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RCRA
PART A AND PART B
POST-CLOSURE
PERMIT APPLICATION

LAND TREATMENT UNIT
GIANT REFINING COMPANY
CINIZA REFINERY

VOLUME I

SUBMITTED TO: NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU
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ACRONYMS AND ABBREVIATIONS

%C	percent of completeness
%R	percent recovery
20 NMAC 4.1	Title 20 *New Mexico Administrative Code*, Chapter 4, Part 1
ASO	acid-soluble oil
BFB	4-bromofluorobenzene
BTEX	benzene, toluene, ethyl benzene, and xylene
BTZ	below the treatment zone
CAP	Corrective Action Plan
CEC	carbon exchange capacity
CFR	*Code of Federal Regulations*
Ciniza	Giant Refining Company—Ciniza Refinery
CME	comprehensive monitoring evaluation
C:N:P	carbon:nitrogen:phosphorous
COC	chain of custody
CWWCS	Contact Wastewater Collection System
DMP	detection monitoring plan
DOT	U.S. Department of Transportation
DRO	Range Organics
EDP	early detection plan
EDS	early detection system
EDW	early detection well
EM	Environmental Manager
EPA	U.S. Environmental Protection Agency
FR	*Federal Register*
FRP	facility response plan
Giant	Giant Refining Company
GRO	gasoline range organics
I-40	Interstate-40
LCS	laboratory control sample
LTD	land treatment demonstration
LTU	land treatment unit
MDL	method detection limit
MW	monitoring well
NMAC	*New Mexico Administrative Code*
NMED	New Mexico Environment Department
NMED/HRMB	New Mexico Environment Department/Hazardous and Radioactive Material Bureau
NMOCD	New Mexico Oil Conservation Division
PHC	principal hazardous constituents
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	Resource Conservation Recovery Act Facility Assessment
RFI	Resource Conservation Recovery Act Facility Investigation
RPD	relative percent difference

SAL	screening action level
SAP	sampling and analysis plan
SMW	shallow monitoring wells
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
TEGD	*RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986)
U.S.C.	*United States Code*
UST	underground storage tank
VCAP	Voluntary Corrective Action Plan
VOA	volatile organic analyte
VOC	volatile organic compound
WAP	waste analysis plan
ZOI	zone of incorporation

C.0 WASTE CHARACTERISTICS

The information provided in this section is submitted in accordance with the applicable requirements of 20 NMAC 4.1, Subpart V, §264.13, and Subpart IX, §270.14(b)(2).

C.1 Chemical and Physical Properties [20 NMAC 4.1, Subpart V, §264.13(a), and Subpart IX, §270.14(b)(2)]

Ciniza applied refinery sludges carrying the EPA hazardous waste numbers D001, D007, K049, K050, K051, and K052 to the LTU in accordance with Ciniza's Hazardous Waste Facility Permit until November 8, 1990. During this time of hazardous waste application, Ciniza treated approximately 2,600 tons of hazardous waste at the LTU. The refinery sludges treated at the LTU were viscous oil-water-solid mixtures. Appendix A describes the chemical and physical properties of the hazardous waste streams treated at the LTU. Ciniza maintains laboratory reports detailing the chemical and physical analyses of representative samples of the wastes.

D.0 LAND TREATMENT UNIT PROGRAM HISTORY

Giant owns and operates the Ciniza Refinery in McKinley County, New Mexico. Ciniza was constructed in 1957, by the El Paso Natural Gas Company, was sold in 1964, and sold again in 1982, to the present owner, Giant Industries, Inc. Ciniza produces fuel products from crude oil. Various hydrocarbon liquids are stored on-site in tanks and distributed throughout the refinery via an extensive piping system. Various wastes are generated during Ciniza operations. Ciniza established the LTU for the degradation, transformation, or immobilization of hazardous wastes generated at Ciniza. The LTU utilized microbial activity and soil characteristics to treat hazardous constituents in the waste. The LTU is approximately 1,500 ft northwest of the refinery process area and consists of three 480-ft x 240-ft sections, as shown on Figure B-1. The LTU received hazardous wastes from October 10, 1980, to November 8, 1990. The LTU received nonhazardous waste between 1990 and 1993. Waste has not been added to the LTU since 1993.

Ciniza established the LTU for the degradation, transformation, or immobilization of hazardous wastes generated at the Ciniza Refinery. The history of the LTU is summarized in Table D-1.

Historical LTU information and data extracted from existing permit applications, operating permits, operating records, and other source documents are provided as Appendix C. The inclusion of this appendix does not imply that historical information and data have been verified.

Table D-1. LTU History at Ciniza Refinery

Date	Event
August 1980	Ciniza notified EPA that it was a generator and operator of a hazardous waste management facility.
October 10, 1980	Ciniza begins application of hazardous wastes to the LTU.
November 1980	Ciniza submitted a Part A permit application as an "existing facility."
November 1980 through February 1988	Ciniza operated the LTU under interim status.
December 1983	Ciniza submitted a Part B permit application.
April 1985	Ciniza submitted a land treatment demonstration (LTD) plan and application for a two-phase LTD permit.
February 9, 1987	EPA issued Ciniza a short-term LTD permit (NMD000333211-1).
November 4, 1988	The state issued Ciniza a Hazardous Waste Facility Permit (NMD000333211-2).
November 8, 1990	Ciniza ceased application of hazardous wastes to the LTU.
1990 to 1993	Ciniza applied nonhazardous wastes to the LTU.
October 10, 1980 to Present	Ciniza has maintained the LTU and has conducted soil and groundwater monitoring.

E.0 POST-CLOSURE MONITORING

Ciniza Refinery has established a post-closure monitoring program in accordance with requirements of 20 NMAC 4.1, Subpart IX, §270.14(c) and §270.20(b)(3). Ciniza is committed to protecting human health and the environment and therefore proposes a post-closure monitoring program that consists of two monitoring sequences: early detection monitoring in the unsaturated zone, and detection monitoring in the groundwater at the point of compliance. The two monitoring sequences, detailed in Appendix E, Post-Closure Monitoring Plan, ensure that data obtained during all post-closure monitoring activities are scientifically defensible and support regulatory compliance.

Early detection monitoring will detect whether any migration of hazardous constituents from the treatment zone has occurred and to ensure that hazardous constituents within the treatment zone have been successfully treated. The number and depth of samples have been selected to adequately detect potential migration of hazardous constituents and determine successful treatment, degradation, transformation, and immobilization in the treatment zone. The details for early detection monitoring are provided in Appendix E, Post-Closure Monitoring Plan, and are summarized in Section E.1.

Detection monitoring comprises the monitoring program required at 20 NMAC 4.1, Subpart V, 264, Subpart F for the uppermost Sonsela aquifer. The purpose of the detection monitoring is to determine existing conditions of groundwater quality and quantity around the LTU. The number and depth of samples and analytical methods have been selected to effectively monitor the saturated zones beneath the LTU. The detection monitoring, designed to monitor the Sonsela aquifer, is provided in Appendix E, Post-Closure Monitoring Plan, and is summarized in Section E.2.

E.1 Early Detection Monitoring [20 NMAC 4.1, Subpart V, §264.278 and Subpart IX, §270.20(b)]
Ciniza will sample and analyze during the post-closure care period to meet the requirements of 20 NMAC 4.1, Subpart V, §264.278 and Subpart IX, §270.20(b). The early detection monitoring includes sampling soil in the ZOI, the treatment zone, and groundwater in the Chinle slope wash. The early detection monitoring will yield samples that provide a reliable measurement of the quality of the soil and groundwater beneath the treatment zone.

Selection of analytical parameters, i.e., the modified Skinner List including total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) and diesel range organics (DRO), and principal hazardous constituents (PHCs), is based on the hazardous constituents expected to be present in the waste and their associated degradation

products. The modified Skinner List is a subset of 40 CFR 261 Appendix VIII constituents and identifies the specific hazardous constituents of concern that typically may be found in refinery waste. NMED established PHCs for the LTU in the Ciniza Hazardous Waste Facility Permit. PHCs are hazardous constituents contained in waste applied to the LTU. NMED determined these PHCs most difficult to treat, considering the combined effects of degradation, transformation, and immobilization. Ciniza will analyze samples for hazardous constituents from the modified Skinner List including TPH as GRO and DRO, and PHCs, collectively referred to as the modified Skinner List.

The sampling schedule (Figure E-1) for the ZOI, treatment zone, and Chinle slope wash provides a sampling frequency based on maximum protection of human health and the environment, while minimizing disruption of the LTU and underlying sediments. Ciniza will analyze samples for organics and metals identified on the modified Skinner List. The sampling schedule is described for each zone in the following subsections.

E.1.1 Zone of Incorporation Sampling

Ciniza will sample the ZOI (upper 12 in. of the treatment zone) to confirm treatment and to ensure that hazardous constituents within the treatment zone have been successfully treated. Ciniza will obtain soil samples following the protocols in Appendix E, Post-Closure Monitoring Plan, which identifies procedures for obtaining soil samples, determining sampling locations, decontaminating equipment, and chain of custody (COC); analytical parameters; analytical procedures; and quality assurance/quality control (QA/QC) requirements.

E.1.1.1 Sampling Frequency and Analytical Parameters. Characterization of the ZOI was completed in 1999 during a special sampling event. The ZOI was characterized for both organics and metals identified on the modified Skinner List (Tables E-1A through E-1D); Tables E-2A through E-2D list the results for this sample event. During the post-closure care period, the ZOI will be sampled three times, with minimum disruption of the vegetative cover.

- Events 1, 2, and 3: The three post-closure sampling events will take place in the ninth year, 19th year, and 30th year, respectively, of post-closure care. Analytical parameters selected for Events 1, 2, and 3 are both organics and metals identified in the modified Skinner List.

- Organics	Modified Skinner List (including TPH as GRO and DRO	Tables E-1A and E-1B
- Metals	Modified Skinner List	Tables E-1C and E-1D

The sampling frequency for organics and metals during post-closure care period is detailed on Figure E-1. This schedule assumes the early sampling events demonstrate no statistically significant increase for any analytes in the ZOI.

If sample results from any sampling event indicate a statistically significant increase in hazardous constituents as defined in 40 CFR 264.278 and § 264.97(h), then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed following protocol established in Appendix E, Post-Closure Monitoring Plan, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the ZOI. The characterization, if required, will include all organics and metals in the modified Skinner List including TPH as GRO and DRO. Confirmation may also trigger a special sampling and analysis event of the Chinle slope wash. This special sampling event, if necessary, will provide additional information on hazardous constituents present and potential migration out of the ZOI.

E.1.2 Treatment Zone Sampling

Ciniza will sample the treatment zone following the protocols in Appendix E, Post-Closure Monitoring Plan. The Post-Closure Monitoring Plan identifies procedures for obtaining soil samples, determining sampling locations, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements.

Initial characterization of the treatment zone was conducted in a 1999 special sampling event (Tables E-2A through E-2D). The zones were characterized for both organics and metals identified in the modified Skinner List (Tables E-1A through E-1D).

The treatment zone sampling frequency is parallel to the frequency of ZOI sampling. The treatment zone will be sampled within the ninth year, 19th year, and 30th year of post-closure care. The samples will be analyzed for both organics and metals in the modified Skinner List plus TPH as GRO and DRO. The sampling schedule is detailed on Figure E-1.

If a statistically significant increase is indicated and confirmed following protocol established in the Post-Closure Monitoring Plan, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the treatment zone. The characterization, if required, will include all organics and metals in the modified Skinner List plus TPH as GRO and DRO. Confirmation may also trigger a special sampling and analysis event of the Chinle slope wash. This special sampling event will provide additional information on hazardous constituents present and potential migration out of the treatment zone.

E.1.3 Chinle Slope Wash Sampling

Beneath the LTU, a water-bearing unit known as the Chinle slope wash lies on top of, but is not part of, the Chinle formation. This water-bearing unit is located above the Chinle formation, and consequently, is located above the Sonsela aquifer (Figure I-1 demonstrates this stratigraphic sequence). The Sonsela is the geologic unit that meets the regulatory definition of the uppermost aquifer that must be monitored in accordance with 20 NMAC 4.1, Subpart V, 264. Although the Chinle slope wash does **not** meet the regulatory definition of an aquifer that must be monitored, as part of early detection monitoring, Ciniza will sample groundwater from the Chinle slope wash to be protective of human health and the environment.

The Chinle slope wash will be sampled using one downgradient stainless steel, shallow monitoring well (SMW)-4. The Post-Closure Monitoring Plan identifies procedures for obtaining groundwater samples from SMW-4, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements. If SMW-4 is dry, this observance will be reported for that sampling event and no further sampling will be conducted until the next scheduled sampling event.

E.1.3.1 Background Determination. Background values for Chinle slope wash samples are not established. Detection of any constituents from Tables E-1A through E-1D, above regulatory limits, may generate additional sampling after consultation with NMED.

E.1.3.2 Sampling Frequency. The Chinle slope wash will be sampled annually for three years. After year three, the Chinle slope wash will be sampled biennially up to and including year nine of the post-closure care period; then the Chinle slope wash will be sampled in years 19 and 30 of post-closure care period. The samples will be analyzed for the organics noted in the modified Skinner List (Tables E-1A and E-1B).

If a statistically significant increase is indicated and verified following protocol established in the Post-Closure Monitoring Plan, Ciniza will submit the required notification to the NMED, and a permit modification of the sampling schedule may be required to further characterize the release. Prior to submitting a modification request, Ciniza may demonstrate that the release is from a source other than the LTU or is from errors in sampling, analysis, or data evaluation. Any modification request will address compliance monitoring requirements and will consist of an approach that is tailored to the specific qualities of the release (e.g., location, depth, concentration, media, constituent identified, migration characteristics expected).

E.2 Detection Monitoring [20 NMAC 4.1, Subpart V, §264.97 and §264.98 and Subpart IX, §270.14(c)]
Ciniza will conduct detection monitoring during the post-closure care period in accordance with the requirements of 20 NMAC 4.1, Subpart V, §264.97 and §264.98 and Subpart IX, §270.14(c). The detection monitoring will yield samples that represent the quality of hydraulically upgradient groundwater in the Sonsela that could not be affected by LTU operations and samples that represent the quality of downgradient groundwater passing the point of compliance (defined in Section E.2.2).

E.2.1 Contaminant Plume Description [20 NMAC 4.1, Subpart IX, §270.14(c)(4)]
Ciniza has routinely monitored the Sonsela aquifer as well as the vadose zone above the Chinle formation in accordance with the Ciniza Hazardous Waste Facility Permit throughout the life of the LTU. This monitoring has at no time indicated that a plume of contamination has migrated from the treatment zone; therefore, the requirements of 20 NMAC 4.1, Subpart IX, §270.14(c)(4) do not apply.

E.2.2 Description of Wells [20 NMAC 4.1, Subpart V, §264.97(a), (b), and (c); §264.98(b); and Subpart IX, §270.14(c)(5)]
20 NMAC 4.1, Subpart V, §264.97 requires that the quality of the groundwater passing the point of compliance in the uppermost aquifer be monitored. 20 NMAC 4.1, Subpart V, §264.95 defines the point of compliance as a vertical surface located at the hydraulically downgradient limit of the waste management unit that extends down into the uppermost aquifer underlying the unit. The uppermost aquifer beneath the LTU is the Sonsela, which is a confined aquifer that generally flows to the north/northeast under the LTU. Ciniza maintains four groundwater monitoring wells (MWs) at the LTU.

Pursuant to 20 NMAC Subpart V, §264.97, Ciniza measured background conditions in the Sonsela by sampling groundwater from MW-4, which is completed in the same region of the Sonsela as MW-1, MW-2, and MW-5. MW-4 is located upgradient from the LTU. Water that passes beneath the LTU in the Sonsela is sampled from MW-1, MW-2, and MW-5, which are located on the downgradient edge of the LTU. MW-1, MW-2, and MW-5 are completed in the uppermost aquifer (i.e., Sonsela) at the point of compliance.

E.2.3 Sampling and Analysis Procedures [20 NMAC 4.1, Subpart V, §264.97(d), (e), and (f) and §264.98(d), (e), and (f); and Subpart IX, §270.14(c)(5) and §270.14(c)(6)(iv)]
Ciniza obtains groundwater samples following the protocols in the Post-Closure Monitoring Plan. The Post-Closure Monitoring Plan identifies procedures for obtaining groundwater samples, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements. These procedures have been designed to ensure that monitoring results provide a reliable indication of groundwater quality below the LTU.

Ciniza will determine groundwater elevations in MWs prior to well evacuation each time the groundwater is sampled. Ciniza will determine the groundwater surface elevation using the electric tape method or other acceptable method prior to obtaining samples. Using the groundwater surface elevation data, Ciniza will determine the groundwater flow rate and the direction of flow in the Sonsela aquifer at least annually to ensure that the monitoring system location is adequate.

The Sonsela aquifer will be sampled annually for three years. After year three, the Sonsela aquifer will be sampled biennially up to and including year nine of the post-closure care period; then the aquifer will be sampled in years 19 and 30 of post-closure care period. The samples will be analyzed for both organics and metals in the modified Skinner List provided in Tables E-1A through E-1D.

If Sonsela sampling results indicate that there is statistically significant increase of hazardous constituents in the Sonsela aquifer, notification of the increase will be provided to the NMED in writing within seven days of that determination. At that time, Ciniza will sample MW-1, MW-2, MW-4, and MW-5, to determine whether constituents in Appendix VIII of 20 NMAC 4.1, Subpart V, 264 are present and in what concentrations. Within one month after determination and notification to NMED, Ciniza will resample these MWs and repeat the analysis for any compounds previously detected. Prior to submitting a modification request, Ciniza may demonstrate that the release is from a source other than the LTU or is from errors in sampling, analysis, or data evaluation. If confirmation sampling verifies Appendix VIII constituents, Ciniza will, within 90 days, submit an application to the NMED to establish a compliance monitoring program for the LTU using the detected compounds as a basis for the compliance monitoring program.

E.2.4 Indicator Parameters, Waste Constituents, Reaction Products to be Monitored [20 NMAC 4.1, Subpart V, §264.98(a) and Subpart IX, §270.14(c)(6)(i)]

Selection of analytical parameters is based on the hazardous constituents expected to be present in the waste and their associated degradation products. Expected hazardous constituents were identified from the modified Skinner List and PHCs (collectively referred to as the modified Skinner List). PHCs are those identified on the Ciniza Hazardous Waste Facility Permit and the modified Skinner List is a subset of 40 CFR 261 Appendix VIII constituents and identifies the specific hazardous constituents of concern that typically may be found in refinery waste. The analytical parameters for detection monitoring are listed in Tables E-1A through E-1D.

E.2.5 Background Groundwater Quality and Concentration Values [20 NMAC 4.1, Subpart V, §264.97(a)(1) and (g), §264.98(g); and Subpart IX, §270.14(c)(6)(iii)]

Background groundwater quality values were established for the LTU during the Land Treatment Demonstration; however, MW-4 will continue to be sampled at the same interval as the other MWs to continuously monitor any changes in background water quality. To ensure that sampling and analytical quality control (QC) is verified, analytical results for the upgradient well (MW-4) will be compared to downgradient wells (MW-1, MW-2, and MW-5). Statistical methods will be employed to determine whether fluctuation in results represent impacts from the LTU or reflect variances in sampling and analytical procedure, natural groundwater fluctuation, or other non-LTU influences. A summary of the statistical methods used is provided in Section E.2.6.

E.2.6 Statistical Procedures [20 NMAC 4.1, Subpart V, §264.97(h) and §264.97 (i)(1), (5), and (6)]

20 NMAC 4.1, Subpart V, §264.97(h) requires that groundwater monitoring data be evaluated using statistical analysis. Ciniza has evaluated groundwater monitoring data using Cochran's approximation to the Behrens-Fisher Student's T-test for its existing groundwater monitoring program. Ciniza plans to continue using this methodology to evaluate groundwater monitoring data during the post-closure care period. Details about the methodology used for the detection monitoring is included as Appendix E, the Post-Closure Monitoring Plan.

E.2.7 Notification and Reporting [20 NMAC 4.1, Subpart V, §264.97 (j) and §264.98 (g)]

Pursuant to the requirements of 20 NMAC 4.1, Subpart V, §264.97(j), Ciniza will submit a groundwater monitoring report annually to the NMED for review.

