Hazardous Substance Pollution Contingency Plan, 40 CFR 300.430(e)(2)(i)(A)(*2*). The EPA recommends a range of 10^{-4} to 10^{-6} lifetime excess cancer risk as acceptable. In general, the Department has selected a target risk level of 10^{-5} for establishing cleanup levels for regulated substances. The Department has generally selected a target hazard quotient (HQ) of one for individual noncarcinogenic regulated compounds. For contamination involving two or more noncarcinogenic regulated substances, the Department has generally selected a target hazard index (HI) of one. Unless otherwise specifically provided in this Order, the Respondents shall follow the cleanup and screening levels described in this Section (VII) in implementing the corrective action requirements of this Order. The Respondents shall comply with the adopted and established cleanup and reporting requirements described in this Section (VII).

VII.A. GROUNDWATER CLEAN UP LEVELS

The New Mexico WQCC has established groundwater cleanup standards for selected contaminants (20.6.2.7 WW NMAC, 20.6.2.3103 and 20.6.2.4103 NMAC). The Department enforces groundwater cleanup levels that incorporate the WQCC standards and the EPA MCLs for drinking water contaminants. If both a WQCC standard and a MCL have been established for an individual substance, then the Respondents shall use the lower of the two levels, and shall be considered the cleanup level for that substance. The Respondents shall use the most recent version of the EPA Region VI Human Health Medium-Specific Screening Level (HHMSSL) for tap water as the target cleanup level if neither a WQCC standard nor an MCL has been established for a specific substance. The Respondents shall use the most recent version of the Department's *Total Petroleum Hydrocarbon (TPH) Screening Guidelines* (as it may be updated) in determining cleanup levels for petroleum hydrocarbons in groundwater.

VII.B. SOIL CLEAN UP LEVELS

In determining soil cleanup levels, the Respondents shall use soil-screening levels that are based on a target total excess cancer risk of 10^{-5} for carcinogenic contaminants and for noncarcinogenic contaminants, a target HI of one (1.0) for residential and industrial land use. The Respondents shall use the Department's *Technical Background Document for Development of Soil Screening Levels* (as updated), the Department's Position Paper *Risk-based Remediation of Polychlorinated Biphenyls at RCRA Corrective Action Sites* (March 2000 as it may be updated), and the Department's *Total Petroleum Hydrocarbon (TPH) Screening Guidelines* (as it may be updated) to determine soil cleanup levels. If a contaminant is not included in the documents listed above, the Respondents shall use the most recent version of the EPA Region VI Human Health Medium Specific Screening Level (HHMSSL) for residential and industrial soil as the target screening level 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).

The Respondents shall use soil screening levels pursuant to the previous paragraph as cleanup levels for purposes of this Order unless one of the following two circumstances applies: 1) cleanup to the specified levels is determined to be impracticable in accordance with Section VII.E; or 2) the current and reasonably foreseeable future land use is one for which the Department has not established soil screening levels. If either of the foregoing circumstances applies, then the Respondents may propose cleanup levels to the Department based on a risk assessment and a target excess cancer risk level of 10^{-5} or for noncarcinogenic contaminants an HI of one (1.0), for current and reasonably foreseeable future land use (e.g., residential, recreational, or industrial). The proposed cleanup level will be subject to the Department's review and approval.

Petroleum hydrocarbons may be detected in environmental media as the result of contaminant releases where individual hazardous constituents are not present at significant concentrations. In these cases, the Respondents shall use the most recent version of the *NMED Total Petroleum Hydrocarbon (TPH) Screening Guidelines* (as it may be updated) for cleanup of petroleum hydrocarbons in soil.

VII.C. SURFACE WATER CLEAN UP LEVELS

The Respondents shall comply with the surface water quality standards set forth in the Clean Water Act (33 U.S.C. § 1313), the New Mexico WQCC Regulations (20.6.2 NMAC) and the State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC).

VII.D. ECOLOGICAL RISK EVALUATION

The Department shall evaluate ecological risk at each site in a manner consistent with the Department's Guidance for *Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (March 2000, as it may be updated).

VII.E. VARIANCE FROM CLEANUP LEVELS OR CLEANUP LEVEL

If attainment of the established cleanup level is demonstrated to be technically infeasible, the Respondents may perform a risk-based evaluation to establish alternative cleanup levels for specific media at individual corrective action units. The risk-based evaluation should be conducted in accordance with the Department's human health risk Position Paper *Assessing Human Health Risks Posed by Chemicals: Screening Level Risk Assessment* (March 2000, as it may be updated) using the equations in the Department's *Technical Background Document for Development of Soil Screening Levels* (August 2005, as it may be updated). The risk-based evaluation should be developed in accordance with the Department's ecological risk guidance document *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-level Ecological Risk Assessment* (March 2000, as it may be updated). For groundwater, if the Respondents propose to demonstrate the technical infeasibility of achievement of a groundwater cleanup level that is a WQCC standard, the applicable requirements of the WQCC Regulations, 6.2.4103.E and 4103.F NMAC, shall be followed.

For all other instances in which the Respondents seek to vary from a cleanup level identified above, the Respondents shall submit a demonstration to the Department that achievement of the cleanup level is impracticable. In making such demonstration, the Respondents may consider such things as technical or physical impracticability of the project, the effectiveness of proposed solutions, the cost

of the project, hazards to workers or to the public, and any other basis that may support a finding of impracticability at a particular SWMU or AOC. The Respondents may also refer to all applicable guidance concerning impracticability, including, for example, the criteria set forth in EPA's *Interim Final Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration* (September 1993) and EPA's Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (September 2002 as it may be updated). In addition to demonstrating the basis for their impracticability request, the Respondent's written submission shall propose the action to be taken by the Respondents if the Department approves the impracticability demonstration. Such action shall include, but is not limited to, completion of a site-specific risk assessment and identification of alternate clean-up levels.

The Department will review the Respondent's written submission concerning impracticability and determine whether achievement of the cleanup level is impracticable. The Department may consider such things as technical or physical feasibility of the project, the effectiveness of proposed solutions, the cost of the project, hazards to workers or to the public, and any other basis that may support or refute a finding of impracticability at a particular SWMU or AOC. If the Department approves or disapproves the Respondents' impracticability demonstration, it will notify the Respondents in writing, and such notice will describe the specific action to be taken by the Respondents.

VIII. INVESTIGATION AND SAMPLING METHODS AND PROCEDURES

The Respondents shall submit to the Department for approval site-specific work plans for each unit 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 Section X.B of this Order. The Respondents shall provide notification to the Department 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 Order 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 VIII of this Order 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 Order. 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.

VIII.A. INVESTIGATION, SAMPLING, AND ANALYSES METHODS

The Investigation, Sampling and Analysis Methods Section of this Order provides minimum requirements for field investigations, sample collection, handling and screening procedures, field and laboratory sample analysis, and quality assurance (QA) procedures for samples of the medium being investigated or tested at the Facility.

The purpose of this section (VIII.A) 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 (QA) 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.

VIII.A.1. Field Exploration Activities

The Department may require exploratory borings to fulfill the requirements of this Order. Any boring locations, if required, will be determined or approved by the Department. The depths and locations of all exploratory and monitoring well borings shall be specified in the unit-specific work plans submitted to the Department for approval prior to the start of the respective field activities.

VIII.A.2. Subsurface Features/Utility Geophysical Surveys

The Respondents shall conduct surveys, where appropriate, to locate underground utilities, pipelines structures, drums, debris, and other buried features 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 unique 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 the Department. The Respondents are responsible for locating and clearing all aboveground and underground utilities or other hazards at any site prior to conducting field work.