Table E-1A. Modified Skinner List 8260 Volatile Organics and PHCs[a]

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Reporting[c] Limit (µg/L)	Soil Reporting[c] Limit (mg/kg)
Benzene	8260	GC/MS	G	4°C	14	5	0.67
2-Butanone (MEK)	8260	GC/MS	G	4°C	14	1900	7000
Carbon Disulfide	8260	GC/MS	G	4°C	14	1000	350
Chlorobenzene	8260	GC/MS	G	4°C	14	39	54
Chloroform	8260	GC/MS	G	4°C	14	0.16	0.24
Chloromethane	8260	GC/MS	G	4°C	14	1.5	1.2
1,1 Dichloroethane	8260	GC/MS	G	4°C	14	25	580
1,2 Dichloroethane	8260	GC/MS	G	4°C	14	5	0.34
1,1 Dichloroethene	8260	GC/MS	G	4°C	14	5.0	0.053
trans-1,2-Dichloroethene	8260	GC/MS	G	4°C	14	100	63
1,4-Dioxane	8260	GC/MS	G	4°C	14	6.1	44
Ethylbenzene[a]	8260	GC/MS	G	4°C	14	700	230
Methylene Chloride	8260	GC/MS	G	4°C	14	4.3	8.6
Styrene	8260	GC/MS	G	4°C	14	100	1700
1,1,2,2-Tetrachloroethane[b]	8260	GC/MS	G	4°C	14	0.55	0.37
Tetrachloroethene[b]	8260	GC/MS	G	4°C	14	5	4.9
Toluene	8260	GC/MS	G	4°C	14	750	1000
1,1,1-Trichloroethane	8260	GC/MS	G	4°C	14	60	200
Trichloroethene	8260	GC/MS	G	4°C	14	5	2.7
Total Xylene[a, d]	8260	GC/MS	G	4°C	14	620	860
Ethylene Dibromide[b]	8260	GC/MS	G	4°C	14	0.1	0.005
Acetone	8260	GC/MS	G	4°C	14	610	1500

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

mg/kg = milligrams per kilogram
µg/L = microgram per liter
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry

Table E-1B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Anthracene	8270	GC/MS	G	4°C	14	1800	16000
Acenaphthene	8270	GC/MS	G	4°C	14	370	2800
Benzo(a)Anthracene	8270	GC/MS	G	4°C	14	0.09	0.62
Benzo(b)Fluoranthene	8270	GC/MS	G	4°C	14	0.09	0.62
Benzo(k)Fluoranthene	8270	GC/MS	G	4°C	14	0.9	6.2
Benzo(a)Pyrene[a]	8270	GC/MS	G	4°C	14	0.0007	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4°C	14	7300	240
Chrysene[a]	8270	GC/MS	G	4°C	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4°C	14	29000	49000
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G	4°C	14	[e]	[e]
Dimethyl Phthalate	8270	GC/MS	G	4°C	14	370000	100000
Di-n-Octyl Phthalate	8270	GC/MS	G	4°C	14	730	1200
Fluoranthene	8270	GC/MS	G	4°C	14	1500	2300
Fluorene	8270	GC/MS	G	4°C	14	240	2000
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G	4°C	14	0.09	0.62
2-Methylnaphthalene[a]	8270	GC/MS	G	4°C	14	30	660
2-Methylphenol (Cresol)	8270	GC/MS	G	4°C	14	1800	3000
3/4-Methylphenol (Cresol)	8270	GC/MS	G	4°C	14	1980	3300
Naphthalene[g]	8270	GC/MS	G	4°C	14	30	55
Nitrobenzene	8270	GC/MS	G	4°C	14	3.4	17
4-Nitrophenol	8270	GC/MS	G	4°C	14	2300	3800
Phenanthrene[a]	8270	GC/MS	G	4°C	14	[e]	[e]
Pyrene[a]	8270	GC/MS	G	4°C	14	180	1700
Pyridine	8270	GC/MS	G	4°C	14	37	61
Quinoline	8270	GC/MS	G	4°C	14	0.0056	0.04
Benzenethiole	8270	GC/MS	G	4°C	14	[e]	[e]
Phenol	8270	GC/MS	G	4°C	14	5	36000
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G	4°C	14	6.0	35
Dibenz(a,j)acridine[b]	8270	GC/MS	G	4°C	14	[e]	[e]
Dibenz(a,h)-anthracene	8270	GC/MS	G	4°C	14	0.0092	0.062
Dichlorobenzene[b, f]	8270	GC/MS	G	4°C	14	675	410
Methyl Naphthalene	8270	GC/MS	G	4°C	14	30	[e]
2,4-Dimethylphenol	8270	GC/MS	G	4°C	14	730	1200
2,4-Dinitrotoluene	8270	GC/MS	G	4°C	14	73	120

Table E-1B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a] (Continued)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
2,4-Dinitrophenol[b]	8270	GC/MS	G	4°C	14	73	120
Benzo(j)Fluoranthene	8270	GC/MS	G	4°C	14	[e]	[e]
2-Chlorophenol	8270	GC/MS	G	4°C	14	30	61
2,4,6-Trichlorophenol	8270	GC/MS	G	4°C	14	6.1	44
Di-n-Butyl Phthalate	8270	GC/MS	G	4°C	14	3700	6100
Benzyl Alcohol[b]	8270	GC/MS	G	4°C	14	11000	18000
Methyl Chrysene	8270	GC/MS	G	4°C	14	[e]	[e]
Total Cresol[a, f]	8270	GC/MS	G	4°C	14	3780	6300
TPH[h]	8015m	GS	G	4°C	7	—	1000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[e]No regulatory limit provided. Laboratory detection limit will be used.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.
[g]Total naphthalene plus monomethylnaphthalenes regulatory limit is < 30µg/L for aqueous samples.
[h]Total Petroleum Hydrocarbon as Gasoline Range Organics and Diesel Range Organics

µg/L = microgram per liter
mg/kg = milligram per kilogram
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry
GC = gas chromatography

Table E-1C. Modified Skinner List Metals and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative [b]	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Antimony	7060(aq), 6010	GFAA/ICP	P or G	4°C	180	6.0	31
Arsenic	6010	ICP-AES	P or G	4°C	180	50	22
Barium	6010	ICP-AES	P or G	4°C	180	2000	5400
Beryllium	6010	ICP-AES	P or G	4°C	180	4.0	150
Cadmium	6010	ICP-AES	P or G	4°C	180	5.0	39
Chromium[a]	6010	ICP-AES	P or G	4°C	180	50	210
Cobalt	6010	ICP-AES	P or G	4°C	180	50	3400
Lead[a]	6010	ICP-AES	P or G	4°C	180	15	400
Nickel	6010	ICP-AES	P or G	4°C	180	100	1600
Selenium	6010	ICP-AES	P or G	4°C	180	50	390
Silver	6010	ICP-AES	P or G	4°C	180	50	390
Vanadium	6010	ICP-AES	P or G	4°C	180	260	550
Zinc	6010	ICP-AES	P or G	4°C	180	10000	23000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

µg/l = microgram per liter
mg/kg = milligram per kilogram
ICP-AES = Inductively Coupled Plasma - Atomic Emission Spectroscopy
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table E-1D. Mercury[a] and Cyanide

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Mercury[a]	7470/7471	CVAA	P or G	4°C[b]	28	2.0	23.
Cyanide	335.3/ 9010, 9014	Colorimetry	P or G	4°C[d]	14	200	1200

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.

[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.

[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

[d]Aqueous samples are field adjusted to pH >12 with NaOH and refrigerated. Non-aqueous samples are cooled to 4°C.

µg/l = microgram per liter
mg/kg = milligram per kilogram
CVAA = cold vapor atomic absorption
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table E-2A. Inorganic Parameters – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
	Reporting Limit	NA	0.025	50	0.05	50
	Units	pH units	mg/Kg	mg/Kg	%	mg/Kg
ZOI-3-38-051899		6.60	0.06	3500	1.7	500
3FT-3-38-051899		*	*	*	*	*
BTZ-3-38-051899		8.35	*	*	0.27	*
ZOI-3-97-051899		8.01	0.54	900	0.50	190
3FT-3-97-051899		*	*	*	*	*
BTZ-3-97-051899		8.57	*	*	0.18	*
ZOI-3-135-051899		8.48	0.24	<50	0.26	320
3FT-3-135-051899		*	*	*	*	*
BTZ-3-135-051899		8.41	*	*	0.32	*
ZOI-3-152-051899		8.40	0.19	<50	0.36	300
3FT-3-152-051899		*	*	*	*	*
BTZ-3-152-051899		8.93	*	*	0.14	*
ZOI-2-40-051899		7.09	0.24	18000	5.8	700
3FT-2-40-051899		*	*	*	*	*
BTZ-2-40-051899		8.05	*	*	0.31	*
ZOI-2-41-051899		8.09	0.2	4500	3.2	540
3FT-2-41-051899		*	*	*	*	*
BTZ-2-41-051899		8.10	*	*	0.31	*
ZOI-2-107-051899		7.47	0.17	7000	3.4	510
3FT-2-107-051899		*	*	*	*	*
BTZ-2-107-051899		8.40	*	*	0.22	*
ZOI-1-40-051899		7.61	0.13	6600	2.8	730
3FT-1-40-051899		*	*	*	*	*
BTZ-1-40-051899		8.39	*	*	0.22	*

Table E-2A. Inorganic Parameters – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Analyte / Reporting Limit / Units	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
	Reporting Limit	NA	0.025	50	0.05	50
	Units	pH units	mg/Kg	mg/Kg	%	mg/Kg
ZOI-1-98-051899		7.20	0.27	4900	2.6	500
3FT-1-98-051899		*	*	*	*	*
BTZ-1-98-051899		8.42	*	*	0.29	*
ZOI-1-143-051899		7.90	0.18	10000	5.5	230
3FT-1-143-051899		*	*	*	*	*
BTZ-1-143-051899		8.54	*	*	0.37	*

NOTE:

* Analysis not required

Table E-2B. ICP 6010 Metals and Mercury – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury
ZOI-3-38-051899	<1.2	3.9	340	<1.2	<1.2	190	5.1	21	11	<1.2	16	<0.1
3FT-3-38-051899	<1.2	1.5	200	1.4	<1.2	8.9	5	11	9.8	<1.2	18	<0.1
BTZ-3-38-051899	<1.2	2.4	300	1.4	<1.2	25	8.6	12	20	<1.2	43	<0.1
ZOI-3-97-051899	<1.2	1.6	360	1.4	<1.2	24	7	12	14	<1.2	30	<0.1
3FT-3-97-051899	<1.2	1.6	310	1.8	<1.2	27	8.8	13	19	<1.2	40	<0.1
BTZ-3-97-051899	<1.1	1.6	330	1.2	<1.1	10	5.3	9.1	11	<1.1	22	<0.1
ZOI-3-135-051899	3.8	17	3400	11	<1.2	130	63	120	130	<1.2	220	<0.1
3FT-3-135-051899	<1.1	1.7	360	1.5	<1.1	24	8.4	12	18	<1.1	36	<0.1
BTZ-3-135-051899	<1.2	1.4	330	1.6	<1.2	6.2	4.1	10	7.6	<1.2	16	<0.1
ZOI-3-152-051899	<1.2	1.5	350	1.5	<1.2	8.5	5.3	10	11	<1.2	17	<0.1
3FT-3-152-051899	<1.1	1.4	370	1.4	<1.1	17	7	11	15	<1.1	27	<0.1
BTZ-3-152-051899	<1.1	1.1	430	<1.1	<1.1	7.8	4.7	8.5	8.8	<1.1	18	<0.1
ER-POST CELL 1-98-0518-99	<0.01	<0.01	<0.01	0.004	0.004	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.002
ZOI-2-40-051899	<1.1	20	710	<1.1	<1.1	200	9.7	87	54	<1.1	40	13
3FT-2-40-051899	<1.2	1.2	310	1.3	<1.2	7.4	4.9	9.6	9.4	<1.2	14	<0.1
BTZ-2-40-051899	<1.2	1.4	260	1.5	<1.2	17	6.9	12	15	<1.2	27	0.18
ZOI-2-41-051899	1.2	10	550	<1.2	<1.2	310	8.2	54	32	3.3	35	8.4
3FT-2-41-051899	<1.2	13	290	1.7	<1.2	18	7	13	15	<1.2	28	<0.1
BTZ-2-41-051899	<1.1	1.8	270	1.4	<1.1	18	7.1	12	15	<1.1	30	<0.1
ZOI-2-107-051899	<2.5	7.5	350	<1	0.78	220	6.2	40	24	<2.5	21	1.6

Table E-2B. ICP 6010 Metals and Mercury – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury
3FT-2-107-051899	<2.5	<2.5	290	<1	<0.5	9.4	4.3	11	9.4	<2.5	15	<0.1
BTZ-2-107-051899	<2.5	<2.5	230	1.1	<0.5	12	5.1	10	12	<2.5	19	<0.1
ZOI-1-40-051899	<2.5	<2.5	290	<1	<0.5	190	7.1	40	28	<2.5	30	0.13
3FT-1-40-051899	16	<2.5	180	1.1	<0.5	9.5	4.1	11	9.4	<2.5	16	<0.1
BTZ-1-40-051899	<2.5	<2.5	210	<1	<0.5	12	5.2	8.9	13	<2.5	20	<0.1
ZOI-1-98-051899	<2.5	<2.5	1100	<1	<0.5	58	6.6	18	13	<2.5	13	2
3FT-1-98-051899	<2.5	<2.5	140	<1	<0.5	7	<2.5	7.9	7	<2.5	12	<0.1
BTZ-1-98-051899	<2.5	<2.5	210	1.1	<0.5	15	5.7	11	13	<2.5	19	<0.1
ZOI-1-143-051899	<2.5	14	350	<1	<0.5	140	5.7	53	39	<2.5	35	1.4
3FT-1-143-051899	<2.5	<2.5	240	<1	<0.5	14	5.7	10	13	<2.5	20	<0.1
BTZ-1-143-051899	<2.5	<2.5	240	1	<0.5	9.2	<2.5	9.1	10	<2.5	13	<0.1

NOTES:

Units are mg/Kg (ER-POST CELL-1-98-0518-99 units are µg/L).
Results are reported on a dry weight basis.

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
ZOI-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
3FT-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
BTZ-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
ZOI-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
BTZ-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
ZOI-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
TRIP BLANK COOLER 1[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
ER-POST CELL 1-98-0518-99[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
3FT-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
BTZ-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
ZOI-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
ZOI-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
TRIP BLANK 2[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
3FT-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
ZOI-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
ZOI-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
3FT-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
BTZ-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13

[a] Aqueous sample

NOTES:

- Not detected above Reporting Limit

Reporting Limit varies with sample % moisture.

Reporting Limit maximum for soil samples was 0.07 mg/Kg for all analytes except 1,4 Dioxane (6.3 mg/Kg) and 2-Butanone (0.6 mg/Kg).

Reporting Limit for aqueous samples was 1.0 µg/L for all analytes except 1,4 Dioxane (100 µg/L) and Acetone and 2-Butanone (10 µg/L).

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
1,2-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.76	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3&4-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Methylcholanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6-Methyl Chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.43	-	-
7,12-Dimethylbenz(a) anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.18	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-

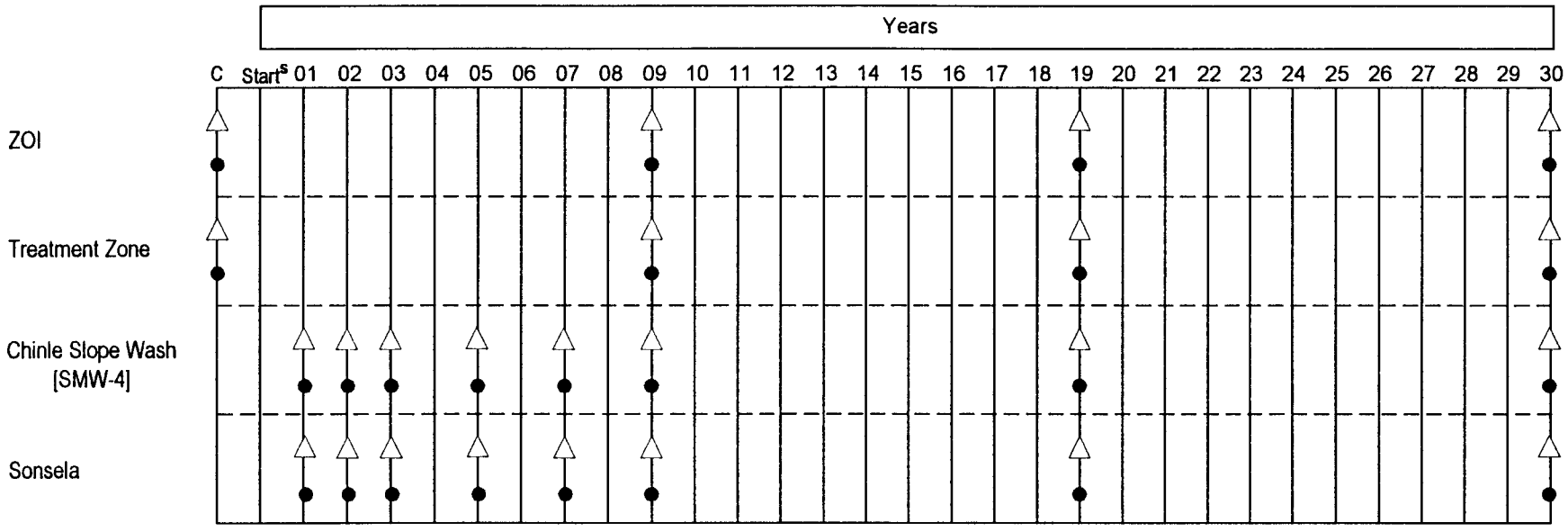
Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
Benzo(b)&(j)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.44	-	-
Benz(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzyl alcohol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butyl benzyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	2.33	-	-	-	-	-	-	-	-	-	-	-	-	3.13	-	-	-	-	-	-	-	-	2.31	-	-	3.39	-	-	-	-	-
Di-n-butyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-octyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)acridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,j)acridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.32	-	-	-	-	-	-	-	-	-	-	-	5.38	-	-

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
Phenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.63	-	-
Pyridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinoline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Moisture	16	19	16	16	16	13	14	13	14	15	13	10	-	9	17	15	16	18	13	16	19	13	21	18	12	16	13	13	17	16	12

NOTES:
Units are mg/Kg
- Not detected at reporting limit
Reporting limit varies with dilution and % moisture 0.38-4.23 mg/Kg for 2,4-Dinitrophenol, 4-Nitrophenol, and Benzyl alcohol, 0.186-2.11 mg/Kg for all other compounds.
Sample ER-POST-1-98-0518-99 is aqueous Reporting limits are 10 µg/L for 2,4-Dinitrophenol and 4-Nitrophenol, and 5 µg/L for all other compounds reported.



△ = Modified Skinner List - Metals

● = Modified Skinner List - Organics

s = Begin sample activities within 90 days of post-closure permit issuance

C = May 1999 special sample event

Figure E-1. LTU Post-Closure Sampling Schedule

I.0 GENERAL CLOSURE AND POST-CLOSURE REQUIREMENTS

I.1 General Closure and Post-Closure Requirements [20 NMAC 4.1, Subpart V, §264.110 through §264.120]

I.1.1 Applicability of Closure and Post-Closure [20 NMAC 4.1, Subpart V, §264.110 through §264.120]

This plan describes the activities necessary to complete *final closure* of the Ciniza's LTU (NMD 000333211-2). *Final closure* refers to all closure activities such that hazardous waste management activities under Part 264 are no longer conducted. *Final closure* is complete at the end of the post-closure care period.

The LTU is the only hazardous waste management unit located at Ciniza that is subject to the closure requirements of 20 NMAC 4.1, Subpart V, 264, Subpart G. Closure of the LTU constitutes *final closure* of the Ciniza's hazardous waste management activities at the LTU subject to 20 NMAC 4.1, Subparts V and IX, as defined in 20 NMAC 4.1, Subpart I, §260.10.

Final closure performance standards are included in Section I.2. The information contained in this plan is designed to meet permit application requirements of 20 NMAC 4.1, Subpart IX, §270.14(b)(13), and the closure/post-closure requirements of 20 NMAC 4.1, Subpart V, §264, §264.110 through §264.120. Unit-specific closure and post-closure obligations of 20 NMAC 4.1, Subpart V, §264.280 reflect the *final closure* plan's focus.

I.1.2 Site Description [20 NMAC 4.1, Subpart V, §264.112]

Ciniza is a crude oil refining facility located in McKinley County, New Mexico, at Township 15 North, Range 15 West, Sections 28 and 33. The refinery is just north of I-40 and approximately 17 miles east of Gallup, New Mexico.

Ciniza, originally owned by El Paso Natural Gas Company, was constructed in 1957. The refinery was purchased by Shell Oil Company (Shell) in 1964, and operated by Shell until 1982. The refinery was then purchased by Giant. Giant Industries Arizona, Incorporated, the parent of Giant, is headquartered in Scottsdale, Arizona.

I.1.3 Land Treatment Unit Description [20 NMAC 4.1, Subpart V, §264.112]

The Ciniza site map is shown on Figure B-1. The LTU is located within the refinery property boundary. The primary purpose of the LTU was the degradation, transformation, or immobilization of hazardous wastes using microbial activity and soil characteristics. The LTU is approximately 1,500 ft northwest of the refinery process area and is above the 100-year floodplain, as shown on Figure B-3. The LTU consists of three 480-ft x 240-ft sections located immediately east of Evaporation Pond 12B. Each section is diked and contains 2.6 acres (1.0 hectare) of available treatment surface. The top 12 in. of soil was plowed and disked to encourage aerobic microbial activity and improve chemical reaction rates. During

treatment, soil nutrients were applied as necessary to maintain the optimum carbon:nitrogen:phosphorous (C:N:P) ratio of 50:2:1. The LTU received hazardous wastes from October 10, 1980, to November 8, 1990, with treatment confined to the upper 12 in. of natural soil (zone of incorporation). Waste management activities for the treatment program are based on the land treatment demonstration (Land Treatment Demonstration 1988) conducted by Ciniza in order to design the operating treatment parameters. Design capacity and conditional limits of the LTU include a treatment zone depth not greater than 5 ft from the original soil surface, and a maximum treatment zone depth at least 3 ft above the seasonal high water table (20 NMAC 4.1, Subpart V, §264.271(c)(1) and §264.271(c)(2).

I.1.4 Hydrogeology [20 NMAC 4.1, Subpart V, §264.112]

A detailed description of the geologic conditions beneath the LTU is provided as Attachment I-1 of this post-closure plan. The interpretation of geologic conditions is derived from the data of past investigations as well as logs from borings and well installations. Subsurface data in the LTU area have been digitized and modeled as surfaces based on general environments of deposition. The results of modeling indicate a complex subsurface below the LTU. The modeling results are presented graphically in Section Maps 1, 3, 4, and 5, as well as Profiles 1-1', 3-3', and 6-6' of Figure I-1.

I.1.5 Surrounding Land Use [20 NMAC 4.1, Subpart V, §264.112]

Ciniza, located in McKinley County, is situated in a remote, undeveloped, and sparsely populated area. The surrounding land use is cattle and sheep grazing at a density of less than six cattle or 30 sheep per section. Most of McKinley County is rural, as are adjoining portions of neighboring counties.

The refinery maintains residences for several employees 0.5 mile south of the refinery process area. A truckstop is approximately 1 mile south-southwest of the process area near the I-40 exit. A rural residential area, with a density of eight to 10 residents per square mile, is approximately 1.5 miles southwest of the refinery. A railroad is within 2 miles to the north, the small community of Iyanbito is within 3 miles to the northwest, the Fort Wingate Military Reservation is within 6 miles to the west, the Cibola National Forest is within 2 miles to the southwest, and a highway rest area is within 1 mile at the I-40 exit to the south. The largest residential community near the refinery is Gallup, New Mexico, which is 17 miles away, west of the refinery.

I.1.6 Description of Waste [20 NMAC 4.1, Subpart V, §264.112]

Ciniza received its Hazardous Waste Facility Permit (NMEID 1988) and has conducted activities since that date in accordance with its permit. The LTU is permitted to treat refinery sludges carrying the EPA hazardous waste numbers D001, D007, K049, K050, K051, and K052. Application of hazardous waste to the LTU ceased on November 8, 1990. Approximately 2,600 tons of hazardous waste were treated at the LTU during its operating life as described in more detail in Appendix D.

The refinery sludges treated at the LTU were viscous oil-water-solids mixtures. Table I-1 summarizes the wastes applied to the LTU. Records of waste inventory and analysis, as well as the operational logbook documenting any activity within the LTU, will be maintained at Ciniza until closure of the LTU, as required by 20 NMAC 4.1, Subpart V, §264.73(b) and §264.119.

Hazardous wastes currently generated at Ciniza are managed according to 20 NMAC 4.1, Subpart III, §262.34. These wastes are shipped off-site to approved treatment, storage, and disposal facilities for treatment and disposal. No hazardous wastes are stored for more than 90 days pursuant to 20 NMAC 4.1, Subpart III, §262.34.

I.1.7 Ancillary Equipment [20 NMAC 4.1, Subpart V, §264.112]

The equipment used to manage waste and soil at the LTU during *final closure* activities may include, but are not limited to, a tractor, disc and harrow, backhoe, dump truck, and road grader. This equipment, as well as contaminated PPE, will be decontaminated during closure as necessary to meet closure performance standards required by 20 NMAC 4.1, Subpart V, §264.114. Decontamination procedures are described in Section I.5.4.

I.2 Final Closure Performance Standard

I.2.1 Final Closure of the Land Treatment Unit [20 NMAC 4.1, Subpart V, §264.111]

The LTU will be closed to meet the following closure and post-closure performance standards:

- Minimize the need for further maintenance.
- Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground, surface waters, or atmosphere.
- Comply with the final closure requirements of 20 NMAC 4.1, Subpart V, §264.110 through §264.115 (which concern closure) and §264.116 through §264.120 (which concern post-closure care), and the requirements of 20 NMAC 4.1, Subpart V, §264.280 for the closure and post-closure of land treatment units.

I.2.2 Criteria to Meet *Final Closure* Standards [20 NMAC 4.1, Subpart V, §264.280]

These performance standards will be met by conducting the following activities throughout the closure and post-closure care period: 1) maintaining the runon and runoff systems of the LTU; 2) controlling wind dispersal of hazardous waste; 3) continuing unsaturated zone monitoring; 4) maintaining the groundwater monitoring system; 5) establishing and maintaining a vegetative cover over the closed LTU; and 6) decontaminating, as necessary, equipment that comes into contact with hazardous waste and waste residues. Details of *final closure* criteria and support activities are described in Sections I.4 through I.6.

I.3 Administrative Requirements

I.3.1 Final Closure: Schedule for Closure and Post-Closure Care Period [20 NMAC 4.1, Subpart V, §264.112(b)(6), §264.117, and §264.118(b)]

Final closure activities will be conducted in accordance with the approved post-closure care permit as required at 20 NMAC 4.1, Subpart V, §264.112(a), §264.112(b), §264.118(a), and §264.118(b). Table I-2A provides the *final closure* schedule of activities through the closure and post-closure care period. Table I-2B provides final vegetative cover activities to be conducted during closure and post-closure care period. Ciniza will conduct post-closure monitoring and reporting activities for the LTU for 30 years after initial post-closure permit issuance by the Secretary of the NMED or as established in an approved permit modification. Maintenance and monitoring of waste containment systems will be implemented for the same time period. Post-closure property use will not be allowed which could disturb the final cover or the monitoring, containment, or security systems, except as provided by 20 NMAC 4.1, Subpart V, §264.117(b) and §264.117(c), and as approved in a permit modification.

I.3.2 Amendments of the Final Closure Plan [20 NMAC 4.1, Subpart V, §264.112(c) and §264.118(d)]

If final closure activities cannot be completed at the LTU in accordance with the approved schedule, Ciniza will notify the Secretary of the NMED in accordance with the extension requirements cited in 20 NMAC 4.1, Subpart V, §264.112(c) and §264.112(d), and in accordance with the time periods of 20 NMAC 4.1, Subpart V, §264.112(3) and §264.118(d)(3). Ciniza will submit a written notification of request for a permit modification to authorize change in the final closure plan. The modification request will describe the proposed change in operation or LTU design. A copy of the amended permit will be submitted with each notification or request. Ciniza will submit a written request for a permit modification to authorize a change in the approved plan if either of the following occur:

- Changes in operating plans or LTU design affecting the final closure plan
- Unexpected events that require modification of the approved closure/post-closure schedule

A copy of the approved post-closure care permit and any approved revisions will be maintained at:

Ciniza Refinery
Route 3, Box 7
Gallup, New Mexico 87301
Telephone (505) 722-3833

I.3.3 Amendments Requested [20 NMAC 4.1, Subpart V, §264.112(c)(4) and §264.118(d)(4)]

If the Secretary of the NMED requests a modification of the final closure plan under the conditions described in 20 NMAC 4.1, Subpart X, §264.112(c) and §264.118(d), a plan modified in accordance with the request will be submitted within 30 days of notification of the request.

I.3.4 Closure Certification [20 NMAC 4.1, Subpart V, §264.115]

Within 60 days after completion of final closure activities, Ciniza will submit to the Secretary of the NMED, via certified mail, a certification that the unit has been closed in accordance with the specifications of the approved closure plan. The certification will be attested to by a registered independent professional engineer or qualified independent soil scientist and will be signed by the appropriate Ciniza official in accordance with 20 NMAC 4.1, Subpart V, §264.115. Documentation supporting the certification will be furnished to the Secretary of the NMED with the original certification. A copy of the certification and supporting documentation will be maintained by Ciniza in accordance with 20 NMAC 4.1, Subpart V, §264.115.

I.3.5 Survey Plat [20 NMAC 4.1, Subpart V, §264.116]

No later than the submission of final closure certification of the LTU, Ciniza will submit a survey plat to the local land use authority at the McKinley County Courthouse indicating the location and dimensions of the LTU with respect to permanently surveyed benchmarks. Ciniza will also submit a copy of the survey plat to the Secretary of the NMED on the date that certification of final closure is submitted. The plat will be prepared and certified as described in Section I.3.4. A note will be included with the plat to state Ciniza's obligation to restrict disturbance of the LTU.

I.3.6 Certification of Completion of Post-Closure Care [20 NMAC 4.1, Subpart V, §264.120]

Within 60 days after completion of the post-closure care period established under 20 NMAC 4.1, Subpart V, §264.117 or §264.280(d), Ciniza will submit to the Secretary of the NMED, by registered mail, a certification that the post-closure care for the LTU was performed according to the approved post-closure permit.

I.3.7 Post-Closure Notice [20 NMAC 4.1, Subpart V, §264.115]

Within 60 days of certification of *final closure* as described in Sections 3.4 and 3.5, Ciniza will: 1) submit a record of the type, location, and quantity of hazardous wastes disposed of in the LTU to the local zoning authority at the McKinley County Courthouse and to the NMED Secretary; and 2) record a notation on the property deed that:

i. The land was used to manage hazardous waste;

ii. Its use is restricted under 20 NMAC 4.1, Subpart V, Subpart G regulations; and

iii. The survey plot described in Section 3.5 and the record of the type, location, and quantity of hazardous waste disposed in the LTU have been filed with the local zoning authority and the Secretary of the NMED.

Ciniza will submit the certification and a copy of the property deed containing the notation to the NMED Secretary as required by 20 NMAC 4.1, Subpart V, §264.119(b)(2) within 60 days of *final closure* certification.

I.3.8 Financial and Liability Requirements [20 NMAC 4.1, Subpart V, §264.140]
Financial assurance for closure and post-closure will be maintained in accordance with 20 NMAC 4.1, Subpart V, §264.12, §264.143(i), § 264.144 and §264.145(i). Table I-3 provides final closure estimates for the LTU. Financial assurance ensures 20 NMAC 4.1, Subpart V, 264, Subpart G compliance through the end of the post-closure care period. A copy of the financial assurance demonstration document is provided as Appendix H.

I.4 Monitoring Maintenance and Reporting

I.4.1 Activities Required [20 NMAC 4.1, Subpart V, §264.280 and §264.112]
Maintenance and monitoring activities will continue through the end of the post-closure care period. Sections I.4.2 and I.4.3 describe maintenance and monitoring activities respectively, in support of final closure performance standards. The designed activities exhibit a commitment to sound hazardous waste management at the LTU. Focused activities are dedicated to control, minimize, or eliminate post-closure escape of constituents from the LTU, as described below.

I.4.1.1 Maintenance Activities

- Provide and maintain surface soil conditions capable of maintaining growth of a low-maintenance vegetative cover on the LTU.
- Inspect and maintain the surface water runon and runoff systems.
- Provide necessary control for wind dispersal of hazardous waste particulate matter.
- Continue compliance with food-chain crops prohibitions.

I.4.1.2 Monitoring Activities. Ciniza will continue soil-core and groundwater monitoring programs that supply reliable subsurface data for tracking performance of the LTU constituent containment integrity. Monitoring activities will continue through the end of the post-closure care period.

I.4.2 Description of Maintenance Activities

I.4.2.1 Plant Growth Soil Conditions. LTU soil conditioning activities in the near term, during closure activities, are to establish a vegetative cover to stabilize the 6 in. clean soil cover over the LTU. Ciniza will conduct final surface soil tests and apply appropriate amendments, as necessary, and topsoil to the LTU. Inspections will determine maintenance activities necessary to continue optimum soil conditions for plant growth after initial soil conditioning operations. The closure schedule (Table I-2) lists the timing of these activities.

I.4.2.2 Control of Runon and Runoff [20 NM,AC 4.1, Subpart V, §264.280(c)(3) and §264.280(c)(4)]
Maintenance of a berm surrounding the LTU effectively controls runoff, preventing potential contamination of adjacent surface water and surface water channels. Ciniza will level the LTU surface as necessary to prevent ponding of rainfall water. The climate of western New Mexico is classified as continental semiarid. The capacity of the berm is sufficient to contain the volume of rain water from the estimated 24-hour, 100-year storm event (2.7 in.) (see Section G.3.2). Likewise, the berm system prevents runon. Low rainfall rates and the generally flat surface terrain minimize runon potential as well. Ciniza will routinely inspect runon and runoff controls and make any repairs that are necessary to ensure the integrity of the systems.

I.4.2.3 Control of Wind Dispersal [20 NMAC 4.1, Subpart V, §264.280(c)(5)]. Potential releases of airborne particulate matter by windstorms will be controlled by the addition of a topsoil layer on the LTU. During the winter months (November through March) snow cover and frozen ground effectively inhibit wind erosion. Vegetative cover growth, when properly dense, will control particulate lift from the soil-atmosphere interface through decreased turbulent air flow. Soil moisture supplemented by irrigation, if necessary, will also be a temporary means to control wind dispersal from any bare areas of the vegetative cover. Routine inspections scheduled for the post-closure period will evaluate the cover system's ability to control wind erosion and initiate any necessary remedies.

I.4.2.4 Compliance with Food Chain Crop Restrictions [20 NMAC 4.1, Subpart V, §264.280(a)(6)]. Ciniza will not allow the cultivation of food-chain crops on the closed LTU, except for the scientific testing of such cultivation with the intent of providing data only or with the intent of plowing under such a crop for mulch to enhance top soil growth conditions of the final cover (with approval of the Secretary of the NMED). In accordance with 20 NMAC 4.1, Subpart V, §264.276(b)(2)(iv), the appropriate Notice of Deed will be filed with McKinley County, New Mexico, to notify future property owners of the LTU location and the food-chain crop restriction.

I.4.3 Description of Monitoring Activities

I.4.3.1 Clay Unit. Immobility of constituents within the treatment zone are demonstrated by permeability data collected from soils in the LTU documented in the Land Treatment Demonstration Engineering Report (Appendix D). Low permeability and other soil properties make the unit an effective barrier for restricting constituent migration.

Planned monitoring activities at various subsurface depths will collect data to verify that the clay layer's effectiveness is maintained throughout the post-closure care period. This monitoring system is the early detection monitoring, which includes the sampling of the ZOI, treatment zone, and Chinle slope wash.

I.4.3.2 Zone of Incorporation and Treatment Zone Soil-Core Monitoring. Ciniza will continue a soil-core monitoring program to collect analytical data from soils in the ZOI and treatment zone at appropriate depths, locations, and numbers of samples to provide adequate detection of any statistically significant constituent concentrations in these zones. Ciniza will conduct post-closure monitoring in accordance with 20 NMAC 4.1, Subpart V, §264.280 and will use consistent procedures for sample collection, preservation, and shipment; analytical methods; and chain-of-custody control.

If significant concentrations are confirmed, appropriate seven day notification to New Mexico Environment Department/ Hazardous and Radioactive Materials Bureau (NMED/HRMB) will be provided and a permit modification request may be required for further characterization of these zones. Ciniza will conduct additional sampling, as necessary, to confirm the presence or absence of the indicated constituent and to ensure that additional constituents that are present in the location of the release area are characterized.

I.4.3.3 Chinle Slope Wash Monitoring. Sampling and analysis of the Chinle slope wash supplements the above-described (Section I.4.3.2) soil-core monitoring program. The combination of ZOI and treatment zone soil-core monitoring and Chinle slope wash monitoring provides ample means to maintain and monitor the LTU integrity in the post-closure care period. Sampling frequency is described in Figure E-1.

I.4.3.4 Groundwater Detection Monitoring Program. The groundwater detection monitoring program established for the Sonsela aquifer (the uppermost aquifer) consists of program elements to meet 20 NMAC 4.1, Subpart V, Section 264, Subpart F requirements and will be conducted through the post-closure care period. No hazardous constituents have been identified in the Sonsela aquifer during the operating life of the LTU. Releases are not expected to be detected because of the physical and chemical properties of the remaining contaminants and due to the site's geologic characteristics. Artesian qualities of the Sonsela demonstrate geological confining layers that isolate this water supply from potential surface recharge in the Ciniza vicinity. These confining shale layers minimize any surface source potential migration that could impact water quality. Nonetheless, the groundwater detection monitoring program contains provisions for

responding to constituents present in the uppermost aquifer. Response for indicated constituents would be confirmation sampling to verify the presence of the indicated constituents. If constituents are confirmed, the program describes the appropriate NMED notification, preparation of a compliance monitoring program and work plan preparation and subsequent implementation of an approved compliance monitoring program.

I.4.3.5 Administrative Amendments for Monitoring Activities. *Final closure* activities for the LTU are designed to meet all regulatory requirements as they relate to the LTU. Section I.3.2 contains procedures for responding to circumstances that require administrative modifications of the final closure plan. Monitoring activities are designed to collect reliable data that will support future decisions on any modifications needed in the monitoring programs. Ciniza will maintain and monitor control systems and programs to ensure that performance standards are preserved. Activities are based on the historical data and records obtained during the operating permit term and are designed for current data needs.

I.5 Site Control Measures

I.5.1 Security [20 NMAC 4.1, Subpart V, §264.117(b)]

Restricted access to authorized personnel and warning signs will effectively safeguard against potential contaminant exposure during the closure and post-closure care period. These restrictions minimize unknowing exposure possibilities. Figure I-2 shows the LTU, location of the refinery fence, and warning signs. Security measures are described further in Section F.1.

I.5.2 Control of Release to Hazardous Constituents to Groundwater [20 NMAC 4.1, Subpart V, §264.112(b)(5)]

Ciniza will continue the groundwater detection monitoring program of the Sonsela aquifer through the post-closure care period, as described in Appendix E, the Post-Closure Monitoring Plan. Other post-closure care monitoring includes the Chinle slope wash and soil-core monitoring as described in Section E.0 and detailed in the Post-Closure Monitoring Plan. The EDW is SMW-4, and detection MWs include MW-1, MW-2, MW-4, and MW-5. Sample collection and analysis of organics and metals from the modified Skinner List and principal hazardous constituents (PHCs) (collectively referred to as the modified Skinner List) are proposed for providing a reliable indication of the presence of hazardous constituents in the uppermost aquifer. Analytes and sample frequency are detailed in Section E.0 and Appendix E, the Post-Closure Monitoring Plan.

I.5.3 Required Personal Protective Equipment [20 NMAC 4.1, Subpart V, §264.112(b)(4)]

Before beginning any field activities, the Ciniza Team Leader will inspect the LTU to determine the PPE and monitoring requirements for the subject activity. The level of PPE required will depend primarily upon environmental factors (wind, precipitation, temperature), field conditions (e.g., soil moisture), and type of activity being conducted. Personnel involved

in *final closure* activities will be trained in decontamination activities, wear appropriate PPE as specified by the closure coordinator, and follow good hygiene practices to protect themselves from potential exposure to hazardous waste and residues. After use, contaminated PPE will be decontaminated and managed in accordance with 20 NMAC 4.1, Subpart V, §264.114. Typical PPE is described in Section F.3.5.