VIII.A.3. Drilling and Soil Sampling

VIII.A.3.a 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. The drilling methods selected for advancement of each boring must be approved by the Department prior to the start of field activities. Based on the drilling conditions, the borings shall be advanced using one of the following methods:

a. Hollow-stem auger

b. Air rotary

c. Direct Push Technology (DPT)

Hollow-stem auger or DPT drilling methods are preferred, depending on the local subsurface conditions and the anticipated investigation requirement. These drilling methods are also preferred if vapor-phase or VOC contamination is known or suspected to be present.

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 Respondents are 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 the Department. The Respondents shall propose drilling depths in the site-specific work plans submitted for each subject area. Unless otherwise specified in this Order, the borings shall be advanced to the following minimum depths:

1. Five feet below the deepest detected contamination,

2. Five feet below the base of structures such as piping or building sumps, footings or other building structures,

3. Five feet below the shallow water table, and

4. Depths specified by the Department based on specific data needs.

The Respondents shall notify the Department as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the depths specified by the Department or sampling at locations specified in approved work plans 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 VIII.A.7 of this Order. 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 Order. The particular methods proposed for use by the Respondents for subsurface explorations and sampling shall be included in the unit-specific investigation work plan submitted to the Department. The Department will include any changes or additional requirements for conducting exploratory excavation and sampling activities at the subject unit in its response to the Respondents after review of the investigation work plan.

VIII.A.3.b Soil Sampling

Relatively undisturbed discrete soil samples shall be obtained 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. Continuously, at 2.5-foot intervals, at 5-foot intervals or as approved by the Department,

2. At the depth immediately below the base of the unit structures and at the fill-native soil interface,

3. At the maximum depth of each boring,

4. At the water table,

5. From soil types relatively more likely to sorb or retain contaminants than the surrounding lithologies,

6. At intervals suspected of being source or contaminated zones, and

7. At other intervals approved or required by the Department.

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 the Department 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 use of an Encore® Sampler or other similar devices are preferred by the Department if sample collection in brass sleeves is not used during collection of soil samples for VOC analysis. The remaining portions of the sample shall be used for logging and field screening, as described in Sections VIII.A.4 and VIII.A.5, 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 Respondents may submit site-specific, alternative methods for homogenization of samples in the field to the Department for 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) the stratigraphy encountered in the boring; and 5) the specific objectives and requirements of this Order. The proposed number of samples and analytical parameters shall be included as part of the unit-specific work plan submitted to the Department 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 approved by the Department prior to implementation.

VIII.A.3.c Surface Sampling

Surface samples shall be collected using decontaminated, hand-held stainless steel coring device, shelby tube, thin-wall sampler or other method approved by the Department where surface or sediment sampling is conducted without the use of the drilling methods described in Section VIII.A.3.b above. The samples shall be transferred to precleaned laboratory prepared containers for submittal to the laboratory. Samples obtained for volatiles analysis shall be collected using Encore® samplers, shelby tubes, thin-wall sampler or other method approved by the Department. Except in the case of the use of Encore® samplers, 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.

VIII.A.3.d 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. An IDW management plan shall be included with the unit-specific investigation work plan submitted to the Department for approval prior to the start of field investigations. The method of containment for drill cuttings must be approved by the Department 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 IX.D of this Order. Borings completed as groundwater monitoring wells shall be constructed in accordance with the requirements described in Section IX.C of this Order.

VIII.A.4. Logging of Soil 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 (American Society for Testing and Materials) D2487 (Unified Soil Classification System) and D2488 and/or AGI (American Geological Institute) 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, test pit logs and field well construction diagrams shall be converted to the format acceptable for use in final reports submitted to the Department.

VIII.A.5. Soil Sample Field Screening

Samples obtained from the borings shall be screened in the field for evidence of the 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 samples for laboratory analysis. 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 one or more of the following: (1) visual examination, (2) headspace vapor screening for volatile organic compounds, and (3) metals screening using X-ray fluorescence. Additional screening for site- or release-specific characteristics such as pH or for specific compounds using field test kits shall be conducted where appropriate.

Visual screening includes examination of soil samples for evidence of staining caused by petroleum-related compounds or other substances that may cause staining of natural soils such as elemental sulfur or cyanide compounds.

Headspace vapor screening targets volatile organic compounds and involves placing a soil 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 to the air trapped in the container. The sealed container shall be allowed to rest for a minimum of 5 minutes while vapors equilibrate. Vapors present within the sample bag's 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 the Department shall be used for VOC field screening. The limitations, precision and calibration of the instrument to be used for VOC field screening shall be included in the site-specific investigation work plan prepared for each unit.

X-ray fluorescence (XRF) may be used to screen soil samples for the presence of metals or isotopes. 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 calibration shall be approved by the Department prior to the start of field activities. Field XRF screening results for selected metals may be used in lieu of laboratory analyses upon approval by the Department; however, the results shall, at a minimum, be confirmed by laboratory analyses at a frequency of 20 percent (1 sample per every five analyzed by XRF analysis).

Field screening results are site- and boring-specific and the results vary with instrument type, the media screened, weather conditions, moisture content, soil type, and type of contaminant, therefore, all conditions capable of influencing the results of field screening shall be recorded on the field logs. The conditions potentially influencing field screening results shall be submitted to the Department as part of the site-specific investigation, remediation and/or monitoring reports.

At a minimum, samples with the greatest apparent degree of contamination, based on field observations and field screening, shall be submitted for laboratory analysis. The location of the sample relative to groundwater, stratigraphic units and/or contacts and the proximity to significant site or subsurface features or structures also shall be used as a guideline for sample selection. In addition, samples with no or low apparent contamination, based on field screening, shall be submitted 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.

VIII.A.6. Soil Sample Types

The Respondents shall collect soil samples at the frequencies stated in the approved site-specific investigation work plans for each unit. The samples collected shall be representative of the media and site conditions being investigated or monitored. QA/QC samples shall be collected to monitor the validity of the soil sample collection procedures. Field duplicates should be collected at a rate of 10 percent. Equipment blanks shall be collected from all sampling apparatus at a frequency of 10 percent for chemical analysis. Equipment blanks shall be collected at a frequency of one per day if disposable sampling equipment is used. Field blanks shall be collected at a frequency of one per day for each media (with the exception of air samples) at each unit. 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 shall 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.

VIII.A.7. Sample Point and Structure Location Surveying

The horizontal coordinates and elevation of each surface sampling location; the surface coordinates and elevation of each boring or test pit, the top of each monitoring well casing, and the ground surface at each monitoring well location; and the locations of all other pertinent structures 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)). Alternate survey methods may be proposed by the Respondents in site specific work plans. Any proposed survey method must be approved by the Department prior to implementation. 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 Respondents 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 the Department.

VIII.A.8. Subsurface Vapor-phase Monitoring and Sampling

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

The Respondents shall, at a minimum, collect field measurements of the following:

1. Organic vapors (using a photo-ionization detector with an 10.6 or higher eV (electron volt) lamp, a combustible vapor indicator or other method approved by the Department) and, if applicable,
2. Percent oxygen,
3. Percent carbon dioxide,
4. Static subsurface pressure, and
5. Other parameters (such as carbon monoxide and hydrogen sulfide) as required by the Department.

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

6. Percent moisture,
7. VOCs, and
8. Other analytes required by the Department.

Vapor samples analyzed by the laboratory for percent moisture and VOCs shall be collected using SUMMA canisters or other sample collection method approved by the Department. 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 VIII.B.9. The methods used to obtain vapor-phase field measurements and samples must be approved by the Department in writing prior to the start of air monitoring at each Facility site where vapor-phase monitoring is conducted.