I.5.4 Equipment Decontamination [20 NMAC 4.1, Subpart V, §264.112(b)(4)]

Decontamination activities are proposed to meet the *final closure* performance standard of controlling, minimizing, or eliminating potential escape of an exposure to hazardous constituents by contaminated equipment and structures. All contaminated equipment, structures, and soils will be properly disposed of or decontaminated according to 20 NMAC 4.1, Subpart V, §264.114. Any hazardous waste generated during *final closure* activities will be managed in compliance with the facility's generator status and as described in this application.

The Post-Closure Monitoring Plan describes measures for preventing sampling and drilling equipment cross contamination during sampling events and measures for decontaminating items after use. Contaminated PPE will be disposed off-site at an approved facility. Items slated for reuse will be scrubbed with biodegradable soap and potable water, triple rinsed in clean water, then wiped dry with a clean towel, and inspected before being properly stored for reuse. Items will again be inspected before each use.

Larger equipment (see Section I.1.7) that is used in *final closure* activities will be moved onto an impermeable synthetic liner for decontamination. The liner will be designed, constructed, and installed to contain the wash water generated by the decontamination process, and to provide sufficient load-bearing capacity for the equipment. Activities will be conducted at the inner perimeter of the LTU so recontamination is prevented as equipment exit the site. Decontamination includes scraping, brushing, or otherwise removing soil that may be clustered on equipment. The outer surface and undercarriage will be washed with potable water and scrubbed with biodegradable soap as necessary to remove remaining residues. Items will be inspected and allowed to air dry before removal from the decontamination area. Wash waters will either be allowed to evaporate or be properly processed through the plant wastewater treatment system. The liner will be properly disposed after use.

I.5.5 Final Cover [20 NMAC 4.1, Subpart V, §264.280(c)(1)]

Maintaining surface soil conditions that foster ample coverage of a vegetative growth are additional measures planned to meet the closure performance standard. The *final closure* schedule (Table I-2) shows how closure and post-closure activities are coordinated. Activities included in vegetative cover maintenance are: inspection, testing soils, amending soils as necessary, planting, irrigating, if necessary, and cultivating young seedlings. Adjustments may be made as indicated by routine inspections of vegetative growth.

The LTU surface is not toxic to the final vegetative cover, the LTU soil surface will be prepared and amended as necessary for seeding. At least a 6-in. topsoil cover will be applied for plant growth.

The LTU surface will be graded as necessary to eliminate local depressions and elevations and provide a flat even expanse. A level surface minimizes the ponding of precipitation and irrigation water, controlling uneven water percolation into the soil. Uniform water distribution promotes optimum nutrient distribution and enhances growth of the vegetative cover.

After considering the appropriate seeding time and making the evaluations noted, Ciniza will determine the appropriate time to seed. There may be a lag time between evaluation and actual seeding in order to take advantage of seasonal weather patterns. Optimal seeding time should occur during the fall or spring immediately following evaluation. When the correct seeding time is reached, the LTU surface will be tilled as necessary to destroy any existing vegetation that may detrimentally compete with the selected plant species and to create a favorable soil density. Native plant varieties that spread naturally have been evaluated to determine whether their presence compromises performance of the vegetative cover. The County Agriculture Agent or other certified professional have been consulted for characteristics of species in question. It is possible that field tests might be performed to provide preliminary information about final selection of a particular seed mixture regarding the ability to germinate and develop in soil conditions of the LTU. The following three factors must be considered for seeding:

1. Seeding Method—Broadcasting or drilling the seeds are the principal preferred methods. Broadcasting, followed by disking, provides the best soil-seed contact for establishing seedlings.
2. Seeding Rate—The suggested seeding rate will be 12 lbs/acre to provide adequate density of vegetative cover.
3. Seeding Depth—Seeding depth will be 0.25 to 0.50 in..

Table I-4 includes the species of grasses to be sown. These grasses are known to thrive locally. They share the characteristics of rapid germination and spread; resistance to fire, insects, and diseases; depth of root system to prevent erosion; vegetative thickness to minimize percolation; and low maintenance. The final vegetative cover will be capable of maintaining growth without extensive maintenance as required by 20 NMAC 4.1, Subpart V, §264.280(c)(2).

Table I-1. Approved Waste Streams Applied to the Land Treatment Unit

EPA Hazardous Waste No.	Waste Description	Annual Application Limit (tons)
D001	Ignitable materials	50
D007	Cooling Water Filter Sludge	5
K049	Slop Oil Emulsion Sludge	200
K050	Heat Exchanger Bundle Cleaning Sludge	15
K051	API Separator Sludge	1,000
K052	Tank Bottoms (Leaded)	5

Table I-2A. Schedule and Vegetative Cover Activities During Closure

Closure Schedule

An estimated 180 days will be required to accomplish closure procedures and reporting requirements. The year of closure of the Land Treatment Units is 2000. Closure will observe the schedule provided below.

Activity	Milestone Date[d]
Notify the NMED	- 90 days
Begin vegetative cover activities	Day 30
Submit certification report to NMED	Day 60

Vegetative Cover Activities During Closure

Activity	Milestone Date[a]
Microtox soil test[b], if necessary	Day 0[c]
Receive and evaluate test results	Day 30
Soil Amendments, if necessary	Day 60
Determine seeding time[a]	Day 60
Prepare LTU	Day 90
• Level surface	
• Add topsoil layer	
• Irrigate as necessary	
Low Maintenance Vegetation	Day 120
• Seeding	1-2 years[d]
• Irrigate as necessary to establish cover system	

[a]Completion dates are dependent on weather conditions and optimal seeding times. NMED will be notified if weather conditions delay listed activities. Under such circumstances, Ciniza will negotiate the closure schedule with NMED.

[b]Microtox or other soil chemical tests may be conducted as needed. Consult with professional agronomist as needed.

[c]Day 0 = within 90 days after post-closure permit issuance (Approval of Closure Plan), weather dependent.

[d]Time dependent on seed germination and vegetation maturity.

Table I-2B. *Final Closure*: Closure and Post-Closure Schedule of Activities

Day 0[1]

Activity	Years										
	1	2	3	4	5	6	7	8	9	19	30
Sample and Analysis											
ZOI									•	•	•
Treatment Zone									•	•	•
Chinle Slope Wash	•	•	•		•		•		•	•	•
Sonsela Aquifer	•	•	•		•		•		•	•	•
Inspection and Maintenance[2] (See Table F-1 for detailed schedule)	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Final Cover Activities[3]	•										
Certification of Post-Closure Care[4]											•

[1] Day 0: All post-closure activities begin 90 days after post-closure permit issuance.

[2] - - - - - - - = ongoing activity

[3] Final cover activities will be completed approximately 120 to 180 days after permit issuance. Completion date is dependent on weather conditions and optimal seeding times.

[4] Certification of post-closure care occurs 60 days after completion of the post-closure care period.

Table I-3. *Final Closure* Cost Estimate

Activity	Material	Cost Frequency (over 30 years)	Estimated Cost
Sample by Zone			
ZOI	4 samples at $1,450	3	$ 17,400
Treatment Zone	4 samples at $1,450	3	$ 17,400
Chinle Slope Wash	1 samples at $1,650	8	$ 13,200
Sonsela Aquifer	4 samples at $1,650	8	$ 52,800
Sample QC	25% of $100,800		$ 25,200
Mobilization			
ZOI and Treatment Zone	3 events at $1,000/event		$ 3,000
Chinle Slope Wash and Sonsela	8 events at $2,000/event		$ 16,000
Field Technician	$10,000		$ 10,000
Microtox	$300 per test	9	$ 2,700
Soil Amendments	352,000 ft^2 at 0.02/ft^2		$ 7,040
Establish Vegetative Cover			
Top Soil	7.8 acres at $2000/acre		$ 15,600
Level LTU	7.8 acres at $950/acre		$ 7,410
Plant Seed	7.8 acres at $750/acre		$ 5,850
Water	1140 Mgal. at $1/Mgal.		$ 1,140
Routine Inspection, Maintenance and Repair			
Site Inspection	Weekly inspection		$ 6,000
Security Device	$100 annually		$ 3,000
Runon/Runoff	$1,000 annually to maintain perimeter berm		$ 30,000
Prepare Certification			
• Certify LTU Closure	120 hours at $125/hour		$ 15,000
Notice in Deed	6 hours at $150/hour		$ 900
• Certify Final Closure	120 hours at $125/hour		$ 15,000
Notice in Deed	6 hours at $150/hour		$ 900
Total Task			$265,540
Indirect Costs	20% Closure and Post-Closure Cost		$ 53,108
Ciniza Overhead			$ 26,554
Contingency			$ 26,554
TOTAL			**$371,756**

Mgal. = million gallons
ZOI = Zone of Incorporation

Table I-4. Revegetation Seed Mixture

Seed Type	Pls/Ac[a]
Blue Grama, *Bouteloua gracilis* "Lovington"	2
Sideoats Grama, *Bouteloua curipendula* "El Reno"	4
Buffalo Grass, *Buchloeda tyloides* "Texoka"	5
Alkali Sacaton, *Sporbolus airoides*	0.5

[a]Pounds of pure live seed per acre.

Fence

Warning Signs

Figure I-2b. LTU, Location of Fence, and Warning Signs Detail/Photos

Attachment I-2

EPA's *Human Health Media-Specific Screening Levels*

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
N=non-carcinogenic effects
sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Acetaldehyde	75-07-0		9.3E+00	C	9.7E+00	C	2.1E+01	C	2.3E+01	C	8.7E-01	C	1.5E+00	C	
Acetochlor	34256-82-1		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
Acetone	67-64-1		1.5E+03	N	1.6E+03	N	5.8E+03	N	6.2E+03	N	3.7E+02	N	6.1E+02	N	8.0E-01
Acetonitrile	75-05-8		6.2E+02	N	6.2E+02	N	2.0E+03	N	2.0E+03	N	6.2E+01	N			
Acetophenone	98-86-2		5.0E-01	N	5.0E-01	N	1.6E+00	N	1.6E+00	N	2.1E-02	N	4.2E-02	N	
Acrolein	107-02-8		1.0E-01	N	1.0E-01	N	3.4E-01	N	3.4E-01	N	2.1E-02	N	4.2E-02	N	
Acrylamide	79-06-1		1.1E-01	C	1.4E-01	C	3.8E-01	C	1.3E+00	C	1.5E-03	C	1.5E-02	C	
Acrylic acid	79-10-7		2.9E+04	N	3.7E+04	N	1.0E+05	max	1.0E+05	max	1.0E+00	N	1.8E+04	N	
Acrylonitrile	107-13-1		2.0E-01	C	2.1E-01	C	4.6E-01	C	5.2E-01	C	2.8E-02	C	3.9E-02	C	
Alachlor	15972-60-8	2.0E+00	6.0E+00	C	8.0E+00	C	2.2E+01	C	7.1E+01	C	8.4E-02	C	8.4E-01	C	
Alar	1596-84-5		9.1E+03	N	1.2E+04	N	9.3E+04	N	1.0E+05	max	5.5E+02	N	5.5E+03	N	
Aldicarb	116-06-3	7.0E+00	6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Aldicarb sulfone	1646-88-4	7.0E+00	6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Aldrin	309-00-2		2.8E-02	C	3.8E-02	C	1.0E-01	C	3.4E-01	C	3.9E-04	C	4.0E-03	C	5.9E+02
Allyl chloride	107-05-1		3.0E+03	N	3.9E+03	N	3.1E+04	N	9.7E+04	N	1.0E+00	N	1.8E+03	N	
Aluminum	7429-90-5		7.8E+04	N	7.8E+04	N	1.0E+05	max	1.0E+05	max			3.7E+04	N	
Amdro	67485-29-4		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	1.1E+00	N	1.1E+01	N	
4-Aminopyridine	504-24-5		1.2E+00	N	1.6E+00	N	1.2E+01	N	4.1E+01	N	7.3E-02	N	7.3E-01	N	
Ammonia	7664-41-7										1.0E+02	N			
Aniline	62-53-3		8.5E+01	C	1.1E+02	C	3.1E+02	C	1.0E+03	C	1.0E+00	N	1.2E+01	C	
Antimony and compounds	7440-36-0	6.0E+00	3.1E+01	N	3.1E+01	N	8.2E+02	N	8.2E+02	N			1.5E+01	N	3.0E-01
Antimony pentoxide	1314-60-9		3.9E+01	N	3.9E+01	N	1.0E+03	N	1.0E+03	N			1.8E+01	N	
Antimony tetroxide	1332-81-6		3.1E+01	N	3.1E+01	N	8.2E+02	N	8.2E+02	N			1.5E+01	N	
Antimony trioxide	1309-64-4		3.1E+01	N	3.1E+01	N	8.2E+02	N	8.2E+02	N			1.5E+01	N	
Arsenic (noncancer endpoint)	7440-38-2	5.0E+01	2.2E+01	N	2.3E+01	N	3.6E+02	N	6.1E+02	N					
Arsenic (cancer endpoint)	7440-38-2		3.9E-01	C	4.3E-01	C	2.3E+00	C	3.8E+00	C	4.5E-04	C	4.5E-02	C	1.0E+00

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Arsine	7784-42-1										5.2E-02	N			
Assure	76578-12-6		5.5E+02	N	7.0E+02	N	5.6E+03	N	1.8E+04	N	3.3E+01	N	3.3E+02	N	
Atrazine	1912-24-9	3.0E+00	2.2E+00	C	2.9E+00	C	7.9E+00	C	2.6E+01	C	3.1E-02	C	3.0E-01	C	
Azobenzene	103-33-3		4.4E+00	C	5.8E+00	C	1.6E+01	C	5.2E+01	C	6.2E-02	C	6.1E-01	C	
Barium and compounds	7440-39-3	2.0E+03	5.4E+03	N	5.4E+03	N	1.0E+05	max	1.0E+05	max	5.2E-01	N	2.6E+03	N	8.2E+01
Baygon	114-26-1		2.4E+02	N	3.1E+02	N	2.5E+03	N	8.2E+03	N	1.5E+01	N	1.5E+02	N	
Baythroid	68359-37-5		1.5E+03	N	2.0E+03	N	1.6E+04	N	5.1E+04	N	9.1E+01	N	9.1E+02	N	
Bentazon	25057-89-0		1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
Benzaldehyde	100-52-7		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	
Benzene	71-43-2	5.0E+00	6.7E-01	C	6.8E-01	C	1.4E+00	C	1.5E+00	C	2.5E-01	C	4.2E-01	C	2.0E-03
Benzidine	92-87-5		2.1E-03	C	2.8E-03	C	7.6E-03	C	2.5E-02	C	2.9E-05	C	2.9E-04	C	
Benzoic acid	65-85-0		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	1.5E+04	N	1.5E+05	N	2.0E+01
Benzyl alcohol	100-51-6		1.8E+04	N	2.3E+04	N	1.0E+05	max	1.0E+05	max	1.1E+03	N	1.1E+04	N	
Benzyl chloride	100-44-7		8.3E-01	C	8.9E-01	C	2.0E+00	C	2.3E+00	C	4.0E-02	C	6.6E-02	C	
Beryllium and compounds	7440-41-7	4.0E+00	1.5E+02	N	1.5E+02	N	2.2E+03	C	2.2E+03	C	8.0E-04	C	7.3E+01	N	3.0E+00
1,1-Biphenyl	92-52-4		2.5E+03	N	3.0E+03	N	1.8E+04	N	3.0E+04	N	1.8E+02	N	3.0E+02	N	
Bis(2-chloroethyl)ether	111-44-4		1.9E-01	C	2.1E-01	C	4.9E-01	C	6.2E-01	C	5.8E-03	C	9.8E-03	C	2.0E-05
Bis(2-chloroisopropyl)ether	39638-32-9		2.6E+00	C	2.9E+00	C	6.6E+00	C	8.1E+00	C	1.9E-01	C	2.7E-01	C	
Bis(chloromethyl)ether	542-88-1		1.9E-04	C	1.9E-04	C	4.2E-04	C	4.4E-04	C	3.1E-05	C	5.2E-05	C	
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	6.0E+00	3.5E+01	C	4.6E+01	C	1.2E+02	C	4.1E+02	C	4.8E-01	C	4.8E+00	C	
Boron	7440-42-8		5.5E+03	N	7.0E+03	N	5.6E+04	N	1.0E+05	max	2.1E+01	N	3.3E+03	N	
Boron trifluoride	7637-07-2		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	7.3E-01	N			
Bromobenzene	108-86-1		2.8E+01	N	2.8E+01	N	9.2E+01	N	9.3E+01	N	1.0E+01	N	2.0E+01	N	
Bromodichloromethane	75-27-4		9.9E-01	C	1.0E+00	C	2.2E+00	C	2.4E+00	C	1.1E-01	C	1.8E-01	C	3.0E-02
Bromoform	75-25-2		6.1E+01	C	8.1E+01	C	2.2E+02	C	7.2E+02	C	1.7E+00	C	8.5E+00	C	4.0E-02

E. A REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
(tribromomethane)															
Bromomethane	74-83-9		3.9E+00	N	3.9E+00	N	1.3E+01	N	1.3E+01	N	5.2E+00	N	8.7E+00	N	1.0E-02
Bromophos	2104-96-3		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Bromoxynil	1689-84-5		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
1,3-Butadiene	106-99-0		6.5E-03	C	6.5E-03	C	1.4E-02	C	1.4E-02	C	6.9E-03	C	1.1E-02	C	
1-Butanol	71-36-3		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	9.0E-01
Butylate	2008-41-5		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	
n-Butylbenzene	104-51-8		1.4E+02	N	1.4E+02	N	2.4E+02	sat	2.4E+02	sat	3.7E+01	N	6.1E+01	N	
sec-Butylbenzene	135-9-88		1.1E+02	N	1.1E+02	N	2.2E+02	sat	2.2E+02	sat	3.7E+01	N	6.1E+01	N	
tert-Butylbenzene	104-5-18		1.3E+02	N	1.3E+02	N	3.9E+02	sat	3.9E+02	sat	3.7E+01	N	6.1E+01	N	
Butyl benzyl phthalate	85-68-7		2.4E+02	sat	2.4E+02	sat	2.4E+02	sat	2.4E+02	sat	7.3E+02	N	7.3E+03	N	8.1E+02
Cadmium and compounds	7440-43-9	5.0E+00	3.9E+01	N	3.9E+01	N	1.0E+03	N	1.0E+03	N	1.1E-03	C	1.8E+01	N	4.0E-01
Caprolactam	105-60-2		3.0E+04	N	3.9E+04	N	1.0E+05	max	1.0E+05	max	1.8E+03	N	1.8E+04	N	
Captan	133-06-2		1.4E+02	C	1.8E+02	C	5.0E+02	C	1.6E+03	C	1.9E+00	C	1.9E+01	C	
Carbaryl	63-25-2		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	4.0E+02	N	3.7E+03	N	
Carbazole	86-74-8		2.4E+01	C	3.2E+01	C	8.7E+01	C	2.9E+02	C	3.4E-01	C	3.4E+00	C	3.0E-02
Carbofuran	1563-66-2	4.0E+01	3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Carbon disulfide	75-15-0		3.5E+02	N	3.6E+02	N	7.2E+02	sat	7.2E+02	sat	7.3E+02	N	1.0E+03	N	2.0E+00
Carbon tetrachloride	56-23-5	5.0E+00	2.4E-01	C	2.4E-01	C	5.2E-01	C	5.3E-01	C	1.3E-01	C	1.7E-01	C	3.0E-03
Carbosulfan	55285-14-8		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Chloral	302-17-0		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
Chloranil	118-75-2		1.2E+00	C	1.6E+00	C	4.3E+00	C	1.4E+01	C	1.7E-02	C	1.7E-01	C	
Chlordane	57-74-9	2.0E+00	1.6E+00	C	1.8E+00	C	8.6E+00	C	1.6E+01	C	1.9E-02	C	1.9E-01	C	5.0E-01
Chlorine	7782-50-5		7.8E+03	N	7.8E+03	N	1.0E+05	max	1.0E+05	max			3.7E+03	N	
Chlorine dioxide	10049-04-4										2.1E-01	N			
Chloroacetic acid	79-11-8		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
4-Chloroaniline	106-47-8		2.4E+02	N	3.1E+02	N	2.5E+03	N	8.2E+03	N	1.5E+01	N	1.5E+02	N	3.0E-02

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Chlorobenzene	108-90-7		5.4E+01	N	5.5E+01	N	1.8E+02	N	1.8E+02	N	2.1E+01	N	3.9E+01	N	7.0E-02
Chlorobenzilate	510-15-6		1.8E+00	C	2.4E+00	C	6.5E+00	C	2.1E+01	C	2.5E-02	C	2.5E-01	C	
p-Chlorobenzoic acid	74-11-3		1.2E+04	N	1.6E+04	N	1.0E+05	max	1.0E+05	max	7.3E+02	N	7.3E+03	N	
4-Chlorobenzotrifluoride	98-56-6		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
2-Chloro-1,3-butadiene	126-99-8		3.6E+00	N	3.6E+00	N	1.2E+01	N	1.2E+01	N	7.3E+00	N	1.4E+01	N	
1-Chlorobutane	109-69-3		4.8E+02	sat	4.8E+02	sat	4.8E+02	sat	4.8E+02	sat	1.5E+03	N	2.4E+03	N	
1-Chloro-1,1-difluoroethane	75-68-3		3.4E+02	sat	3.4E+02	sat	3.4E+02	sat	3.4E+02	sat	5.2E+04	N	8.7E+04	N	
Chlorodifluoromethane	75-45-6		3.4E+02	sat	3.4E+02	sat	3.4E+02	sat	3.4E+02	sat	5.1E+04	N	8.5E+04	N	
2-Chloroethyl vinyl ether	110-75-8														
Chloroform	67-66-3		2.4E-01	C	2.4E-01	C	5.2E-01	C	5.2E-01	C	8.4E-02	C	1.6E-01	C	3.0E-02
Chloromethane	74-87-3		1.2E+00	C	1.2E+00	C	2.6E+00	C	2.7E+00	C	1.1E+00	C	1.5E+00	C	
4-Chloro-2-methylaniline	95-69-2		8.3E-01	C	1.1E+00	C	3.0E+00	C	9.9E+00	C	1.2E-02	C	1.2E-01	C	
beta-Chloronaphthalene	91-58-7		3.3E+03	N	3.9E+03	N	2.0E+04	N	2.7E+04	N	2.9E+02	N	4.9E+02	N	
o-Chloronitrobenzene	88-73-3		1.3E+01	C	1.5E+01	C	3.7E+01	C	5.9E+01	C	2.7E-01	C	4.5E-01	C	
p-Chloronitrobenzene	100-00-5		1.7E+01	C	2.0E+01	C	4.9E+01	C	7.6E+01	C	3.7E-01	C	6.2E-01	C	
2-Chlorophenol	95-57-8		6.1E+01	N	6.4E+01	N	2.3E+02	N	2.4E+02	N	1.8E+01	N	3.0E+01	N	2.0E-01
2-Chloropropane	75-29-6		1.7E+02	N	1.7E+02	N	5.8E+02	N	6.0E+02	N	1.0E+02	N	1.7E+02	N	
o-Chlorotoluene	95-49-8		1.5E+02	N	1.6E+02	N	5.1E+02	sat	5.1E+02	sat	7.3E+01	N	1.2E+02	N	
Chlorpyrifos	2921-88-2		1.8E+02	N	2.3E+02	N	1.9E+03	N	6.1E+03	N	1.1E+01	N	1.1E+02	N	
Chlorpyrifos-methyl	5598-13-0		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Chromium III	16065-83-1	1.0E+02	1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max			5.5E+04	N	
Total Chromium (1/6 ratio Cr VI/Cr III)	18540-29-9	1.0E+02	2.1E+02	C	2.1E+02	C	4.5E+02	C	4.5E+02	C	1.6E-04	C			2.0E+00
Chromium VI	7440-47-3	1.0E+02	3.0E+01	C	3.0E+01	C	6.4E+01	C	6.4E+01	C	2.3E-05	C	1.8E+02	N	2.0E+00
Cobalt	7440-48-4		3.4E+03	N	3.4E+03	N	2.9E+04	N	2.9E+04	N	2.1E-02	N	2.2E+03	N	
Coke Oven Emissions	8007-45-2				4.1E+03	C			8.7E+03	C	3.1E-03	C			

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)						Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Copper and compounds	7440-50-8	1.3E+03	2.9E+03	N	2.9E+03	N	7.6E+04	N	7.6E+04	N			1.4E+03	N	
Crotonaldehyde	123-73-9		5.3E-03	C	5.3E-03	C	1.1E-02	C	1.1E-02	C	3.5E-03	C	5.9E-03	C	
Cumene (isopropylbenzene)	98-82-8		1.6E+02	N	1.6E+02	N	5.2E+02	N	5.2E+02	N	4.0E+02	N	6.6E+02	N	
Cyanazine	21725-46-2		5.8E-01	C	7.6E-01	C	2.1E+00	C	6.8E+00	C	8.0E-03	C	8.0E-02	C	
Cyanides	n/a														
Barium cyanide	542-62-1		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max			3.7E+03	N	
Calcium cyanide	592-01-8		2.4E+03	N	3.1E+03	N	2.5E+04	N	8.2E+04	N			1.5E+03	N	
Copper cyanide	544-92-3		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N			1.8E+02	N	
Cyanogen	460-19-5		2.4E+03	N	3.1E+03	N	2.5E+04	N	8.2E+04	N					
Cyanogen bromide	506-68-3		5.5E+03	N	7.0E+03	N	5.6E+04	N	1.0E+05	max			3.3E+03	N	
Cyanogen chloride	506-77-4		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max			1.8E+03	N	
Free cyanide	57-12-5	2.0E+02	1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N			7.3E+02	N	2.0E+00
Hydrogen cyanide	74-90-8		1.1E+01	N	1.1E+01	N	3.5E+01	N	3.5E+01	N	3.1E+00	N	6.2E+00	N	
Potassium cyanide	151-50-8		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max			1.8E+03	N	
Potassium silver cyanide	506-61-6		1.2E+04	N	1.6E+04	N	1.0E+05	max	1.0E+05	max			7.3E+03	N	
Silver cyanide	506-64-9		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max			3.7E+03	N	
Sodium cyanide	143-33-9		2.4E+03	N	3.1E+03	N	2.5E+04	N	8.2E+04	N			1.5E+03	N	
Zinc cyanide	557-21-1		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max			1.8E+03	N	
Cyclohexanone	108-94-1		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	1.8E+04	N	1.8E+05	N	
Cyhalothrin/Karate	68085-85-8		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Cypermethrin	52315-07-8		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Dacthal	1861-32-1		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Dalapon	75-99-0	2.0E+02	1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
DDD	72-54-8		2.4E+00	C	2.7E+00	C	1.4E+01	C	2.4E+01	C	2.8E-02	C	2.8E-01	C	8.0E-01
DDE	72-55-9		1.7E+00	C	1.9E+00	C	1.0E+01	C	1.7E+01	C	2.0E-02	C	2.0E-01	C	3.0E+00
DDT	50-29-3		1.7E+00	C	1.9E+00	C	1.0E+01	C	1.7E+01	C	2.0E-02	C	2.0E-01	C	2.0E+00