Total well vapor sampling and vapor monitoring shall be conducted by sealing the top of the well with a cap containing a sample port. Polyethylene, teflon or other nonreactive tubing shall be used to connect the sample port and a low-velocity pump not associated with a field instrument. The well shall be purged of a minimum of five well volumes prior to collection of samples or field measurements. If a sample is not being obtained for laboratory analysis, the well may be purged using the field instrument pump. SUMMA canisters, Tedlar bags or field instruments shall draw effluent from the pump discharge either directly or through polyethylene, Teflon or other nonreactive tubing. All connections between the wellhead and the instruments and sample containers must be airtight.

VIII.B. GROUNDWATER AND SURFACE WATER MONITORING

VIII.B.1. Groundwater Levels

Groundwater level and SPH thickness measurements shall be obtained at intervals required by the Department. Groundwater and SPH 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 and SPH thickness levels shall be measured to the nearest 0.01 ft. The depth to groundwater and SPH thickness shall be recorded relative to the surveyed well casing rim or other surveyed datum. A corrected water table elevation shall be provided in wells containing SPH by adding 0.8 times the measured SPH thickness to the calculated water table elevation. The method of water level and SPH thickness measurements shall be approved by the Department. Groundwater and SPH levels shall be measured in all wells within 48 hours of the start of obtaining water level measurements. All automated and manual extraction of SPH and water from recovery wells, observation wells, and collection wells shall be discontinued for 48 hours prior to the measurement of water and product level.

VIII.B.2. Groundwater Sampling

Groundwater samples shall initially be obtained from newly constructed monitoring wells no later than five days after the completion of well development. Groundwater monitoring and sampling shall be conducted on a semi-annual basis or other interval approved by the Department after the initial sampling event. All monitoring wells scheduled for sampling during a groundwater sampling event shall be sampled within 15 days of the start of the monitoring and sampling event. The Respondents shall sample all saturated zones screened to allow entry of groundwater into each monitoring well during each sampling event. All requests for variances from the groundwater sampling schedule shall be submitted to the Department, in writing, at least 30 days prior to the start of scheduled monitoring and sampling events. Groundwater samples shall be collected from all exploratory borings not intended to be completed as monitoring wells prior to abandonment of the borings, where practicable, unless otherwise specified in a Department-approved work plan.

Water samples shall be analyzed for one or more of the following general chemistry parameters as required by the Department:

nitrate/nitrite	sulfate	chloride	dissolved CO_2
alkalinity	carbonate/bicarbonate	fluoride	Manganese
Calcium	Biological activity testing	Ferric/ferrous iron	Ammonia
Potassium	Magnesium	Phosphate	Sodium
Methane	pH	total organic carbon (TOC)	total kjeldahl nitrogen (TKN)
dissolved oxygen (DO)	oxidation reduction potential (ORP)	Total suspended solids (TSS)	electrical conductivity (EC)

Temperature

Any additional analytes required by the Department.

VIII.B.3. Well Purging

All zones in each monitoring well shall be purged by removing groundwater prior to sampling 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, oxidation-reduction potential, and temperature during purging of volumes and at measurement intervals approved by the Department. Field water quality parameters shall be compared to historical data to ensure that the measurements are indicative of formation water. The groundwater quality parameters shall be measured using instruments approved by the Department. The volume of groundwater purged, the instruments used, and the readings obtained at each interval shall be recorded on the field-monitoring log. 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 the Department's Position Paper *Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring* (October 30, 2001, as updated). The Respondents may submit to the Department 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.

VIII.B.4. 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 the Department within 24 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 VIII.B.6 of this Order. Decontamination procedures shall be established for reusable water sampling equipment as described in Section VIII.B.8.

All purged groundwater and decontamination water shall be characterized prior to disposal unless it is disposed in the refinery wastewater treatment system upstream of the API Separator. The methods for disposal of purge/decontamination water must be approved by the Department prior to disposal. Disposable materials shall be handled as described in Section VIII.B.10.

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

VIII.B.5. Groundwater Sample Types

Groundwater samples shall be collected from each monitoring well, and surface water and remediation system samples shall be collected as required by the Department. Field duplicates, field blanks, equipment rinsate blanks, reagent blanks, if necessary, and trip blanks shall be obtained for quality assurance during groundwater and other water sampling activities. The samples shall be handled as described in Section VIII.B.6 of this Order.

Field duplicate water 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 minimum frequency of 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 rinsate blanks shall be obtained for chemical analysis at the rate of ten percent or a minimum of one rinsate 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 20 percent or a minimum of 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.

VIII.B.6. 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 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. The sample depth and the top of the sample shall be clearly marked. Sample container volumes and preservation methods shall be in accordance with the most recent standard EPA and industry accepted 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 approved by the Department. 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 VIII.C.2 of this Order, 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. At a minimum, 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.

VIII.B.7. 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 must be approved by the Department 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. A summary of the general test results, including unexpected or unusual test results and equipment failures or testing limitations shall be reported to the Department within 30 days of completion of the test. The summary shall be presented in a format acceptable to the Department and in general accordance with the report formats outlined in Section X of this Order. A formal report summarizing the results of each test shall be submitted to the Department within 120 days of completion of each test.

VIII.B.8. 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 methods approved by the Department 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 the Department 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 the Department (examples include Fantastik™, Liqui-Nox®) followed by a tap water rinse,

4. Rinse with 0.1 M 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 VIII.B.10 of this Order. Decontamination procedures and the cleaning agents used shall be documented in the daily field log.

VIII.B.9. 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 the Department, 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.

VIII.B.10. 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 Respondents shall submit an IDW management and disposal plan as part of all work plans submitted to the Department for approval prior to disposal of any IDW produced during investigation, corrective action, or monitoring activities.

All water generated during sampling and decontamination activities shall either be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums or other containers approved by the Department until proper characterization and disposal can be arranged or disposed in the refinery wastewater treatment system upstream of the API separator. 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 the Department prior to disposal.

VIII.C. DOCUMENTATION OF FIELD ACTIVITIES

VIII.C.1. 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:

1. Site or unit designation,
2. Date,
3. Time of arrival and departure,
4. Field investigation team members including subcontractors and visitors,
5. Weather conditions,
6. Daily activities and times conducted,
7. Observations,
8. Record of samples collected with sample designations and locations specified,
9. Photographic log,
10. Field monitoring data, including health and safety monitoring,
11. Equipment used and calibration records, if appropriate,
12. List of additional data sheets and maps completed,
13. An inventory of the waste generated and the method of storage or disposal, and
14. Signature of personnel completing the field record.

VIII.C.2. 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 Respondents shall maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of the chain-of-custody records shall be included with all draft and final laboratory reports submitted to the Department.

VIII.D. CHEMICAL ANALYSES

The Respondents shall submit all samples for laboratory analysis to accredited contract laboratories. The laboratories shall use the most recent standard EPA and industry-accepted analytical methods for target analytes as the testing methods for each medium sampled. Chemical analyses shall be performed in accordance with the most recent EPA standard analytical methodologies and extraction methods.

The Respondents shall submit a list of analytes and analytical methods to the Department for approval as part of each site-specific investigation, corrective measures, 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 the Department.

VIII.D.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 Respondents that provide analytical services for environmental investigation, corrective action, and monitoring activities conducted at the Facility. The Respondents shall provide the names of the contract analytical laboratories and copies of the laboratory quality assurance manuals to the Department within 180 days of awarding a contract for analytical services to any contract laboratory.

VIII.D.2. Quality Assurance Procedures

Contract analytical laboratories shall maintain internal quality assurance programs in accordance with EPA and industry 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.

VIII.D.3. Equipment Calibration Procedures and Frequency

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

VIII.D.4. Laboratory QA/QC Samples

Analytical procedures shall be evaluated by analyzing reagent or method blanks, surrogates, matrix spike/matrix spike duplicates (MS/MSDs), blank spike/blank spike duplicates (BS/BSDs) and/or 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 other 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 a

frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples shall be project specific.

VIII.D.5. Laboratory Deliverables

The analytical data package submitted to the Department shall be prepared in accordance with EPA-established Level II analytical support protocol. The Respondents shall ensure that the contract laboratory prepares the following items, which must be included in the analytical laboratory reports submitted to the Respondent. Any or all of the following items shall be made available to the Department upon request:

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 ppmv); 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 reporting 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 and/or matrix spikes (MS/MSDs),

14. Variability for duplicate analyses,

15. Completeness,

16. Data report formats., and

17. The following data deliverables for organic compounds shall be required from the laboratory

a. 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,

b. Report of sample collection, extraction, and analysis dates, including sample holding conditions,

c. Tabulated results for samples in units as specified, including data qualification in conformance with EPA protocol, and definition of data descriptor codes,

d. Reconstructed ion chromatograms for gas chromatograph/mass spectrometry (GC/MS) analyses for each sample and standard calibration,

e. Selected ion chromatograms and mass spectra of detected target analytes (GC/MS) for each sample and calibration with associated library/reference spectra,

f. Gas chromatograph/electron capture device (GC/ECD) and/or gas chromatograph/flame ionization detector (GC/FID) chromatograms for each sample and standard calibration,

g. Raw data quantification reports for each sample and calibrations, including areas and retention times for analytes, surrogates, and internal standards,

h. 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],

i. Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitation limit for each analyte,

j. Analyte concentrations with reporting units identified, including data qualification in conformance with the contract laboratory program Statement of Work (SOW) (include definition of data descriptor codes),

k. Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample,

l. 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

m. 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. 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,

b. Report of sample collection, digestion, and analysis dates, with sample holding conditions,

c. Tabulated results for samples in units as specified, including data qualification in conformance with the contract laboratory program (CLP) statement of work (including definition of data descriptor codes),

d. Results of all method QA/QC checks, including inductively coupled plasma (ICP) Interference Check Sample and ICP serial dilution results,

e. Tabulation of instrument and method practical detection/quantitation limits,

f. Raw data quantification report for each sample,

g. A calibration data summary reporting calibration range used and a measure of linearity, where appropriate,

h. Final digestate volumes (and dilutions required), sample size, and wet-to-dry weight ratios,

i. Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample, and

j. 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 Respondents shall present summary tables of these data in the formats described in Section X of this Order. 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 Respondents shall make the data available to the Department upon request.

VIII.D.6. Review of Field and Laboratory QA/QC Data

The Respondents 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: *Guidance Document for the Assessment of RCRA Environmental Data Quality, National Functional Guidelines for Organic Data Review,* and *Laboratory Data Validation Functional Guidelines for*

Evaluating Inorganics Analyses and the most recent version of SW-846, and industry-accepted QA/QC methods and procedures.

The Respondents shall require the laboratory to notify the Facility project manager of data quality exceptions within one business day in order to allow for sample re-analysis, if possible. The Facility project manager shall contact the Department within one business day of receipt of laboratory notification of data quality exceptions 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 Department project leader regarding the data quality exceptions in a memorandum. The Respondents shall submit the memorandum to the Department by fax or electronic mail within two business days of the conclusion of the data quality discussion.

VIII.D.7. Blanks, Field Duplicates, Reporting Limits and Holding Times

VIII.D.7.a Blanks

The analytical results of field blanks and field rinsate 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.

VIII.D.7.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. Relative percent differences for field duplicates shall be calculated. A precision of no more than 20 percent for duplicates shall be considered acceptable for soil sampling conducted at the Facility. The analytical DQO for precision shall be used for water duplicates.

VIII.D.7.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.

VIII.D.7.d Holding Times

The Respondents 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.

VIII.D.8. Representativeness and Comparability

VIII.D.8.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 Respondents 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 Respondents shall note any procedures or variations that may affect the collection or analysis of representative samples and shall qualify the data.

VIII.D.8.b Comparability

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, the Respondents 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.

VIII.D.9. 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 Section X of this Order. Data validation procedures for all samples shall include checking the following, when appropriate:

1. Holding times,
2. Detection limits,
3. Field equipment rinsate 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.

VIII.E. HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

If required by the Department or proposed as part of corrective action, the Respondents shall prepare a human health and ecological risk assessment report for determination of clean closure or risk-based closure, and/or in support of corrective action. Risk assessments shall be conducted in accordance with current and acceptable EPA, Regional EPA, and State of New Mexico guidance and methodology.

VIII.F. 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 future land use scenarios may include residential, industrial, construction, and recreational. Other special receptors may be required on a site-specific basis.

VIII.F.1.a Exposure Pathways

The identification of exposure pathways shall include a discussion of all potential pathways and justify whether the pathways are complete. Pathways that shall be considered include soil, groundwater, air, surface water, 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 or groundwater, or both.

VIII.F.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.

VIII.F.1.c Constituents of Potential Concern

Appropriate EPA or Department or both 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 (e.g., of soil, air, surface water, groundwater, biota, or sediment) shall be retained or eliminated as possible COPCs using one or more of the following processes:

1. Site attribution analysis,

2. Essential nutrients,

3. Risk-based toxicity screen.

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

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 or box and whisker plots),

4. Conduct a geochemical analysis of site data to a background reference chemical, and

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.

VIII.F.1.d Risk-Based Toxicity Screen

The Respondents 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 Region 6 Soil Screening Levels). Contaminants for which the maximum detected site concentrations exceed the respective risk-based screening levels shall be retained for further risk analysis.

VIII.F.1.e Exposure Point Concentrations

The Respondents shall determine exposure point concentrations (EPCs) that are representative of the concentrations of contaminants 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 or Department-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 or Department methodology, based upon the volatilization factor or particulate emission factor. Indoor air concentrations shall be determined using EPA- and Department-accepted approaches, such as the EPA-recommended Johnson and Ettinger model.

VIII.F.1.f Exposure Assumptions

The Respondents shall use EPA or Department-approved exposure assumptions. Exposure assumptions may be based upon site-specific data.

VIII.F.1.g Toxicity Assessment

The Respondents shall use the most recently available toxicity factors to calculate carcinogenic risks and noncarcinogenic risks/hazards based upon the currently acceptable hierarchy of sources for toxicity data. Generally, the approved hierarchy is as follows:

1. EPA's Integrated Risk Information System (IRIS),

2. Provisional EPA National Center for Environmental Assessment (NCEA),

3. Agency for Toxic Substances and Disease Registry (ASTDR), and

4. Other EPA publications (such as the Health Effects Assessment Summary Tables (HEAST), Water Quality Criteria, and Health Advisories).

The Respondents 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 and hazards shall be qualitatively addressed in the uncertainties section of the report.

VIII.F.1.h Uncertainties

The Respondents 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 and hazards may have been under or overestimated due to the assumptions made in the assessment.

VIII.G. ECOLOGICAL RISK ASSESSMENT METHODS

The Department may require an ecological risk assessment for receptors that are potentially exposed to site-related contaminants 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 Respondents 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.

VIII.G.1. Scoping Assessment

In order to assess whether ecological hazards are a concern at the site, the Respondents shall conduct a scoping assessment. The Department's "Site Assessment Checklist" or other current EPA or Department guidance shall be used for conducting the scoping assessment. The site assessment checklist and 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 possible ecological receptors, and

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

If the scoping assessment indicates that any rare, threatened, endangered, or otherwise protected species live on or otherwise use the property, or any species which are considered a recreational or a commercial resource live on or use the property, or any plants or animal species use the property for habitat or foraging and could come into contact with site contaminants, then the Respondents may be required by the Department to conduct a screening level ecological risk assessment.