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
N=non-carcinogenic effects
sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)						Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Diazinon	333-41-5		5.5E+01	N	7.0E+01	N	5.6E+02	N	1.8E+03	N	3.3E+00	N	3.3E+01	N	
Dibenzofuran	132-64-9		2.3E+02	N	2.9E+02	N	2.1E+03	N	5.1E+03	N	1.5E+01	N	2.4E+01	N	
1,4-Dibromobenzene	106-37-6		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Dibromochloromethane	124-48-1		9.7E-01	C	1.0E+00	C	2.2E+00	C	2.4E+00	C	8.0E-02	C	1.3E-01	C	2.0E-02
1,2-Dibromo-3-chloropropane	96-12-8		3.4E-01	C	4.5E-01	C	1.2E+00	C	4.0E+00	C	2.1E-01	N	4.8E-02	C	
1,2-Dibromoethane	106-93-4		5.3E-03	C	6.9E-03	C	1.8E-02	C	4.8E-02	C	8.7E-03	C	7.6E-04	C	
Dibutyl phthalate	84-74-2		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	2.7E+02
Dicamba	1918-00-9		1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
1,2-Dichlorobenzene	95-50-1		3.7E+02	sat	3.7E+02	sat	3.7E+02	sat	3.7E+02	sat	2.1E+02	N	3.7E+02	N	9.0E-01
1,3-Dichlorobenzene	541-73-1	6.0E+02	4.1E+01	N	4.1E+01	N	1.4E+02	N	1.4E+02	N	8.4E+00	N	1.7E+01	N	
1,4-Dichlorobenzene	106-46-7	7.5E+01	3.1E+00	C	3.2E+00	C	7.0E+00	C	7.5E+00	C	2.8E-01	C	4.7E-01	C	1.0E-01
3,3-Dichlorobenzidine	91-94-1		1.1E+00	C	1.4E+00	C	3.9E+00	C	1.3E+01	C	1.5E-02	C	1.5E-01	C	3.0E-04
1,4-Dichloro-2-butene	764-41-0		7.6E-03	C	7.9E-03	C	1.7E-02	C	1.8E-02	C	7.2E-04	C	1.2E-03	C	
Dichlorodifluoromethane	75-71-8		9.4E+01	N	9.4E+01	N	3.1E+02	N	3.1E+02	N	2.1E+02	N	3.9E+02	N	
1,1-Dichloroethane	75-34-3		5.8E+02	N	5.9E+02	N	2.0E+03	N	2.1E+03	N	5.2E+02	N	8.1E+02	N	1.0E+00
1,2-Dichloroethane (EDC)	107-06-2	5.0E+00	3.4E-01	C	3.5E-01	C	7.5E-01	C	7.7E-01	C	7.4E-02	C	1.2E-01	C	1.0E-03
1,1-Dichloroethylene	75-35-4	7.0E+00	5.3E-02	C	5.4E-02	C	1.2E-01	C	1.2E-01	C	3.8E-02	C	4.6E-02	C	3.0E-03
1,2-Dichloroethylene (cis)	156-59-2	7.0E+01	4.2E+01	N	4.3E+01	N	1.5E+02	N	1.5E+02	N	3.7E+01	N	6.1E+01	N	2.0E-02
1,2-Dichloroethylene (trans)	156-60-5	1.0E+02	6.3E+01	N	6.3E+01	N	2.1E+02	N	2.1E+02	N	7.3E+01	N	1.2E+02	N	3.0E-02
2,4-Dichlorophenol	120-83-2		1.8E+02	N	2.3E+02	N	1.9E+03	N	6.1E+03	N	1.1E+01	N	1.1E+02	N	5.0E-02
4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	94-82-6	7.0E+01	4.9E+02	N	6.3E+02	N	5.0E+03	N	1.6E+04	N	2.9E+01	N	2.9E+02	N	
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94-75-7		6.8E+02	N	7.8E+02	N	9.6E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
1,2-Dichloropropane	78-87-5	5.0E+00	3.5E-01	C	3.5E-01	C	7.5E-01	C	7.7E-01	C	9.9E-02	C	1.6E-01	C	1.0E-03
1,3-Dichloropropene	542-75-6		8.2E-02	C	8.2E-02	C	1.8E-01	C	1.8E-01	C	5.2E-02	C	8.1E-02	C	2.0E-04
2,3-Dichloropropanol	616-23-9		1.8E+02	N	2.3E+02	N	1.9E+03	N	6.1E+03	N	1.1E+01	N	1.1E+02	N	
Dichlorvos	62-73-7		1.7E+00	C	2.2E+00	C	6.0E+00	C	2.0E+01	C	2.3E-02	C	2.3E-01	C	
Dicofol	115-32-2		1.1E+00	C	1.5E+00	C	4.0E+00	C	1.3E+01	C	1.5E-02	C	1.5E-01	C	
Dicyclopentadiene	77-73-6		5.5E-01	N	5.5E-01	N	1.8E+00	N	1.8E+00	N	2.1E-01	N	4.2E-01	N	
Dieldrin	60-57-1		3.0E-02	C	4.0E-02	C	1.1E-01	C	3.6E-01	C	4.2E-04	C	4.2E-03	C	2.0E-04
Diethylene glycol, monobutyl ether	112-34-5		3.5E+02	N	4.5E+02	N	3.6E+03	N	1.2E+04	N	2.1E+01	N	2.1E+02	N	
Diethylene glycol, monoethyl ether	111-90-0		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	7.3E+03	N	7.3E+04	N	
Di(2-ethylhexyl)adipate	103-23-1	4.0E+02	4.0E+02	C	5.3E+02	C	1.5E+03	C	4.8E+03	C	5.6E+00	C	5.6E+01	C	
Diethyl phthalate	84-66-2		4.9E+04	N	6.3E+04	N	1.0E+05	max	1.0E+05	max	2.9E+03	N	2.9E+04	N	
Diethylstilbestrol	56-53-1		1.0E-04	C	1.4E-04	C	3.7E-04	C	1.2E-03	C	1.4E-06	C	1.4E-05	C	
Difenzoquat (Avenge)	43222-48-6		4.9E+03	N	6.3E+03	N	5.0E+04	N	1.0E+05	max	2.9E+02	N	2.9E+03	N	
1,1-Difluoroethane	75-37-6		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	4.2E+04	N	6.9E+04	N	
Diisopropyl methylphosphonate	1445-75-6		4.9E+03	N	6.3E+03	N	5.0E+04	N	1.0E+05	max	2.9E+02	N	2.9E+03	N	
3,3'-Dimethoxybenzidine	119-90-4		3.5E+01	C	4.6E+01	C	1.2E+02	C	4.1E+02	C	4.8E-01	C	4.8E+00	C	
Dimethylamine	124-40-3		6.4E-02	N	6.7E-02	N	2.4E-01	N	2.5E-01	N	2.1E-02	N	3.5E-02	N	
N-N-Dimethylaniline	121-69-7		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
2,4-Dimethylaniline	95-68-1		6.4E-01	C	8.5E-01	C	2.3E+00	C	7.6E+00	C	9.0E-03	C	9.0E-02	C	
2,4-Dimethylaniline hydrochloride	21436-96-4		8.3E-01	C	1.1E+00	C	3.0E+00	C	9.9E+00	C	1.2E-02	C	1.2E-01	C	
3,3'-Dimethylbenzidine	119-93-7		5.3E-02	C	7.0E-02	C	1.9E-01	C	6.2E-01	C	7.3E-04	C	7.3E-03	C	
1,1-Dimethylhydrazine	57-14-7		1.9E-01	C	2.5E-01	C	6.7E-01	C	2.2E+00	C	1.9E-03	C	2.6E-02	C	
1,2-Dimethylhydrazine	540-73-8		1.3E-02	C	1.7E-02	C	4.7E-02	C	1.5E-01	C	1.8E-04	C	1.8E-03	C	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Dimethylphenethylamine	122-09-8		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
2,4-Dimethylphenol	105-67-9		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	4.0E-01
2,6-Dimethylphenol	576-26-1		3.6E+01	N	4.7E+01	N	3.7E+02	N	1.2E+03	N	2.2E+00	N	2.2E+01	N	
3,4-Dimethylphenol	95-65-8		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Dimethyl phthalate	131-11-3		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	3.7E+04	N	3.7E+05	N	
4,6-Dinitro-o-cyclohexyl phenol	131-89-5		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
1,2-Dinitrobenzene	528-29-0		2.4E+01	N	3.1E+01	N	2.5E+02	N	8.2E+02	N	1.5E+00	N	1.5E+01	N	
1,3-Dinitrobenzene	99-65-0		6.1E+00	N	7.8E+00	N	6.2E+01	N	2.0E+02	N	3.7E-01	N	3.7E+00	N	
1,4-Dinitrobenzene	100-25-4		2.4E+01	N	3.1E+01	N	2.5E+02	N	8.2E+02	N	1.5E+00	N	1.5E+01	N	
2,4-Dinitrophenol	51-28-5		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	1.0E-02
Dinitrotoluene mixture	25321-14-6		7.1E-01	C	9.4E-01	C	2.6E+00	C	8.4E+00	C	9.9E-03	C	9.9E-02	C	4.0E-05
2,4-Dinitrotoluene	121-14-2		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	4.0E-05
2,6-Dinitrotoluene	606-20-2		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	3.0E-05
Dinoseb	88-85-7	7.0E+00	6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
di-n-Octyl phthalate	117-84-0		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	1.0E+04
1,4-Dioxane	123-91-1		4.4E+01	C	5.8E+01	C	1.6E+02	C	5.2E+02	C	6.1E-01	C	6.1E+00	C	
Dioxin (2,3,7,8-TCDD)	1746-01-6		3.9E-06	C	4.3E-06	C	2.3E-05	C	3.8E-05	C	4.5E-08	C	4.5E-07	C	
Diphenylamine	122-39-4		1.5E+03	N	2.0E+03	N	1.6E+04	N	5.1E+04	N	9.1E+01	N	9.1E+02	N	
1,2-Diphenylhydrazine	122-66-7		6.0E-01	C	8.0E-01	C	2.2E+00	C	7.2E+00	C	8.7E-03	C	8.4E-02	C	
Diphenyl sulfone	127-63-9		5.5E+02	N	7.0E+02	N	5.6E+03	N	1.8E+04	N	3.3E+01	N	3.3E+02	N	
Diquat	85-00-7	2.0E+01	1.3E+02	N	1.7E+02	N	1.4E+03	N	4.5E+03	N	8.0E+00	N	8.0E+01	N	
Disulfoton	298-04-4		2.4E+00	N	3.1E+00	N	2.5E+01	N	8.2E+01	N	1.5E-01	N	1.5E+00	N	
1,4-Dithiane	505-29-3		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Diuron	330-54-1		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
Endosulfan	115-29-7		3.6E+02	N	4.7E+02	N	3.7E+03	N	1.2E+04	N	2.2E+01	N	2.2E+02	N	9.0E-01
Endothall	145-73-3	1.0E+02	1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels								Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)				Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal		
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Endrin	72-20-8	2.0E+00	1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	1.1E+00	N	1.1E+01	N	5.0E-02
Epichlorohydrin	106-89-8		7.5E+00	N	7.6E+00	N	2.5E+01	N	2.6E+01	N	1.0E+00	N	2.0E+00	N	
Ethion	563-12-2		3.0E+01	N	3.9E+01	N	3.1E+02	N	1.0E+03	N	1.8E+00	N	1.8E+01	N	
2-Ethoxyethanol	110-80-5		2.4E+04	N	3.1E+04	N	1.0E+05	max	1.0E+05	max	2.1E+02	N	1.5E+04	N	
2-Ethoxyethanol acetate	111-15-9		1.8E+04	N	2.3E+04	N	1.0E+05	max	1.0E+05	max	1.1E+03	N	1.1E+04	N	
Ethyl acetate	141-78-6		1.7E+04	N	1.9E+04	N	3.7E+04	sat	3.7E+04	sat	3.3E+03	N	5.5E+03	N	
Ethylbenzene	100-41-4	7.0E+02	2.3E+02	sat	2.3E+02	sat	2.3E+02	sat	2.3E+02	sat	1.1E+03	N	1.3E+03	N	7.0E-01
Ethyl chloride	75-00-3		1.6E+03	sat	1.6E+03	sat	1.6E+03	sat	1.6E+03	sat	1.0E+04	N	8.6E+03	N	
Ethylene diamine	107-15-3		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
Ethylene glycol	107-21-1		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	7.3E+03	N	7.3E+04	N	
Ethylene glycol, monobutyl ether	111-76-2		3.5E+02	N	4.5E+02	N	3.6E+03	N	1.2E+04	N	2.1E+01	N	2.1E+02	N	
Ethylene oxide	75-21-8		1.3E-01	C	1.4E-01	C	3.1E-01	C	3.6E-01	C	1.9E-02	C	2.4E-02	C	
Ethylene thiourea (ETU)	96-45-7		4.4E+00	C	5.8E+00	C	1.6E+01	C	5.2E+01	C	6.1E-02	C	6.1E-01	C	
Ethyl ether	60-29-7		1.8E+03	sat	1.8E+03	sat	1.8E+03	sat	1.8E+03	sat	7.3E+02	N	1.2E+03	N	
Ethyl methacrylate	97-63-2		1.4E+02	sat	1.4E+02	sat	1.4E+02	sat	1.4E+02	sat	3.3E+02	N	5.5E+02	N	
Fenamiphos	22224-92-6		1.5E+01	N	2.0E+01	N	1.6E+02	N	5.1E+02	N	9.1E-01	N	9.1E+00	N	
Fluometuron	2164-17-2		7.9E+02	N	1.0E+03	N	8.1E+03	N	2.7E+04	N	4.7E+01	N	4.7E+02	N	
Fluoride	16984-48-8		3.6E+03	N	4.7E+03	N	3.7E+04	N	1.0E+05	max			2.2E+03	N	
Fomesafen	72178-02-0		2.5E+00	C	3.4E+00	C	9.2E+00	C	3.0E+01	C	3.5E-02	C	3.5E-01	C	
Fonofos	944-22-9		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
Formaldehyde	50-00-0		9.1E+03	N	1.2E+04	N	9.3E+04	N	1.0E+05	max	1.5E-01	C	5.5E+03	N	
Formic Acid	64-18-6		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	7.3E+03	N	7.3E+04	N	
Furan	110-00-9		2.5E+00	N	2.5E+00	N	8.5E+00	N	8.6E+00	N	3.7E+00	N	6.1E+00	N	
Furazolidone	67-45-8		1.3E-01	C	1.7E-01	C	4.6E-01	C	1.5E+00	C	1.8E-03	C	1.8E-02	C	
Furfural	98-01-1		1.8E+02	N	2.3E+02	N	1.9E+03	N	6.1E+03	N	5.2E+01	N	1.1E+02	N	
Glycidaldehyde	765-34-4		2.4E+01	N	3.1E+01	N	2.5E+02	N	8.2E+02	N	1.0E+00	N	1.5E+01	N	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
N=non-carcinogenic effects
sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)						Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Glyphosate	1071-83-6	7.0E+02	6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	
Heptachlor	76-44-8	1.0E-01	1.1E-01	C	1.4E-01	C	3.9E-01	C	1.3E+00	C	1.5E-03	C	1.5E-02	C	1.0E+00
Heptachlor epoxide	1024-57-3	2.0E-01	5.3E-02	C	7.0E-02	C	1.9E-01	C	6.3E-01	C	7.4E-04	C	7.4E-03	C	3.0E-02
Hexabromobenzene	87-82-1		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
Hexachlorobenzene	118-74-1	1.0E+00	3.0E-01	C	4.0E-01	C	1.1E+00	C	3.6E+00	C	4.2E-03	C	4.2E-02	C	1.0E-01
Hexachlorobutadiene	87-68-3		6.2E+00	C	8.2E+00	C	2.2E+01	C	7.3E+01	C	8.7E-02	C	8.6E-01	C	1.0E-01
HCH (alpha)	319-84-6		9.0E-02	C	1.0E-01	C	4.8E-01	C	9.1E-01	C	1.1E-03	C	1.1E-02	C	3.0E-05
HCH (beta)	319-85-7		3.1E-01	C	3.6E-01	C	1.7E+00	C	3.2E+00	C	3.7E-03	C	3.7E-02	C	1.0E-04
HCH (gamma) Lindane	58-89-9	2.0E-01	4.4E-01	C	4.9E-01	C	2.3E+00	C	4.4E+00	C	5.2E-03	C	5.2E-02	C	5.0E-04
HCH-technical	608-73-1		3.1E-01	C	3.6E-01	C	1.7E+00	C	3.2E+00	C	3.8E-03	C	3.7E-02	C	1.0E-04
Hexachlorocyclo-pentadiene	77-47-4	5.0E+01	4.2E+02	N	5.4E+02	N	4.2E+03	N	1.3E+04	N	7.3E-02	N	2.6E+02	N	2.0E+01
Hexachlorodibenzo-p-dioxin mixture (HxCDD)	19408-74-3		7.8E-05	C	1.0E-04	C	2.8E-04	C	9.2E-04	C	1.5E-06	C	1.1E-05	C	
Hexachloroethane	67-72-1		3.5E+01	C	4.6E+01	C	1.2E+02	C	4.1E+02	C	4.8E-01	C	4.8E+00	C	2.0E-02
Hexachlorophene	70-30-4		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	1.1E+00	N	1.1E+01	N	
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4		4.4E+00	C	5.8E+00	C	1.6E+01	C	5.2E+01	C	6.1E-02	C	6.1E-01	C	
1,6-Hexamethylene diisocyanate	822-06-0		1.7E-01	N	2.2E-01	N	1.8E+00	N	5.8E+00	N	1.0E-02	N	1.0E-01	N	
n-Hexane	110-54-3		1.1E+02	sat	1.1E+02	sat	1.1E+02	sat	1.1E+02	sat	2.1E+02	N	3.5E+02	N	
Hexazinone	51235-04-2		2.0E+03	N	2.6E+03	N	2.1E+04	N	6.7E+04	N	1.2E+02	N	1.2E+03	N	
Hydrazine, hydrazine sulfate	302-01-2		1.6E-01	C	2.1E-01	C	5.8E-01	C	1.9E+00	C	3.9E-04	C	2.2E-02	C	
Hydrogen chloride	7647-01-0		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	2.1E+01	N			
Hydrogen sulfide	7783-06-4		1.8E+02	N	2.3E+02	N	1.9E+03	N	6.1E+03	N	1.0E+00	N	1.1E+02	N	
p-Hydroquinone	123-31-9		2.4E+03	N	3.1E+03	N	2.5E+04	N	8.2E+04	N	1.5E+02	N	1.5E+03	N	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Iron	7439-89-6		2.3E+04	N	2.3E+04	N	1.0E+05	max	1.0E+05	max			1.1E+04	N	
Isobutanol	78-83-1		1.1E+04	N	1.3E+04	N	4.0E+04	sat	4.0E+04	sat	1.1E+03	N	1.8E+03	N	
Isophorone	78-59-1		5.1E+02	C	6.7E+02	C	1.8E+03	C	6.0E+03	C	7.1E+00	C	7.1E+01	C	3.0E-02
Isopropalin	33820-53-0		9.1E+02	N	1.2E+03	N	9.3E+03	N	3.1E+04	N	5.5E+01	N	5.5E+02	N	
Isopropyl methyl phosphonic acid	1832-54-8		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	4.0E+02	N	3.7E+03	N	
Kepone	143-50-0		2.7E-02	C	3.6E-02	C	9.7E-02	C	3.2E-01	C	3.7E-04	C	3.7E-03	C	
Lead	7439-92-1	1.5E+01	4.0E+02				2.0E+03						1.5E+01		
Lead (tetraethyl)	78-00-2		6.1E-03	N	7.8E-03	N	6.2E-02	N	2.0E-01	N			3.7E-03	N	
Lithium	7439-93-2		1.6E+03	N	1.6E+03	N	4.1E+04	N	4.1E+04	N			7.3E+02	N	
Malathion	121-75-5		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
Maleic anhydride	108-31-6		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	
Manganese and compounds	7439-96-5		3.2E+03	N	3.2E+03	N	4.7E+04	N	4.7E+04	N	5.1E-02	N	1.7E+03	N	
Mephosfolan	950-10-7		5.5E+00	N	7.0E+00	N	5.6E+01	N	1.8E+02	N	3.3E-01	N	3.3E+00	N	
Mepiquat	24307-26-4		1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
2-Mercaptobenzothiazole	149-30-4		1.7E+01	C	2.2E+01	C	6.0E+01	C	2.0E+02	C	2.3E-01	C	2.3E+00	C	
Mercury and compounds	7487-94-7	2.0E+00	2.3E+01	N	2.3E+01	N	6.1E+02	N	6.1E+02	N			1.1E+01	N	
Mercury (elemental)	7439-97-6										3.1E-01	N			
Mercury (methyl)	22967-92-6		6.1E+00	N	7.8E+00	N	6.2E+01	N	2.0E+02	N			3.7E+00	N	
Methacrylonitrile	126-98-7		1.9E+00	N	2.1E+00	N	8.0E+00	N	8.8E+00	N	7.3E-01	N	1.0E+00	N	
Methanol	67-56-1		3.0E+04	N	3.9E+04	N	1.0E+05	max	1.0E+05	max	1.8E+03	N	1.8E+04	N	
Methidathion	950-37-8		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Methoxychlor	72-43-5	4.0E+01	3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	8.0E+00
Methyl acetate	79-20-9		2.0E+04	N	2.2E+04	N	8.7E+04	N	9.6E+04	N	3.7E+03	N	6.1E+03	N	
Methyl acrylate	96-33-3		6.9E+01	N	7.0E+01	N	2.3E+02	N	2.3E+02	N	1.1E+02	N	1.8E+02	N	
2-Methylaniline (o-	95-53-4		2.0E+00	C	2.7E+00	C	7.3E+00	C	2.4E+01	C	2.8E-02	C	2.8E-01	C	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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sat= soil saturation concentration
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)						Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
toluidine)															
2-Methyl-4-chlorophenoxyacetic acid	94-74-6		3.0E+01	N	3.9E+01	N	3.1E+02	N	1.0E+03	N	1.8E+00	N	1.8E+01	N	
4-(2-Methyl-4-chlorophenoxy) butyric acid (MCPB)	94-81-5		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
2-(2-Methyl-4-chlorophenoxy) propionic acid	93-65-2		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
2-(2-Methyl-1,4-chlorophenoxy) propionic acid (MCPP)	16484-77-8		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Methylcyclohexane	108-87-2		1.4E+02	sat	1.4E+02	sat	1.4E+02	sat	1.4E+02	sat	3.1E+03	N	5.2E+03	N	
4,4'-Methylene bis(2-chloroaniline)	101-14-4		3.7E+00	C	4.9E+00	C	1.3E+01	C	4.4E+01	C	5.2E-02	C	5.2E-01	C	
4,4'-Methylene bis(N,N'-dimethyl)aniline	101-61-1		1.1E+01	C	1.4E+01	C	3.8E+01	C	1.2E+02	C	1.5E-01	C	1.5E+00	C	
Methylene bromide	74-95-3		1.3E+02	N	1.4E+02	N	5.2E+02	N	5.5E+02	N	3.7E+01	N	6.1E+01	N	
Methylene chloride	75-09-2		8.6E+00	C	8.9E+00	C	1.9E+01	C	2.1E+01	C	4.1E+00	C	4.3E+00	C	1.0E-03
4,4'-Methylenediphenyl isocyanate	101-68-8		1.0E+01	N	1.3E+01	N	1.1E+02	N	3.5E+02	N	6.2E-01	N	6.2E+00	N	
Methyl ethyl ketone	78-93-3		7.0E+03	N	7.3E+03	N	2.6E+04	N	2.8E+04	N	1.0E+03	N	1.9E+03	N	
Methyl hydrazine	60-34-4		4.4E-01	C	5.8E-01	C	1.6E+00	C	5.2E+00	C	6.1E-03	C	6.1E-02	C	
Methyl isobutyl ketone	108-10-1		7.6E+02	N	7.9E+02	N	2.8E+03	N	2.9E+03	N	8.3E+01	N	1.6E+02	N	
Methyl mercaptan	74-93-1		3.5E+01	N	4.5E+01	N	3.6E+02	N	1.2E+03	N	2.1E+00	N	2.1E+01	N	
Methyl methacrylate	80-62-6		2.2E+03	N	2.2E+03	N	2.7E+03	sat	2.7E+03	sat	7.3E+02	N	1.4E+03	N	
2-Methyl-5-nitroaniline	99-55-8		1.5E+01	C	1.9E+01	C	5.3E+01	C	1.7E+02	C	2.0E-01	C	2.0E+00	C	
Methyl parathion	298-00-0		1.5E+01	N	2.0E+01	N	1.6E+02	N	5.1E+02	N	9.1E-01	N	9.1E+00	N	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)	Tap Water (Residential Scenario: Ingestion & Inhalation)	
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3	ug/l	mg/kg
2-Methylphenol	95-48-7		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	8.0E-01
3-Methylphenol	108-39-4		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	
4-Methylphenol	106-44-5		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Methyl phosphonic acid	993-13-5		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
Methyl styrene (mixture)	25013-15-4		1.2E+02	N	1.3E+02	N	5.1E+02	N	5.6E+02	N	4.2E+01	N	6.0E+01	N	
Methyl styrene (alpha)	98-83-9		6.8E+02	sat	6.8E+02	sat	6.8E+02	sat	6.8E+02	sat	2.6E+02	N	4.3E+02	N	
Methyl tertbutyl ether (MTBE)	1634-04-4										3.1E+03	N	2.0E+01		
Metolaclor (Dual)	51218-45-2		9.1E+03	N	1.2E+04	N	9.3E+04	N	1.0E+05	max	5.5E+02	N	5.5E+03	N	
Mirex	2385-85-5		2.7E-01	C	3.6E-01	C	9.7E-01	C	3.2E+00	C	3.7E-03	C	3.7E-02	C	
Molybdenum	7439-98-7		3.9E+02	N	3.9E+02	N	1.0E+04	N	1.0E+04	N			1.8E+02	N	
Monochloramine	10599-90-3		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	
Naled	300-76-5		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
Nickel and compounds	7440-02-0	1.0E+02	1.6E+03	N	1.6E+03	N	4.1E+04	N	4.1E+04	N			7.3E+02	N	7.0E+00
Nickel refinery dust	n/a		1.1E+04	C	1.1E+04	C	2.2E+04	C	2.2E+04	C	8.0E-03	C			
Nickel subsulfide	12035-72-2		5.2E+03	C	5.2E+03	C	1.1E+04	C	1.1E+04	C	4.0E-03	C			
Nitrate	14797-55-8	1.0E+04											1.0E+04		
Nitric Oxide	10102-43-9		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max			3.7E+03	N	
Nitrite	14797-65-0	1.0E+03											1.0E+03		
2-Nitroaniline	88-74-4		3.6E+00	N	4.7E+00	N	3.7E+01	N	1.2E+02	N	2.1E-01	N	2.2E+00	N	
Nitrobenzene	98-95-3		1.7E+01	N	2.0E+01	N	9.1E+01	N	1.1E+02	N	2.1E+00	N	3.4E+00	N	7.0E-03
Nitrofurantoin	67-20-9		4.2E+03	N	5.5E+03	N	4.4E+04	N	1.0E+05	max	2.6E+02	N	2.6E+03	N	
Nitrofurazone	59-87-0		3.2E-01	C	4.3E-01	C	1.2E+00	C	3.8E+00	C	7.2E-04	C	4.5E-02	C	
Nitrogen dioxide	101102-44-0		6.1E+04	N	7.8E+04	N	1.0E+05	max	1.0E+05	max			3.7E+04	N	
4-Nitrophenol	100-02-7		3.8E+03	N	4.8E+03	N	3.9E+04	N	1.0E+05	max	2.3E+02	N	2.3E+03	N	
2-Nitropropane	79-46-9		5.1E-02	C	6.8E-02	C	1.9E-01	C	6.1E-01	C	7.2E-04	C	1.2E-03	C	
N-Nitrosodi-n-butylamine	924-16-3		2.3E-02	C	2.4E-02	C	5.4E-02	C	6.2E-02	C	1.2E-03	C	2.0E-03	C	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
N=non-carcinogenic effects
sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)	Tap Water (Residential Scenario: Ingestion & Inhalation)	
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3	ug/l	mg/kg
N-Nitrosodiethanolamine	1116-54-7		1.7E-01	C	2.3E-01	C	6.2E-01	C	2.0E+00	C	2.4E-03	C	2.4E-02	C	
N-Nitrosodiethylamine	55-18-5		3.2E-03	C	4.3E-03	C	1.2E-02	C	3.8E-02	C	4.5E-05	C	4.5E-04	C	
N-Nitrosodimethylamine	62-75-9		9.5E-03	C	1.3E-02	C	3.4E-02	C	1.1E-01	C	1.4E-04	C	1.3E-03	C	
N-Nitrosodiphenylamine	86-30-6		9.9E+01	C	1.3E+02	C	3.6E+02	C	1.2E+03	C	1.4E+00	C	1.4E+01	C	6.0E-02
N-Nitroso di-n-propylamine	621-64-7		6.9E-02	C	9.1E-02	C	2.5E-01	C	8.2E-01	C	9.6E-04	C	9.6E-03	C	2.0E-06
N-Nitroso-N-methylethylamine	10595-95-6		2.2E-02	C	2.9E-02	C	7.9E-02	C	2.6E-01	C	3.1E-04	C	3.1E-03	C	
N-Nitrosopyrrolidine	930-55-2		2.3E-01	C	3.0E-01	C	8.3E-01	C	2.7E+00	C	3.1E-03	C	3.2E-02	C	
m-Nitrotoluene	99-08-1		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
o-Nitrotoluene	99-08-1		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
p-Nitrotoluene	99-99-0		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
NuStar	85509-19-9		4.2E+01	N	5.5E+01	N	4.4E+02	N	1.4E+03	N	2.6E+00	N	2.6E+01	N	
Octahydro-1357-tetranitro-1357- tetrazocine (HMX)	2691-41-0		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	
Oryzalin	19044-88-3		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	
Oxadiazon	19666-30-9		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Oxamyl	23135-22-0	2.0E+02	1.5E+03	N	2.0E+03	N	1.6E+04	N	5.1E+04	N	9.1E+01	N	9.1E+02	N	
Oxyfluorfen	42874-03-3		1.8E+02	N	2.3E+02	N	1.9E+03	N	6.1E+03	N	1.1E+01	N	1.1E+02	N	
Paraquat	4685-14-7		2.7E+02	N	3.5E+02	N	2.8E+03	N	9.2E+03	N	1.6E+01	N	1.6E+02	N	
Parathion	56-38-2		3.6E+02	N	4.7E+02	N	3.7E+03	N	1.2E+04	N	2.2E+01	N	2.2E+02	N	
Pentachlorobenzene	608-93-5		4.9E+01	N	6.3E+01	N	5.0E+02	N	1.6E+03	N	2.9E+00	N	2.9E+01	N	
Pentachloronitrobenzene	82-68-8		1.9E+00	C	2.5E+00	C	6.7E+00	C	2.2E+01	C	2.6E-02	C	2.6E-01	C	
Pentachlorophenol	87-86-5	1.0E+00	2.9E+00	C	5.3E+00	C	7.1E+00	C	4.8E+01	C	5.6E-02	C	5.6E-01	C	1.0E-03
Perchlorate	7601-90-3		3.9E+01	N	3.9E+01	N	1.0E+03	N	1.0E+03	N			1.8E+01	N	
Permethrin	52645-53-1		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	
Phenol	108-95-2		3.6E+04	N	4.7E+04	N	1.0E+05	max	1.0E+05	max	2.2E+03	N	2.2E+04	N	5.0E+00

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Phenothiazine	92-84-2		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
m-Phenylenediamine	108-45-2		3.6E+02	N	4.7E+02	N	3.7E+03	N	1.2E+04	N	2.2E+01	N	2.2E+02	N	
p-Phenylenediamine	106-50-3		1.2E+04	N	1.5E+04	N	1.0E+05	max	1.0E+05	max	6.9E+02	N	6.9E+03	N	
Phenylmercuric acetate	62-38-4		4.9E+00	N	6.3E+00	N	5.0E+01	N	1.6E+02	N	2.9E-01	N	2.9E+00	N	
2-Phenylphenol	90-43-7		2.5E+02	C	3.3E+02	C	9.0E+02	C	2.9E+03	C	3.5E+00	C	3.5E+01	C	
Phosphine	7803-51-2		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	3.1E-01	N	1.1E+01	N	
Phosphoric acid	7664-38-2										1.0E+01	N			
Phosphorus (white)	7723-14-0		1.6E+00	N	1.6E+00	N	4.1E+01	N	4.1E+01	N			7.3E-01	N	
p-Phthalic acid	100-21-0		6.1E+04	N	7.8E+04	N	1.0E+05	max	1.0E+05	max	3.7E+03	N	3.7E+04	N	
Phthalic anhydride	85-44-9		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	1.2E+02	N	7.3E+04	N	
Polybrominated biphenyls			5.4E-02	C	7.2E-02	C	2.0E-01	C	6.4E-01	C	7.6E-04	C	7.6E-03	C	
Polychlorinated biphenyls (PCBs)	1336-36-3	5.0E-01	2.2E-01	C	3.2E-01	C	6.8E-01	C	2.9E+00	C	3.4E-03	C	3.4E-02	C	
Aroclor 1016	12674-11-2		3.9E+00	N	5.5E+00	N	3.4E+01	N	1.4E+02	N	2.6E-01	N	2.6E+00	N	
Aroclor 1254	11097-69-1		1.1E+00	N	1.6E+00	N	9.8E+00	N	4.1E+01	N	7.3E-02	N	7.3E-01	N	
Polynuclear aromatic hydrocarbons															
Acenaphthene	83-32-9		2.8E+03	N	3.7E+03	N	2.0E+04	N	3.8E+04	N	2.2E+02	N	3.7E+02	N	2.9E+01
Anthracene	120-12-7		1.6E+04	N	2.2E+04	N	1.0E+05	max	1.0E+05	max	1.1E+03	N	1.8E+03	N	5.9E+02
Benz[a]anthracene	56-55-3		6.2E-01	C	8.8E-01	C	2.0E+00	C	7.8E+00	C	2.2E-02	C	9.2E-02	C	8.0E-02
Benzo[b]fluoranthene	205-99-2		6.2E-01	C	8.8E-01	C	2.0E+00	C	7.8E+00	C	2.2E-02	C	9.2E-02	C	2.0E-01
Benzo[k]fluoranthene	207-08-9		6.2E+00	C	8.8E+00	C	2.0E+01	C	7.8E+01	C	2.2E-01	C	9.2E-01	C	2.0E+00
Benzo[a]pyrene	50-32-8	2.0E-01	6.2E-02	C	8.8E-02	C	2.0E-01	C	7.8E-01	C	2.2E-03	C	9.2E-03	C	4.0E-01
Chrysene	218-01-9		6.2E+01	C	8.8E+01	C	2.0E+02	C	7.8E+02	C	2.2E+00	C	9.2E+00	C	8.0E+00
Dibenz[ah]anthracene	53-70-3		6.2E-02	C	8.8E-02	C	2.0E-01	C	7.8E-01	C	2.2E-03	C	9.2E-03	C	8.0E-02
Fluoranthene	206-44-0		2.3E+03	N	3.1E+03	N	2.1E+04	N	8.2E+04	N	1.5E+02	N	1.5E+03	N	2.1E+02
Fluorene	86-73-7		2.0E+03	N	2.6E+03	N	1.5E+04	N	3.3E+04	N	1.5E+02	N	2.4E+02	N	2.8E+01
Indeno[1,2,3-cd]pyrene	193-39-5		6.2E-01	C	8.8E-01	C	2.0E+00	C	7.8E+00	C	2.2E-02	C	9.2E-02	C	7.0E-01