VIII.G.2. Screening Level Ecological Assessment

The screening level ecological risk assessment shall be conducted in accordance with current EPA or Department-approved methodologies. The Respondents 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.

VIII.G.2.a Site-specific Ecological Risk Assessment

If the screening level ecological risk assessment indicates unacceptable risk, then the Respondents shall conduct a site-specific ecological risk assessment. The assessment shall be conducted using EPA or Department-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.

VIII.H. DETERMINATION OF BACKGROUND

The Respondents shall determine an appropriate background data set for inorganic constituents at the Facility. The Respondents shall determine whether one or more background data sets are appropriate depending on soil type and geology at the site. Background concentrations for groundwater shall be collected from upgradient wells. The background data sets shall be representative of natural conditions unaffected by site activities and shall be statistically defensible.

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

VIII.H.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, or sediment due to Facility 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 or Department-accepted guidance. The site attribution analyses shall consists 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 Respondents shall include metal as a site contaminant.

IX. MONITORING WELL CONSTRUCTION REQUIREMENTS

IX.A. MONITORING WELL

Groundwater monitoring wells at the Facility generally extend from depths of approximately 10 to 60 feet bgs.

General drilling procedures are presented in Section IX.B and monitoring well construction requirements are presented in Section IX.C of this Order.

IX.B. DRILLING METHODS

Groundwater monitoring wells and piezometers must be designed and constructed in a manner that will yield high quality samples, ensure the well will last the duration of the project, and ensure 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:

1. U.S. EPA, *RCRA Groundwater Monitoring: Draft Technical Guidance,* EPA/530-R-93-001, November, 1992,
2. U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document,* OSWER-9950.1, September, 1986, and
3. 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:

1. Drilling shall be performed in a manner that minimizes impacts to the natural properties of the subsurface materials,
2. Contamination and cross-contamination of groundwater and aquifer materials during drilling shall be avoided,
3. The drilling method shall allow for the collection of representative samples of rock, unconsolidated materials, and soil,
4. The drilling method shall allow the Respondents to determine when the appropriate location for the screened interval(s) has been encountered, and
5. 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 (including 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 the Department.

IX.B.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.

IX.B.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.

IX.C. WELL CONSTRUCTION/COMPLETION METHODS

IX.C.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, PVC materials may be used. PVC is less desirable 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).

IX.C.2. Well Construction Techniques

IX.C.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 feet 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 feet 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).

IX.C.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 feet 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 feet 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.

IX.C.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.

IX.C.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 target, 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 feet or less). While monitoring wells are usually constructed with longer screens (usually five to ten feet), 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 Respondents 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 the Department.

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 feet 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 feet 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 feet deep), the filter pack may not compress when initially installed. As a result, filter packs may need to be installed as high as five feet 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-foot layer of chemically inert fine sand shall be placed over the filter pack to prevent the intrusion of annular sealants into the filter pack.

IX.C.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 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 feet), or by pouring directly down the annulus in shallow wells (less than 30 feet). 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 feet 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 feet 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.

IX.C.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:

1. Pumping and overpumping,
2. Backwashing,
3. Surging (with a surge block),
4. Bailing,
5. Jetting, and
6. 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 the Department 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.

IX.C.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.

IX.D. WELL ABANDONMENT

Wells deleted from the facility monitoring program or when they are damaged beyond repair shall be plugged and abandoned. Well plugging and abandonment methods and certification shall be conducted in accordance with *Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells* [19.27.4 NMAC]. The Respondents shall notify the Department and submit a well abandonment plan to the New Mexico State Engineers Office and to the Department no less than 30 days prior to the date the wells are removed from the monitoring program.

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.

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 feet 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.

IX.E. 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:

1. Well name/number,
2. Date/time of well construction,
3. Borehole diameter and well casing diameter,
4. Well depth,
5. Casing length,
6. Casing materials,
7. Casing and screen joint type,
8. Screened interval(s),
9. Screen materials,
10. Screen slot size and design,
11. Filter pack material and size,
12. Filter pack volume (calculated and actual),
13. Filter pack placement method,

14. Filter pack interval(s),
15. Annular sealant composition,
16. Annular sealant placement method,
17. Annular sealant volume (calculated and actual),
18. Annular sealant interval(s),
19. Surface sealant composition,
20. Surface seal placement method,
21. Surface sealant volume (calculated and actual),
22. Surface sealant interval,
23. Surface seal and well apron design and construction,
24. Well development procedure and turbidity measurements,
25. Well development purge volume(s) and stabilization parameter measurements,
26. Type and design and construction of protective casing,
27. Well cap and lock,
28. Ground surface elevation,
29. Survey reference point elevation on well casing,
30. Top of monitoring well casing elevation, and
31. Top of protective steel casing elevation.

X. REPORTING REQUIREMENTS

X.A. GENERAL

The purpose of this Section (X) is to provide the general reporting requirements and report formats for corrective action activities required under this Order. This Section (X) 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, routine monitoring reports, risk assessment reports, and corrective measures evaluations. The Respondents shall generally consider the reports to be the equivalents of RFI work plans, RFI reports, periodic monitoring reports, risk assessments, and CMS reports, respectively, for the purposes of RCRA compliance. The Respondents shall include detailed, site-specific requirements in all interim status unit, SWMU, and AOC investigation work plans, investigation reports, monitoring reports, and corrective measures evaluations. All plans and reports shall be prepared with technical and regulatory input from the Department. All work plans and reports shall be submitted to the Department in the form of two paper copies and an electronic copy.

The reporting requirements listed in this Section (X) do not include all sections that may be necessary to complete each type of report listed. The Respondents or the Department 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 Respondents must submit variations of the general report format and the formats for reports not listed in this Section (X) in outline form to the Department for approval prior to submittal of the reports. The Department will approve or disapprove, in writing, the proposed report outline after receipt of the outline. If the Department disapproves the report outline, the Department will notify the Respondents, in writing, of the outline's deficiencies and will specify a date for submittal of a revised report outline. All reports submitted by the Respondents shall follow the general approach and limitations for data presentation described in this Section (X).

X.B. INVESTIGATION WORK PLAN

The Respondents shall fulfill the requirements acceptable to the Department for preparation of work plan for unit-specific 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 analyses, 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 provided below.

X.B.1. Title Page

The title page shall include the type of document, Facility name and the unit, SWMU, or AOC name (s) and the submittal date. A signature block providing spaces for the name, title, and organization

of the preparer and the responsible Respondents representative shall be provided on the title page in accordance with 20.4.1.900 NMAC incorporating 40 CFR 270.11(d)(1).

X.B.2. Executive Summary (Abstract)

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

X.B.3. Table of Contents

The table of contents shall list all text sections and subsections, 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.

X.B.4. Introduction

The introduction shall include the Facility name, unit name and location, and unit status (e.g., active operations, 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.

X.B.5. Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses 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 site plan.

This section shall identify potential receptors, including groundwater, and include a brief summary of the type and characteristics of all waste and all contaminants, 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 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.

X.B.6. Site Conditions

X.B.6.a Surface Conditions

A section on surface conditions shall provide a detailed description of current site topography, features and structures including a description of drainages, vegetation, erosional features, and a

detailed description of current site uses and 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.

X.B.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 section if no previous investigations have been conducted at the site.

X.B.7. Scope of Services

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 testing, and IDW storage, disposal and reporting.

X.B.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 but is not limited to 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 testing, and other proposed investigation and testing methods. This information may also be summarized in table format, if appropriate.

X.B.9. Monitoring And Sampling Program

A section on monitoring and sampling shall describe the anticipated monitoring and sampling program to be implemented after the initial investigation activities are completed. This section shall provide a description of the anticipated groundwater, ambient air, subsurface vapor, remediation system, engineering controls, and other monitoring and sampling programs to be implemented at the unit.