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)						Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Naphthalene	91-20-3		5.5E+01	N	5.6E+01	N	1.9E+02	N	1.9E+02	N	3.1E+00	N	6.2E+00	N	4.0E+00
Pyrene	129-00-0		1.7E+03	N	2.3E+03	N	1.5E+04	N	5.4E+04	N	1.1E+02	N	1.8E+02	N	2.1E+02
Prometon	1610-18-0		9.1E+02	N	1.2E+03	N	9.3E+03	N	3.1E+04	N	5.5E+01	N	5.5E+02	N	
Prometryn	7287-19-6		2.4E+02	N	3.1E+02	N	2.5E+03	N	8.2E+03	N	1.5E+01	N	1.5E+02	N	
Propachlor	1918-16-7		7.9E+02	N	1.0E+03	N	8.1E+03	N	2.7E+04	N	4.7E+01	N	4.7E+02	N	
Propanil	709-98-8		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Propargite	2312-35-8		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
Propargyl alcohol	107-19-7		1.2E+02	N	1.6E+02	N	1.2E+03	N	4.1E+03	N	7.3E+00	N	7.3E+01	N	
Propazine	139-40-2		1.2E+03	N	1.6E+03	N	1.2E+04	N	4.1E+04	N	7.3E+01	N	7.3E+02	N	
Propiconazole	60207-90-1		7.9E+02	N	1.0E+03	N	8.1E+03	N	2.7E+04	N	4.7E+01	N	4.7E+02	N	
iso-Propylbenzene	104-5-18		1.3E+02	N	1.3E+02	N	3.9E+02	sat	3.9E+02	sat	3.7E+01	N	6.1E+01	N	
n-Propylbenzene	104-51-8		1.4E+02	N	1.4E+02	N	2.4E+02	sat	2.4E+02	sat	3.7E+01	N	6.1E+01	N	
Propylene glycol	57-55-6		1.0E+05	max	1.0E+05	max	1.0E+05	max	1.0E+05	max	7.3E+04	N	7.3E+05	N	
Propylene glycol, monoethyl ether	111-35-3		4.2E+04	N	5.5E+04	N	1.0E+05	max	1.0E+05	max	2.6E+03	N	2.6E+04	N	
Propylene glycol, monomethyl ether	107-98-2		4.2E+04	N	5.5E+04	N	1.0E+05	max	1.0E+05	max	2.1E+03	N	2.6E+04	N	
Propylene oxide	75-56-9		1.6E+00	C	1.9E+00	C	4.9E+00	C	9.1E+00	C	5.2E-01	C	2.2E-01	C	
Pursuit	81335-77-5		1.5E+04	N	2.0E+04	N	1.0E+05	max	1.0E+05	max	9.1E+02	N	9.1E+03	N	
Pyridine	110-86-1		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Quinoline	91-22-5		4.0E-02	C	5.3E-02	C	1.5E-01	C	4.8E-01	C	5.6E-04	C	5.6E-03	C	
RDX (Cyclonite)	121-82-4		4.4E+00	C	5.8E+00	C	1.6E+01	C	5.2E+01	C	6.1E-02	C	6.1E-01	C	
Resmethrin	10453-86-8		1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
Ronnel	299-84-3		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	
Rotenone	83-79-4		2.4E+02	N	3.1E+02	N	2.5E+03	N	8.2E+03	N	1.5E+01	N	1.5E+02	N	
Selenious Acid	7783-00-8		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N			1.8E+02	N	
Selenium	7782-49-2	5.0E+01	3.9E+02	N	3.9E+02	N	1.0E+04	N	1.0E+04	N			1.8E+02	N	3.0E-01

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Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Silver and compounds	7440-22-4		3.9E+02	N	3.9E+02	N	1.0E+04	N	1.0E+04	N			1.8E+02	N	2.0E+00
Simazine	122-34-9	4.0E+00	4.0E+00	C	5.3E+00	C	1.5E+01	C	4.8E+01	C	5.6E-02	C	5.6E-01	C	
Sodium azide	26628-22-8		2.4E+02	N	3.1E+02	N	2.5E+03	N	8.2E+03	N	1.5E+01	N	1.5E+02	N	
Sodium diethyldithiocarbamate	148-18-5		1.8E+00	C	2.4E+00	C	6.5E+00	C	2.1E+01	C	2.5E-02	C	2.5E-01	C	
Sodium fluoroacetate	62-74-8		1.2E+00	N	1.6E+00	N	1.2E+01	N	4.1E+01	N	7.3E-02	N	7.3E-01	N	
Sodium metavanadate	13718-26-8		6.1E+01	N	7.8E+01	N	6.2E+02	N	2.0E+03	N	3.7E+00	N	3.7E+01	N	
Strontium, stable	7440-24-6		4.7E+04	N	4.7E+04	N	1.0E+05	max	1.0E+05	max			2.2E+04	N	
Strychnine	57-24-9		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	1.1E+00	N	1.1E+01	N	
Styrene	100-42-5	1.0E+02	1.7E+03	sat	1.7E+03	sat	1.7E+03	sat	1.7E+03	sat	1.1E+03	N	1.6E+03	N	2.0E-01
2,3,7,8-TCDD (dioxin)	1746-01-6	3.0E-05	3.9E-06	C	4.3E-06	C	2.3E-05	C	3.8E-05	C	4.5E-08	C	4.5E-07	C	
1,2,4,5-Tetrachlorobenzene	95-94-3		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	1.1E+00	N	1.1E+01	N	
1,1,1,2-Tetrachloroethane	630-20-6		2.9E+00	C	3.0E+00	C	6.6E+00	C	7.1E+00	C	2.6E-01	C	4.3E-01	C	
1,1,2,2-Tetrachloroethane	79-34-5		3.7E-01	C	3.8E-01	C	8.4E-01	C	9.0E-01	C	3.3E-02	C	5.5E-02	C	2.0E-04
Tetrachloroethylene (PCE)	127-18-4	5.0E+00	4.9E+00	C	5.7E+00	C	1.3E+01	C	1.9E+01	C	3.3E+00	C	1.1E+00	C	3.0E-03
2,3,4,6-Tetrachlorophenol	58-90-2		1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
p,a,a,a-Tetrachlorotoluene	5216-25-1		2.4E-02	C	3.2E-02	C	8.7E-02	C	2.9E-01	C	3.4E-04	C	3.4E-03	C	
Tetrachlorovinphos	961-11-5		2.0E+01	C	2.7E+01	C	7.3E+01	C	2.4E+02	C	2.8E-01	C	2.8E+00	C	
Tetrahydrofuran	109-99-9		5.2E+03	N	6.7E+03	N	5.3E+04	N	1.0E+05	max	3.1E+02	N	3.1E+03	N	
Thallic oxide	1314-32-5		5.5E+00	N	5.5E+00	N	1.4E+02	N	1.4E+02	N			2.6E+00	N	
Thallium acetate	563-68-8	2.0E+00	7.0E+00	N	7.0E+00	N	1.8E+02	N	1.8E+02	N			3.3E+00	N	4.0E-01
Thallium carbonate	6533-73-9	2.0E+00	6.3E+00	N	6.3E+00	N	1.6E+02	N	1.6E+02	N			2.9E+00	N	4.0E-01
Thallium chloride	7791-12-0	2.0E+00	6.3E+00	N	6.3E+00	N	1.6E+02	N	1.6E+02	N			2.9E+00	N	4.0E-01
Thallium nitrate	10102-45-1	2.0E+00	7.0E+00	N	7.0E+00	N	1.8E+02	N	1.8E+02	N			3.3E+00	N	4.0E-01
Thallium selenite	12039-52-0	2.0E+00	7.0E+00	N	7.0E+00	N	1.8E+02	N	1.8E+02	N			3.3E+00	N	4.0E-01
Thallium sulfate	7446-18-6	2.0E+00	6.3E+00	N	6.3E+00	N	1.6E+02	N	1.6E+02	N			2.9E+00	N	4.0E-01

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
N=non-carcinogenic effects
sat= soil saturation concentration
max= maximum concentration

Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels										Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)						Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal				
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
Thiobencarb	28249-77-6		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
Thiocyanate	N/A		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	
Tin and compounds	N/A		4.7E+04	N	4.7E+04	N	1.0E+05	max	1.0E+05	max			2.2E+04	N	
Toluene	108-88-3	1.0E+03	5.2E+02	sat	5.2E+02	sat	5.2E+02	sat	5.2E+02	sat	4.0E+02	N	7.2E+02	N	6.0E-01
Toluene-2,4-diamine	95-80-7		1.5E-01	C	2.0E-01	C	5.5E-01	C	1.8E+00	C	2.1E-03	C	2.1E-02	C	
Toluene-2,5-diamine	95-70-5		3.6E+04	N	4.7E+04	N	1.0E+05	max	1.0E+05	max	2.2E+03	N	2.2E+04	N	
Toluene-2,6-diamine	823-40-5		1.2E+04	N	1.6E+04	N	1.0E+05	max	1.0E+05	max	7.3E+02	N	7.3E+03	N	
p-Toluidine	106-49-0		2.5E+00	C	3.4E+00	C	9.2E+00	C	3.0E+01	C	3.5E-02	C	3.5E-01	C	
Toxaphene	8001-35-2	3.0E+00	4.4E-01	C	5.8E-01	C	1.6E+00	C	5.2E+00	C	6.0E-03	C	6.1E-02	C	2.0E+00
1,2,4-Tribromobenzene	615-54-3		3.0E+02	N	3.9E+02	N	3.1E+03	N	1.0E+04	N	1.8E+01	N	1.8E+02	N	
Tributyltin oxide (TBTO)	56-35-9		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N			1.1E+01	N	
2,4,6-Trichloroaniline	634-93-5		1.4E+01	C	1.9E+01	C	5.1E+01	C	1.7E+02	C	2.0E-01	C	2.0E+00	C	
1,2,4-Trichlorobenzene	120-82-1	7.0E+01	5.2E+02	N	6.5E+02	N	3.0E+03	sat	3.0E+03	sat	2.1E+02	N	1.9E+02	N	3.0E-01
1,1,1-Trichloroethane	71-55-6	2.0E+02	7.1E+02	N	7.7E+02	N	1.4E+03	sat	1.4E+03	sat	1.0E+03	N	7.9E+02	N	1.0E-01
1,1,2-Trichloroethane	79-00-5	5.0E+00	8.2E-01	C	8.4E-01	C	1.8E+00	C	1.9E+00	C	1.2E-01	C	2.0E-01	C	9.0E-04
Trichloroethylene (TCE)	79-01-6	5.0E+00	2.7E+00	C	2.8E+00	C	6.0E+00	C	6.1E+00	C	1.1E+00	C	1.6E+00	C	3.0E-03
Trichlorofluoromethane	75-69-4		3.8E+02	N	3.9E+02	N	1.3E+03	N	1.3E+03	N	7.3E+02	N	1.3E+03	N	
2,4,5-Trichlorophenol	95-95-4		6.1E+03	N	7.8E+03	N	6.2E+04	N	1.0E+05	max	3.7E+02	N	3.7E+03	N	1.4E+01
2,4,6-Trichlorophenol	88-06-2		4.4E+01	C	5.8E+01	C	1.6E+02	C	5.2E+02	C	6.2E-01	C	6.1E+00	C	8.0E-03
2,4,5-Trichlorophenoxyacetic Acid	93-76-5		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
2-(2,4,5-Trichlorophenoxy) propionic acid	93-72-1		4.9E+02	N	6.3E+02	N	5.0E+03	N	1.6E+04	N	2.9E+01	N	2.9E+02	N	
1,1,2-Trichloropropane	598-77-6		1.5E+01	N	1.5E+01	N	5.1E+01	N	5.1E+01	N	1.8E+01	N	3.0E+01	N	
1,2,3-Trichloropropane	96-18-4		1.4E-03	C	1.4E-03	C	3.1E-03	C	3.1E-03	C	9.6E-04	C	1.6E-03	C	
1,2,3-Trichloropropene	96-19-5		1.1E+01	N	1.2E+01	N	3.8E+01	N	3.9E+01	N	1.8E+01	N	3.0E+01	N	

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

Basis: C=carcinogenic effects
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Contaminant	CAS No.	MCL or Action Level	Risk-Based Screening Levels												Soil Screening Level- Transfers from Soil to: Ground water (DAF=1)
			Soil (ingestion, inhalation, with and without dermal exposure routes)								Ambient Air (Residential Scenario)		Tap Water (Residential Scenario: Ingestion & Inhalation)		
			Residential		Residential w/o dermal		Industrial		Industrial w/o dermal						
		ug/l	mg/kg		mg/kg		mg/kg		mg/kg		ug/m3		ug/l		mg/kg
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1		5.6E+03	sat	5.6E+03	sat	5.6E+03	sat	5.6E+03	sat	3.1E+04	N	5.9E+04	N	
Triethylamine	121-44-8		2.2E+01	N	2.3E+01	N	8.4E+01	N	8.8E+01	N	7.3E+00	N	1.2E+01	N	
1,2,4-Trimethylbenzene	95-63-6		5.2E+01	N	5.2E+01	N	1.7E+02	N	1.7E+02	N	6.2E+00	N	1.2E+01	N	
1,3,5-Trimethylbenzene	108-67-8		2.1E+01	N	2.1E+01	N	7.0E+01	N	7.0E+01	N	6.2E+00	N	1.2E+01	N	
Trimethyl phosphate	512-56-1		1.3E+01	C	1.7E+01	C	4.7E+01	C	1.5E+02	C	1.8E-01	C	1.8E+00	C	
1,3,5-Trinitrobenzene	99-35-4		1.8E+03	N	2.3E+03	N	1.9E+04	N	6.1E+04	N	1.1E+02	N	1.1E+03	N	
Trinitrophenylmethyl-nitramine	479-45-8		6.1E+02	N	7.8E+02	N	6.2E+03	N	2.0E+04	N	3.7E+01	N	3.7E+02	N	
2,4,6-Trinitrotoluene	118-96-7		1.6E+01	C	2.1E+01	C	5.8E+01	C	1.9E+02	C	2.2E-01	C	2.2E+00	C	
Vanadium	7440-62-2		5.5E+02	N	5.5E+02	N	1.4E+04	N	1.4E+04	N			2.6E+02	N	3.0E+02
Vanadium pentoxide	1314-62-1		7.0E+02	N	7.0E+02	N	1.8E+04	N	1.8E+04	N			3.3E+02	N	3.0E+02
Vanadium sulfate	13701-70-7		1.6E+03	N	1.6E+03	N	4.1E+04	N	4.1E+04	N			7.3E+02	N	3.0E+02
Vinclozolin	50471-44-8		1.5E+03	N	2.0E+03	N	1.6E+04	N	5.1E+04	N	9.1E+01	N	9.1E+02	N	
Vinyl acetate	108-05-4		4.3E+02	N	4.3E+02	N	1.4E+03	N	1.4E+03	N	2.1E+02	N	4.1E+02	N	8.0E+00
Vinyl bromide	593-60-2		1.9E-01	C	1.9E-01	C	4.1E-01	C	4.2E-01	C	6.1E-02	C	1.0E-01	C	
Vinyl chloride	75-01-4	2.0E+00	2.1E-02	C	2.2E-02	C	4.7E-02	C	4.9E-02	C	2.2E-02	C	2.0E-02	C	7.0E-04
Warfarin	81-81-2		1.8E+01	N	2.3E+01	N	1.9E+02	N	6.1E+02	N	1.1E+00	N	1.1E+01	N	
m-Xylene	108-38-3		2.1E+02	sat	2.1E+02	sat	2.1E+02	sat	2.1E+02	sat	7.3E+02	N	1.4E+03	N	1.0E+01
o-Xylene	95-47-6		2.8E+02	sat	2.8E+02	sat	2.8E+02	sat	2.8E+02	sat	7.3E+02	N	1.4E+03	N	9.0E+00
p-Xylene	106-42-3		3.7E+02	sat	3.7E+02	sat	3.7E+02	sat	3.7E+02	sat					1.0E+01
Zinc	7440-66-6		2.3E+04	N	2.3E+04	N	1.0E+05	max	1.0E+05	max			1.1E+04	N	6.2E+02
Zinc phosphide	1314-84-7		2.3E+01	N	2.3E+01	N	6.1E+02	N	6.1E+02	N			1.1E+01	N	
Zineb	12122-67-7		3.0E+03	N	3.9E+03	N	3.1E+04	N	1.0E+05	max	1.8E+02	N	1.8E+03	N	

J.0 SOLID WASTE MANAGEMENT UNITS

The information provided in this section is submitted in accordance with the applicable requirements of 20 NMAC 4.1 Subpart IX, §270.14(d). The solid waste management units (SWMUs) identified at Ciniza are listed in Ciniza's Hazardous Waste Facility Permit NMD000333211-2 (EPA 1988).

Ciniza uses the definition of a SWMU presented in 50 *Federal Register* (FR) 278702. This definition states that a SWMU is "any unit at the facility from which hazardous constituents might migrate, irrespective of whether the unit was intended for the management of solid and/or hazardous wastes." Applying the definition to units at Ciniza, the following have the potential to be considered SWMUs:

- Container storage units
- Tanks
- Surface impoundments
- Waste piles
- Land treatment units
- Landfills
- Incinerators
- Underground injection wells
- Physical, chemical, and biological treatment units
- Recycling units
- Areas contaminated by routine and systematic discharges from process areas

In August 1987, a RCRA Facility Assessment (RFA) was conducted at Ciniza that identified 17 SWMUs and 10 *units of concern* requiring investigation as sources of suspected releases of hazardous material to the environment. From the original 27 SWMUs identified in the Resource Conservation Recovery Act Facility Assessment (RFA), EPA identified and designated 13 SWMUs in the HSWA permit. The *Aeration Basin*, not previously classified as either a SWMU or *unit of concern*, was added to the list in the HSWA permit as (i) *Aeration Basin* resulting in 14 SWMUs. In 1990, in response to permit requirements, Ciniza conducted a release verification and source characterization study and developed a site-specific Resource Conservation Act Facility Investigation (RFI) Work Plan. In the RFI Work Plan the 14 SWMUs were reduced to 13 because the *Inactive Land Treatment Area* and the *Drainage Ditch* were combined to become SWMU No. 9, the *Drainage Ditch Near the Inactive Land Treatment Area.*

The Ciniza SWMU numbering system differs in the various Ciniza and EPA reference documents related to SWMUs. The 1998 HSWA permit lists each SWMU preceded by a lowercase roman numeral. The lowercase roman numerals reflects the document numbering format, not SWMU identification numbers. The 1990 RFI Work Plan provides the first SWMU numbering system for the 14 SWMUs. EPA letters, 1994, refer to both the RFI Work Plan numbering system and to arabic numbers assigned to the roman numerals used in the HSWA permit as a format numbering system. Table J-2 provides a crosswalk between the SWMU numbers designated

in the various reference documents. This Part B post-closure permit application uses the SWMU numbering system from the RFI Work Plan.