X.B.10. Schedule

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

X.B.11. Tables

The following summary tables may be included in the investigation work plans, if previous investigations have been conducted at the unit. Data presented in the tables shall include information on dates of data collection, analytical methods, detection limits, and significant data quality exceptions. All 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, sediment, 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 elevations, SPH thickness, 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 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, and

8. Summary of historical pilot testing data, if applicable, including units of measurement and types of instruments used to obtain measurements.

X.B.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.

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

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 (corrected if SPH was present), and indicating groundwater flow directions,

7. Figures presenting historical SPH thickness data,

8. 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,

9. Figures presenting historical and proposed surface water sample locations and field measurement data, if applicable,

10. Figures presenting historical surface water laboratory analytical data, if applicable,

11. Figures showing historical and proposed air sampling locations and presenting historical air quality data, if applicable,

12. Figures presenting historical pilot testing locations and data, where applicable, including site plans and graphic data presentation, and

13. Figures presenting geologic cross-sections, based on outcrop and borehole data acquired during previous investigations, if applicable.

X.B.13. Appendices

An IDW management plan shall be included as an appendix to the investigation work plan. Additional appendices may be necessary to present additional data or documentation not listed above.

X.C. INVESTIGATION REPORT

The Respondents shall fulfill the requirements acceptable to the Department for reporting of site investigation at the Facility. This Section (X.C) provides a general outline for site investigation reports and describes the minimum requirements for reporting within each subsection when preparing site investigation reports for Facility units. 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.

X.C.1. Title Page

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

X.C.2. Executive Summary

The executive summary shall provide a brief summary of the purpose, scope, and results of the investigation conducted at the subject site during the reporting period. In addition, this section shall include a brief summary of conclusions based on the investigation data collected and recommendations for future investigation, monitoring, remedial action or site closure.

X.C.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.

X.C.4. Introduction

The introduction section shall include the Facility name, unit name and location, and unit status (e.g., active operations, 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.

X.C.5. Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses 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 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. 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 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.

X.C.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 testing, and IDW storage or disposal.

X.C.7. Field Investigation Results

This section shall provide a summary of the procedures used and the results of all field investigation activities conducted at the site including, but not limited to, 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. Tables summarizing all pertinent sampling, testing and screening results shall be prepared in a format approved by the Department. The tables shall be presented in the Tables section of the reports. At a minimum, the following subsections shall be included, where appropriate.

X.C.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 section.

X.C.7.b Exploratory Drilling or Excavation Investigations

This subsection 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.

X.C.7.c 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

the 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.

X.C.7.d Monitoring Well Construction, 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, boring and test pit logs, and well construction diagrams shall be included in an attachment or appendix and well construction diagrams shall be included with the associated boring logs for monitoring well borings.

X.C.7.e Groundwater Conditions

A section shall describe groundwater conditions observed beneath the site and relate local groundwater conditions to regional groundwater conditions. A description of the depths to water, SPH thickness, 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.

X.C.7.f 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.

X.C.7.g 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.

X.C.7.h 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.

X.C.7.i Pilot Testing Results

A section shall discuss the results of any pilot testing. Pilot testing is typically conducted after initial subsurface investigations are completed and the need for additional investigation or

remediation has been evaluated. Pilot testing, including aquifer testing and remediation system pilot testing, shall be addressed through separate work plans and pilot test reports. The format for pilot test work plans and reports shall be approved by the Department prior to submittal.

X.C.8. Regulatory Criteria

A section shall set forth the applicable cleanup standards, 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 inclusion of applicable cleanup standards in the data tables shall be included as part of the document. Risk-based evaluation procedures, if used to calculate cleanup levels, shall be presented in a separate document or in an appendix to this report. If cleanup levels calculated in a risk evaluation are employed, the risk evaluation document shall be referenced and shall include pertinent page numbers for referenced information.

X.C.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.

X.C.9.a Soil and Sediment Sampling

A section shall describe the sampling of soil 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.

X.C.9.b Soil Sample Field Screening Results

This subsection 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 subsection.

X.C.9.c Soil Sampling Chemical Analytical Results

This subsection shall briefly summarize the laboratory analyses conducted, the analytical methods and the analytical results and provide a comparison of the data to 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.

X.C.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 sites and surrounding area well locations shall be included in the figures section of the report.

X.C.9.e General Groundwater 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 subsection. If appropriate, 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.

X.C.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 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 data tables or as isoconcentration contours on a map included in the figures section of the report.

X.C.9.g 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 site plan showing all air sampling locations shall be provided in the figures section of the report.

X.C.9.h 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 and the field screening results. 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.

X.C.9.i Air and Subsurface Vapor Laboratory Analytical Results

A section shall describe the results of air and subsurface vapor laboratory analyses. 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 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. Contaminant concentrations shall be presented as data tables or as isoconcentration contours on a map included in the figures section of the report.

X.C.10. Conclusions

A conclusions 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 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 analysis shall be presented in the Risk Assessment format described in Section X.E of this Order. References to the risk analysis shall be presented only in the summary and conclusions sections of the Investigation Report.

X.C.11. Recommendations

Recommendations and explanations regarding future investigation, monitoring, corrective measures, risk analyses or site closure shall be included in this section. A corresponding schedule for further action regarding the site shall also be provided.

X.C.12. Tables

A section shall provide the following summary tables. Data presented in the tables shall include the current data, dates of data collection, analytical methods, detection limits, and significant data quality exceptions. All summary 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, sediment, groundwater, surface water, and air quality data,

4. A table summarizing soil 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, SPH thickness, and depth to groundwater data. The table shall include the monitoring well depths, SPH thickness, 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 chemical 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 testing data, if applicable, including units of measurement and types of instruments used to obtain measurements, and

10. A table summarizing the materials testing data if applicable.

X.C.13. Figures

All figures shall be included with each investigation report as appropriate. All figures must include a 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. A section shall provide the following figures:

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. 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 the Department. The chemical analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map,

8. Figures presenting SPH data. The SPH data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map,

9. Figures presenting surface water sample locations and field measurement data including any past data requested by the Department,

10. Figures presenting surface water laboratory analytical data including any past data, if applicable. The laboratory analytical data corresponding to each sampling location may be presented in tabular form on the figure,

11. Figures showing air or subsurface vapor sampling locations and presenting air quality data. The field screening or laboratory analytical data corresponding to each sampling location may be presented in tabular form on the figure or as an isoconcentration map,

12. Figures presenting geologic cross-sections based on outcrop and borehole data, and

13. Figures presenting pilot testing locations and data, where applicable, including site plans or graphic data presentation.

X.C.14. Appendices

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

X.C.14.a Field Methods

An appendix shall provide detailed descriptions of the methods used to acquire field measurements of each media that was surveyed or tested during the investigation. Methods shall include, but are not limited to, 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 testing shall be reported in this appendix, if applicable. Copies of IDW disposal documentation shall be provided in a separate appendix.

X.C.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.

X.C.14.c Chemical Analytical Program

Chemical analytical methods, a summary of data quality objectives and data quality review procedures shall be reported in this appendix. 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 case narratives provided in the laboratory reports.

X.C.14.d Chemical Analytical Reports

This section shall include all laboratory chemical analytical data generated for the reporting period. The reports must include all chain-of-custody records and QA/QC results provided by the laboratory. The laboratory reports may be provided electronically in a format approved by the Department and shall be in the form of a final laboratory report. Laboratory report data tables may be submitted in Microsoft Excel format. Hard (paper) copies of the chain-of-custody forms shall be submitted with the reports regardless of whether the final laboratory report is submitted electronically or in hard copy.

X.C.14.e Other Appendices

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

X.D. PERIODIC MONITORING REPORT

The Respondents shall use the following guidance for preparing periodic monitoring reports. The reports shall present the reporting of periodic groundwater, 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 within each subsection when preparing routine monitoring reports for specific units and for Facility-wide 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. The general report outline is provided below.

X.D.1. Title Page

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

X.D.2. Executive Summary

The executive summary shall provide a brief summary of the purpose, scope, and results of the monitoring conducted at the subject site during the reporting period. The Facility, unit, SWMU, and

AOC names and location shall be included in the executive summary. In addition, this section shall include a brief summary of conclusions based on the monitoring data collected.

X.D.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.

X.D.4. Introduction

The introduction section shall include the Facility name, unit name and location and unit status (e.g. active operations, 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.

X.D.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.

X.D.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 site. A table summarizing the applicable cleanup standards or inclusion of applicable cleanup standards in the data tables can be substituted for this section. The appropriate cleanup 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 levels, must either be included as an attachment or referenced. The specific document and page numbers must be included for all referenced materials.

X.D.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/product, directions of groundwater flow, field air and water quality measurements, 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 X.D.11 below.

X.D.8. Chemical Analytical Data Results

A section shall discuss the results of the chemical analyses. It shall provide the dates of vapor or groundwater sampling, the vapor or groundwater analytical methods, and the analytical results. It shall also provide a comparison of the data to previous results and to any cleanup standards or

established cleanup levels for the site. The rationale or purpose for altering or modifying the 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 vapor and groundwater sampling program can be substituted for this section. The tables shall include all information required in Section X.D.11.

X.D.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 X.D.11.

X.D.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 chemical 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 shall also be included in this section.

X.D.11. Tables

With prior approval from the Department, the Respondents may combine one or more of the tables. Data presented in the tables shall include the current data plus data from the three previous monitoring events or, if data from fewer than three monitoring events is available, data acquired during previous investigations and vapor, groundwater, and remediation system monitoring. The dates of data collection shall be included in the tables. Summary tables may be substituted for portions of the text. All data tables shall include only detected analytes and data quality exceptions that could potentially mask detections. A section shall provide the following summary tables:

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, SPH thickness, and depths to groundwater data. The table shall include the monitoring well depths, SPH thickness, casing elevations, the screened intervals in each well, and the dates and times of measurements,

3. A table summarizing field measurements of surface water quality data, if applicable,

4. A table summarizing field measurements of vapor monitoring data (including historical vapor monitoring data as described above),

5. A table summarizing field measurements of groundwater quality data (including historical water quality data as described above),

6. A table summarizing vapor sample chemical analytical data, if applicable (including historical vapor sample analytical data as described above),

7. A table summarizing surface water chemical analytical data, if applicable (including historical surface water analytical data as described above),

8. A table summarizing groundwater chemical analytical data (including historical groundwater analytical data as described above), and

9. A table summarizing remediation system monitoring data, if applicable (including historical remediation system monitoring data as described above).

X.D.12. Figures

The section shall include the following figures. All figures shall include a scale and 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 site relative to surrounding features or properties,

2. A Facility 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 in tabular form on the figure or as an isoconcentration map,

5. Figures presenting SPH thickness data for the current monitoring event. The SPH thickness data corresponding to each sampling location may be presented in tabular form on the figure or as an isoconcentration map,

6. Figures presenting surface water sampling locations and analytical data for the current monitoring period,

7. Figures presenting vapor sampling locations and analytical data for the current monitoring event. The analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map, and

8. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.

X.D.13. Appendices

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

X.D.13.a Field Methods

An appendix shall include the methods used to acquire field measurements of groundwater elevations, SPH thickness, vapor and water quality data, and vapor and groundwater samples. It shall include the methods and types of instruments used to measure depths to water, air or headspace parameters, 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 section, 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.

X.D.13.b Chemical 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.

X.D.13.c Chemical Analytical Reports

This appendix shall include all laboratory chemical analytical data generated for the reporting period. The data may be submitted electronically on a compact disc in Microsoft Excel format. The reports shall include all chain-of-custody records and QA/QC results provided by the laboratory. Hard (paper) copies of all chain-of-custody records shall be submitted as part of this appendix.

X.E. RISK ASSESSMENT REPORT

The Respondents shall prepare risk assessment reports for sites requiring corrective action at the Facility using the format described below. This Section (X.E) provides a general outline for risk assessments and also sets forth 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 X.E.8 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.

X.E.1. Title Page

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

X.E.2. Executive Summary

The executive summary 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, unit, SWMU, or AOC names and locations shall be included in the executive summary.

X.E.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.

X.E.4. Introduction

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

X.E.5. Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses 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.

X.E.5.a Site Description

This subsection shall provide a description of current site topography, features and structures including a description of drainages, erosional features, current site uses, and other data relevant to assessing risk at the site. Depth to groundwater and directions of groundwater flow shall be included in this section. The presence and location of surface water bodies such as springs or wetlands shall be noted in this section. Photos of the site may be incorporated into this section if desired. Ecological features of the site should 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.

X.E.5.b Sampling Results

This section shall include a summary of the history of releases of contaminants, known and possible sources of contamination, and the vertical and lateral extent of contamination present in each media. This section shall include summaries of sampling results of all investigations including site plans (included in the Figures section of the document) 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 for each constituent shall include the maximum value detected, the detection limit, the 95% UCL of the mean value detected (if applicable to the data set) and whether that 95% 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 in this subsection. 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 (facility-wide, site-specific, UCL, UTL). This section shall also include a discussion of how "non-detect" sample results were handled in the averaging of data.

X.E.6. Site Conceptual 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 residential land use as the future land use for all risk assessments. In addition, site-specific future land use may be included, provided that written approval to consider a site-specific future land use has been obtained from the Department prior to inclusion in the risk assessment. If a site-specific future land use scenario appears in the risk assessment, 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 Respondents in the site description Section X.E.5.a.

X.E.7. Risk Screening Levels

This section shall present the actual screening values used for each contaminant for comparison to all human health and ecological risk screening levels. Department soil screening levels for residential soil shall be used to screen soil for human health. For those contaminants not appearing on the Departments SSL table, the EPA Region 6 soil screening value adjusted to meet the Departments risk goal of 10^{-5} for total risk for carcinogens shall be used to screen the site for human

health risks. If the Departments database does not contain a screening value for the receptor or contaminant, the Facility shall use USEPA ECO-SSLs or derive a screening level using the methodology in the Departments *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening –Level Ecological Risk Assessment* (March 2000 as updated). If no valid toxicological studies exist for the receptor or contaminant, the contaminant and receptor combination shall be addressed using qualitative methods. If an 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 MCLs, shall also be included in this section.

X.E.8. Risk Assessment Results

A section shall present all risk values, Hazard Quotient (HQ), and Hazard Index (HI) for human health under projected future residential scenario and any site-specific scenarios. This section shall also present the HQ and HI for each contaminant for each ecological receptor.

X.E.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.

X.E.9. Conclusions and Recommendations

A section shall include an 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 Respondents believe are relevant to the analysis of the site.

X.E.10. Tables

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

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, site-specific, 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 projected future residential scenario,

5. A table presenting all risk values, HQs, and HIs under approved additional site-specific future land use scenario, and

6. A table presenting the HQ and HI for each contaminant for each ecological receptor.

X.E.11. Figures

A section shall present the following figures for each site, as appropriate. With prior approval from the Department, the Respondents may combine one or more of the figures. All figures shall include a 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 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 locations 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, and

4. Conceptual site model diagrams for both human health and ecological risk assessments.

X.E.12. Appendices

Appendices may be included to present additional relevant information for the risk analysis such as the results of statistical analyses of data sets and comparisons of data, ecological checklists for the site, full sets of results of all sampling investigations at the site or other data as appropriate.

X.F. CORRECTIVE MEASURES EVALUATION

The Respondents shall prepare corrective measures evaluations for sites requiring corrective measures using the format described below. This Section (X.F) provides a general outline for corrective measures evaluations and also sets forth 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 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.

X.F.1. Title Page

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

X.F.2. Executive Summary

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

X.F.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.

X.F.4. Introduction

The introduction section shall include the Facility name, unit location and unit status (e.g., active operations, 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.

X.F.5. Background

The background section shall describe the relevant background information. This section shall briefly summarize historical site activities 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 subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background section and labeled on the site plan.

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.

X.F.6. Site Conditions

X.F.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.

X.F.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.

X.F.7. Potential Receptors

X.F.7.a Sources

A section shall provide a list of all sources of contamination at the 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.

X.F.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 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.

X.F.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 potential receptors. This section shall identify

relevant pathways such as pathways that could divert or accelerate the transport of contamination to human receptors, ecological receptors, and groundwater.

X.F.8. Regulatory Criteria

A section shall set forth the applicable cleanup standards, risk-based screening levels, and risk-based cleanup goals for each medium at the site. The appropriate cleanup levels for each site shall be included, if site-specific levels have been established. A table summarizing the applicable cleanup standards, or inclusion of applicable cleanup standards in the summary data tables providing the results of previous investigations, shall be included in the Tables section of the document. If cleanup levels calculated in a risk evaluation are employed, the risk evaluation document shall be referenced including pertinent page numbers for referenced information.

X.F.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 onsite remediation alternatives, complete removal, and any combination of alternatives that would potentially achieve cleanup goals.

X.F.10. Evaluation of Corrective Measures Options

A section shall provide an evaluation of the corrective measures options identified in Section X.F.9 above. 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 described below.

X.F.10.a Applicability

Applicability addresses the overall suitability for the corrective action option for containment or remediation of the contaminants in the relevant media with regard to protection of human health and the environment.

X.F.10.b Technical Feasibility

Technical feasibility 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.

X.F.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.

X.F.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.

X.F.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.

X.F.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.

X.F.11. Selection of Preferred Corrective Measure

The Respondents shall propose the preferred corrective measures 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 standard 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 X.F.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.

X.F.12. Design Criteria To Meet Cleanup Objectives

The Respondents 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 site. The preliminary design shall discuss the design life of the alternative and provide engineering calculations for proposed remediation systems.

X.F.13. Schedule

A section shall set forth a proposed schedule for completion of remedy-related activities such as bench tests, pilot testing, 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 the Department, including a schedule for submitting all status reports and preliminary data.

X.F.14. Tables

A section shall present the following summary tables, as appropriate. Data presented in the summary tables shall include information on dates of sample collection, analytical methods, detection limits, and significant data quality exceptions. All data tables shall include only detected analytes and data quality exceptions that could potentially mask detections. The following summary tables shall be included in the corrective measures evaluations, as appropriate:

1. A table summarizing regulatory criteria, background, and the applicable cleanup standards,

2. A table summarizing historical field survey location data,

3. Tables summarizing historical field screening and field parameter measurements for individual media,

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, depth to groundwater data, and measured SPH thickness. 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 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,

8. Tables summarizing historical pilot testing data, if applicable, including units of measurement and types of instruments used to obtain measurements,

9. A table summarizing the corrective measures alternatives and evaluation criteria, and

10. A table presenting the schedule for installation, construction, implementation, and reporting of selected corrective measures.

X.F.15. Figures

A section shall present the following figures for each site, as appropriate. All figures must include a 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 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 in table form on the figure or as an isoconcentration map,

7. Figures showing all existing wells including vapor monitoring wells and piezometers,

8. 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 in table form on the figure,

9. 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 in table form on the figure or as an isoconcentration map,

10. Figures presenting historical pilot testing locations and data, where applicable, including site plans or graphic data presentation,

11. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable,

12. Figures presenting the locations of existing and proposed remediation systems, and

13. Figures presenting existing remedial system design and construction details,

14. Figures presenting preliminary design and construction details for preferred corrective measures.

X.F.16. Appendices

Each corrective measures evaluation shall include, as an appendix, the management plan for 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 testing or investigation data, remediation system design specifications, system performance data, or cost analyses as necessary.

XI. TABLE I SCHEDULE

Section	Deliverable/Activity	Due Date /Schedule
III.Q.1	Cost estimate for Corrective Action	Within 180 days of the effective date of the Order
IV.A.1	Revised facility-wide groundwater monitoring work plan	July 31, 2007
IV.A.2	Groundwater monitoring report	April 15 of each respective year.
V.A.1	Interim Measures Implementation Report (also known as CMI report)	Submitted
V.A.2 No. 2	System Monitoring Annual Report (N. Barrier Wall)	Submitted
V.B.1 No. 2	Six Month System Start-up Report (River Terrace Area)	Submitted
V.B.1 No. 3	Annual Monitoring Report (River Terrace Area)	Submitted
V.C	The Respondents shall collect a sample of effluent from the discharge point to the Raw Water Ponds on a quarterly basis. The sample shall be analyzed for BTEX and MTBE.	The Respondents shall report the quarterly analytical data to the Department within 7 days of receipt of the final laboratory report
IV.B.5.	**Group 1 Closure Plan**: Interim Status Unit No. 1: North and South Aeration Lagoons.	September 1, 2007
IV.B.5.	**Group 2 Work Plans**: SWMU No. 2 Drum Storage Area North Bone Yard; SWMU No. 8 Inactive Landfill; SWMU No. 9 Landfill Pond; and SWMU No. 11 Spray Irrigation Area; and SWMU No. 18 Warehouse Yard.	December 31, 2007

Section	Deliverable/Activity	Due Date /Schedule
IV.B.5.	**Group 3 Work Plans**: SWMU No. 4 Transportation Terminal Sump; SWMU No. 5 Heat Exchanger Bundle Cleaning Area; AOC No. 22 Product Loading Rack and Crude Receiving Loading Racks; AOC No. 23 Southeast Holding Ponds; AOC No. 24 Tank Areas 41 and 43; AOC No. 25 Auxiliary Warehouse and 90-Day Storage Area; and AOC No. 26 Tank Area 44 and 45.	June 30, 2008
IV.B.5.	**Group 4 Work Plans**: SWMU No. 7 Raw Water Ponds; SWMU No. 10 Fire Training Area and SWMU No. 16 Active Landfill.	December 31, 2008
IV.B.5.	**Group 5 Work Plans**: SWMU No. 15 Tank Farm Area.	June 30, 2009
IV.B.5.	**Group 6 Work Plans**: AOC No. 19 Seep North of MW-45; AOC No. 20 Seep North of MW-46 and AOC No. 21 Seep North of MW-47.	December 31, 2009
IV.B.5.	**Group 7 Remedy Completion Report**: SWMU No. 17 River Terrace Area.	June 30, 2010
IV.B.5.	**Group 8 Work Plans**: SWMU No. 3 Underground Piping Currently in Use and SWMU No. 6 Abandoned Underground Piping.	December 31, 2010
IV.B.5.	**Group 9 Work Plans**: SWMU No. 13 Process Area, SWMU No. 14 Tanks 3, 4, and 5 and SWMU No. 12 API Separator.	June 30, 2011

IT IS SO ORDERED.

DATE: _____ **BY: _____**

RON CURRY
Cabinet Secretary
New Mexico Environment Department

IT IS SO ORDERED.

DATE: 7/27/07 **BY:** _____

RON CURRY
Cabinet Secretary
New Mexico Environment Department