Between November 1990, and October 1992, Ciniza prepared three RFI reports covering the 14 SWMUs and submitted them to the EPA for review and comment. Based on the nature and extent of contamination detected during the RFI, 10 of the SWMUs were recommended for no further action. The four remaining SWMUs were recommended for corrective action. Voluntary Corrective Action Plans (VCAPs) were prepared for these four SWMUs and submitted to EPA for review. The following sections describe the activities conducted during RFIs and correctives actions conducted, as required. Table J-1 provides the SWMU number, SWMU title, and current status of the Ciniza SWMUs; Figure J-14 depicts the 13 SWMUs on the survey plat; and Volume III of this Part B post-closure application provides SWMU Summary Reports as Appendices I-1 through I-13.

J.1 SWMU No. 1, Aeration Basin

SWMU No. 1 (Figure J-1) consists of three cells located west of the Ciniza tank farm. The three cells include two aerated lagoons and Evaporation Pond No. 1. The aeration basins site was identified as a SWMU, and designated as SWMU No. 1 during a RFI conducted at the refinery in the early 1990's. Soil samples were collected on the perimeter of the site and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Based on soil sample results, Ciniza recommended NFA for SWMU No. 1. EPA formally agreed with this finding (Attachment J-1); however, EPA required periodic soil sample collection around the aeration basin every five years. Ciniza submitted a survey plat of the site to EPA in 1995. Ciniza conducted the first sampling event in October 1996, and submitted results to the New Mexico Oil Conservation Division (NMOCD) in their Quarterly Progress Report for fourth quarter 1996. The *Aeration Basin - SWMU No. 1 Summary* is included as Appendix I-1.

J.2 SWMU No. 2, Evaporation Ponds

SWMU No. 2 (Figure J-2) consists of a series of evaporation ponds located west and northwest of the Ciniza tank farm. The evaporation pond area was identified as a SWMU, and designated as SWMU No. 2 during a RFI conducted at the refinery in the early 1990's. This investigation included both soil and groundwater sampling and analysis. Samples were collected around the perimeter of the ponds and were sampled for VOCs, SVOCs, and metals. Ciniza recommended NFA for this SWMU and EPA formally approved the finding of NFA on January 7, 1994 (Attachment J-1); however, EPA requested follow-up groundwater sampling from the seven groundwater wells surrounding the evaporation ponds every five years, with analysis identical to that required in the RFI. Ciniza initiated the five-year sampling schedule in 1996. The survey plat, as required, was submitted to EPA in 1995. The *Evaporation Ponds - SWMU No. 2 Summary* is included as Appendix I-2.

J.3 SWMU No. 3, Empty Container Storage Area

SWMU No. 3 (Figure J-3) consists of the empty container storage area, which was located behind the maintenance buildings. The area was used for storing empty drums awaiting recycle. The empty container storage area was identified as a SWMU, and designated as SWMU No. 3, during a RFI conducted at the refinery in the early 1990's. The investigation focused on soil sampling and anaysis. Soil borings were drilled to a depth of 4.5 ft, within the perimeter of the empty container storage area. Samples were collected from each boring in accordance with procedures specified in the Ciniza Sampling and Analysis Plan. Samples were analyzed for priority VOCs using EPA-approved methods.

Ciniza recommended NFA for this SWMU and EPA formally approved the finding of NFA on January 7, 1994 (Attachment J-1). The survey plat as required was submitted to EPA in 1995. The *Empty Container Storage - SWMU No. 3 Summary* is included as Appendix I-3.

J.4 SWMU No. 4, Old Burn Pit

SWMU No. 4 (Figure J-4) consists of the old burn pit located just north of the Ciniza tank farm. The old burn pit was used to burn acid-soluble oils (ASOs). ASOs are heavy-molecular-weight, asphalt-type, cross-polymerized hydrocarbons. The old burn pit was identified as a SWMU, and designated as SWMU No. 4, during a RFI conducted at the refinery during the early 1990's. The RFI investigation included soil sampling and analysis. Soil borings were drilled to a depth of 4.5 ft, within the perimeter of the old burn pit. Soil samples were collected from each boring and were analyzed for VOCs, SVOCs, total metals, and pH using EPA-approved methods. Trace organics and metals were detected. Ciniza recommended NFA for this SWMU, which was rejected by EPA (Attachment J-1). The EPA required additional borings with samples collected at 6 and 10 ft. As an interim measure, an engineered earthen cap composed of low hydraulic conductivity, native soil has been installed over the site. The *Old Burn Pit - SWMU No. 4 Summary* details these activities and is included as Appendix I-4.

J.5 SWMU No. 5, Landfill Areas

In 1987 five inactive solid waste landfill areas were identified a SWMU during a RFA. No further action was recommended at one site, but further evaluation was required at the other four landfill areas. A subsequent RFI designated these four inactive solid waste landfill areas collectively as SWMU No. 5. SWMU No. 5 (Figure J-5) is located midway between the Ciniza tank farm and air strip. Three of the landfill areas are contiguous, and the fourth is located approximately 50 feet north of the main landfill area. The landfills were used to dispose of

nonregulated materials from refinery construction, maintenance, and operational activities.. The landfills have been inactive since the early 1980s.

Landfill Area SWMU No. 5 was recommended for corrective action in the Phase III RFI. A VCAP was submitted in March 1993; the recommendation was regrading of the landfills, compaction and placement of a 6-in. vegetated cover layer. EPA approved the VCAP on January 5, 1994 (Attachment J-1). Ciniza proceeded with capping the landfills in accordance with the approved VCAP. This activity has been documented in the *Landfill Area - SWMU No. 5 Closure Certification*. The closure certification report is included as Appendix I-5 and provides certification of closure by a registered Professional Engineer.

J.6 SWMU No. 6, Tank Farm—Leaded Gasoline Tanks

SWMU No. 6 (Figure J-6) consists of 10 tanks in the refinery storage area that were used for the storage of leaded gasolines. The tank farm area was identified as a SWMU, and designated as SWMU No. 6, during a RFI conducted at the refinery in the early 1990's. Trace organics and metals were detected. In 1994, EPA requested additional sampling at greater depth (Attachment J-1). Vertical borings were made near the manway of each tank and an angle boring was made at a preapproved location around each tank. Soil samples were collected and analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX); lead; and nickel. Laboratory analysis of the free product indicated that it was gasoline.

Ciniza submitted a VCAP in April 1996 (Giant 1996). The VCAP proposed product recovery from the two investigation wells, with downgradient well monitoring thereafter. The NMOCD approved the VCAP with modifications, which included drilling six borings to identify the vertical and horizontal extent of the gasoline plume. Corrective action is proceeding in accordance with the VCAP. The *Tank Farm—Leaded Gasoline Tanks - SWMU No. 6 Summary* is included as Appendix I-6.

J.7 SWMU No. 7, Fire Training Area

SWMU No. 7 (Figure J-7) consists of the fire training area located adjacent to the idle process equipment storage area. It consists of a fire water header, a 4-ft-high by 16-ft-diameter tank, and an industrial pump on a cement pedestal. The fire training area was used two to three times a year to train Ciniza Refinery fire crews. The fire training area was identified as a SWMU, and designated as SWMU No. 7, during a RFI conducted at the refinery in the early 1990's. The investigation included soil sampling and analysis. Soil borings were drilled to a depth of 4.5 ft around the perimeter of the fire training area. Soil samples were collected at each boring and sampled for oil and grease and total petroleum hydrocarbons (TPH) using EPA-approved methods.

The *Fire Training Area* SWMU No. 7 was recommended for corrective action in the Phase III RFI and a VCAP was submitted in March 1993 (Giant 1993a). The VCAP recommends removing the existing steel tank, aeration of soils beneath the tank to a depth of 5 ft, amending soils with fertilizer and water to increase biological degradation, and quarterly monitoring. When oil and grease are at, or below cleanup levels, closure will be initiated. The EPA approved the VCAP January 5, 1994. Corrective action is proceeding in accordance with the VCAP. The *Fire Training Area - SWMU No. 7 Summary* is included as Appendix I-7.

J.8 SWMU No. 8, Railroad Rack Lagoon

SWMU No. 8 (Figure J-8) consists of the railroad rack lagoon, and its overflow ditch and fanout. This area is located to the north of the refinery tank farm area near the railway spur. The railroad rack lagoon was identified as a SWMU, and designated as SWMU No. 8, during a RFI conducted at the refinery in the early 1990's. Soil samples from adjacent and under the railroad rack lagoon and within the overflow ditch and fanout area were collected and analyzed during this initial investigation. A Final Remedy Plan was proposed in the Phase I RFI supplemental report, which included diverting drainage water around the railroad rack from the existing lagoon to the refinery wastewater system; plugging the old system; transferring the lagoon liquids to the refinery wastewater system; and treating contaminated soils. This procedure was formalized through a VCAP for the Railroad Rack Lagoon. The VCAP was submitted to the EPA in December 1992 and approved in November 1993 (Attachment J-1); however, additional site monitoring during soil remediation is required. Ciniza completed the piping modifications and evacuation of lagoon liquids by June 1994. Corrective action is ongoing in accordance with the approved VCAP criteria. The *Railroad Rack Lagoon - SWMU No. 8 Summary* is included as Appendix I-8.

J.9 SWMU No. 9 and No. 14, Drainage Ditch Near the Inactive Land Farm

SWMU No. 9 (Figure J-9) consists of an inactive treatment area and associated drainage ditch. This SWMU is located north of the Ciniza tank farm. In 1990 the *Inactive Land Treatment Unit* and *Drainage Ditch* were identified as SWMU No. 9 and SWMU No. 14, respectively. They were combined to become SWMU No. 9, the *Drainage Ditch Near the Inactive Land Treatment Area.* Specific sample activities at SWMU No. 9 included vertical soil borings at the inactive treatment area. The soil samples were analyzed for VOCs, SVOCs, and total metals. Ciniza recommended NFA for the *Drainage Ditch Near the Inactive Land Treatment Area;* a survey plat was submitted to EPA in July 1995 (Attachment J-1). The *Drainage Ditch Near the Inactive Land Farm - SWMU No. 9 and No. 14 Summary* is included as Appendix I-9.

J.10 SWMU No. 10, Sludge Pits

SWMU No. 10 (Figure J-10) consists of two former American Petroleum Institute (API) separator sludge pits located to the west of the existing API separator. The pits were backfilled in 1980. The sludge pit area was identified as a SWMU, and designated as SWMU No. 10, during a RFI conducted at the refinery in the early 1990's. Soil borings were advanced at this site, and samples were collected and analyzed for VOCs, SVOCs, and metals. Soil sampling results detected organic contaminants. A Final Remedy Plan was proposed in the Phase I RFI supplemental report, which included remediation of the soils. In place remediation of the soils was formalized in the VCAP for the Sludge Pits submitted to the EPA in December 1992. The EPA approved the VCAP in November 1993, requiring additional site monitoring. The additional monitoring was completed in 1994. Ciniza is proceeding with corrective actions in accordance with the approved VCAP criteria. The *Sludge Pits - SWMU No. 10 Summary* is submitted as Appendix I-10.

J.11 SWMU No. 11, Secondary Oil Skimmer

SWMU No. 11 (Figure J-11) consists of the secondary oil skimmer located south of the main evaporation ponds. Prior to removal, it was used as a backup oil skimmer during maintenance activities on the primary oil skimmer. During a 1987 RFA the secondary oil skimmer was identified as a *unit of concern*. Subsequent investigation determined this area to be a SWMU, designated as SWMU No. 11. Soil samples were collected from the oil skimmer area in accordance with the Ciniza Sampling and Analysis Plan. Each of the borings and analyzed for VOCs and SVOCs using EPA-approved methods. Based on sample results, Ciniza recommended NFA. The EPA rejected the recommendation and required two additional borings with samples collected at 10 ft. Additional monitoring was completed. Ciniza is proceeding with corrective actions in accordance with the approved VCAP criteria. The *Secondary Oil Skimmer - SWMU No. 11 Summary* is submitted as Appendix I-11.

J.12 SWMU No. 12, Contact Wastewater Collection System

SWMU No. 12 (Figure J-12) consists of the piping runs and catch basins of the Contact Wastewater Collection System (CWWCS). A Vactor system was used to clean the sewer boxes and underground lines. Once cleaned, the lines were inspected by inserting TV cameras inside the pipe and video taping the inside of the lines. The inspection showed evidence of pitting and corrosion throughout the CWWCS; however, it did not show any evidence of leaks or exfiltration of hydrocarbons into the surrounding soil. NFA was recommended for the CWWCS in the Phase I RFI report. EPA rejected the NFA recommendation and required inspection of the CWWCS every five years, beginning in calendar year 1996. The inspection was to be identical to the one performed in the RFI unless better technologies are proposed by Ciniza and approved by EPA. Ciniza is currently inspecting the system and will notify the NMOCD upon completion. CWWCS is also regulated by the NMOCD pursuant to Clean Water Act (G10-32-Part A). Because the CWWCS is a closed loop system connected to a

permitted unit, it is exempt from HSWA based on Criterion 2 (Attachment J-1). The *Contact Wastewater Collection System - SWMU No. 12 Summary* is submitted as Appendix I-12.

J.13 SWMU No. 13, Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds (a.k.a. Drainage Ditch Between API Evaporation Ponds and the North Series and South Series of Ponds)

SWMU No. 13 (Figure J-13) consists of the small overflow lagoon known as Pond No. 10 and its associated drainage ditch. The drainage ditch site was identified as a SWMU, and designated as SWMU No. 13, during a RFI conducted at the refinery in the early 1990's. Based on the results of soil collected on the perimeter of the pond and beside the ditch, Ciniza recommended NFA for this SWMU. The EPA concurred with this finding of NFA and approved cessation of the investigative process; however, they required soil sample collection around the drainage ditch every five years, with analysis identical to that required in the RFI. The EPA reviewed Ciniza's proposal and in August 1994, agreed to the five-year sampling schedule to begin in 1995. Ciniza also submitted a survey plat of the site in July 1995. Ciniza conducted the first sampling event in October 1996, and submitted results to the NMOCD in their Quarterly Progress Report for fourth-quarter 1996. The *Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds - SWMU No. 13 Summary* is submitted as Appendix I-13.

Table J-1. Solid Waste Management Units

SWMU No.[1]	SWMU Title	Status	Report
1	The Aeration Basin (i)[2]	EPA approval of NFA given in January 1994. Survey plat[3] submitted to EPA. Investigative process complete. Five-year sampling of soil around basin required again in 2001.	Appendix I-1: Aeration Basin - SWMU No. 1 Summary
2	The Evaporation Ponds (ii)	EPA approval of NFA given in January 1994. Investigative process complete. Follow-up monitoring required. Survey plat[3] submitted. Five-year sampling required again in 2001.	Appendix I-2: Evaporation Ponds - SWMU No. 2 Summary
3	Empty Container Storage Area (v)	EPA approval of NFA given January 1994. Investigative process complete. Survey plat[3] submitted to EPA.	Appendix I-3: Empty Container Storage Area - SWMU No. 3 Summary
4	Old Burn Pit (viii)	RFI 1990; sampling report identified corrective action. Site capped in 1998. Investigative process complete. Survey plat[3] submitted.	Appendix I-4: Old Burn Pit - SWMU No. 4 Summary
5	Landfill Areas (vii)	VCAP submitted February 1993 and approved in January 1994. Closure plan prepared and certified by PE, 1998.	Appendix I-5: Landfill Areas - SWMU No. 5 Closure Certification
6	The Tank Farm—Leaded Gasoline Tanks (iii)	VCAP submitted in April 1996. Investigative process complete. Corrective action currently under way. Survey plat[3] submitted.	Appendix I-6: Tank Farm—Leaded Gasoline Tanks - SWMU No. 6 Summary
7	Fire Training Area (iv)	VCAP submitted in March 1993, and approved via fax in March 1996. RFI sampling complete. Investigative process complete. Survey plat[3] submitted. Corrective action ongoing.	Appendix I-7: Fire Training Area - SWMU No. 7 Summary
8	The Railroad Rack Lagoon (vi)	VCAP submitted in December 1992, and approved in November 1994. RFI sampling complete. Investigative process complete. Corrective action ongoing. Survey plat[3] submitted.	Appendix I-8: Railroad Rack Lagoon - SWMU No. 8 Summary
9	The Drainage Ditch Near the Inactive Land Farm (x and xiii)	RFI sampling complete. Report on additional RFI sampling suggested NFA. Investigative process complete. Survey plat[3] submitted to EPA.	Appendix I-9: Drainage Ditch and the Inactive Land Farm - SWMU No. 9 Summary
10	The Sludge Pits (ix)	VCAP submitted in December 1992, and approved in January 1994. RFI sampling complete. Investigative process complete. Proceed with closure activities. Survey plat[3] submitted.	Appendix I-10: Sludge Pits - SWMU No. 10 Summary

Table J-1. Solid Waste Management Units (Continued)

SWMU No.[1]	SWMU Title	Status	Report
11	Secondary Oil Skimmer (xi)	RFI sampling complete. Report on additional RFI sampling suggested NFA. Investigative process complete. Corrective action ongoing. Survey plat[3] submitted.	Appendix I-11: Secondary Oil Skimmer - SWMU No. 11 Summary
12	Contact Wastewater Collection System (CWWCS) (xii)	Investigative process complete. EPA requires inspection every 5 years. Ciniza currently repairing and inspecting system. Will notify NMOCD upon completion.	Appendix I-12: Contact Wastewater Collection System - SWMU No. 12 Summary
13	The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds (xiv)	EPA approval of NFA given in January 1994. Follow-up monitoring required. Survey plat[3] submitted to EPA. Soil sampling collected around drainage ditch required again in 2001.	Appendix I-13: Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds - SWMU No. 13 Summary

[1]Solid Waste Management Unit Numbers as designated in the RCRA Facility Investigation Work Plan (submitted May 1990).

[2]Solid Waste Management Unit Numbers as designated in the HSWA Permit (Section C, Corrective Actions for Continuing Releases, 5.(a)(1). December 1988.

[3]See Figure J-14.

Table J-2. Ciniza Refinery—Solid Waste Management Unit Identification

Description	HSWA[1] Permit 1988	RFI[2] Work Plan 1990	EPA[3] Letters 1994	LTU[4] Post-Closure Part B 1998
Aeration Basin	i	1	1	1
Evaporation Ponds	ii	2	2	2
Empty Container Storage Area	v	3	5	3
Old Burn Pit	viii	4	8	4
Landfill Areas	vii	5	7	5
Tank Farm	iii	6	6	6
Fire Training Area	iv	7	4	7
Railroad Rack Lagoon, Overflow Ditch and Fan Out Area	vi	8	8	8
Inactive Land Treatment Area	x and xiii	9	—	9 and 14
Sludge Pits	ix	10	9	10
Secondary Oil Skimmer and Associated Drainage Ditch	xi	11	11	11
Contact Waste Water Collection System	xii	12	13	12
Drainage Ditch Between APIs Evaporation Ponds and Neutralization Tank Evaporation Ponds	xiv	13	13	13
Drainage Ditch near the Inactive Land Treatment Area		14		

[1]Solid Waste Management Unit Numbers as designated in the HSWA Permit (Section C, Corrective Actions for Continuing Releases, 5(a)(1), December 1988.

[2]Solid Waste Management Unit Numbers as designated in the RCRA Facility Investigation Work Plan (submitted May 1990).

[3]Solid Waste Management Unit Numbers as designated in the EPA letters (provided as Attachment J-1).

[4]Solid Waste Management Unit Numbers as designated in the RCRA Part B Post-Closure Application (Volume III, Appendix J-1 through J-13).

Figure J-1b. SWMU No. 1, Aeration Basin Detail Photo

Figure J-2b. SWMU No. 2, Evaporation Ponds Detail Photo

Figure J-3b. SWMU No. 3, Empty Container Storage Area Detail Photo

Figure J-4b. SWMU No. 4, Old Burn Pit Detail Photo

Figure J-5b. SWMU No. 5, Landfill Areas Detail Photo

Figure J-6b. SWMU No. 6, Tank Farm—Leaded Gasoline Tanks Detail Photo

Figure J-7b. SWMU No. 7, Fire Training Area Detail Photo

Figure J-8b. SWMU No. 8, Railroad Rack Lagoon Detail Photo

Figure J-9b. SWMU No. 9, Drainage Ditch and the Inactive Land Farm Detail Photo

Figure J-10b. SWMU No. 10, Sludge Pits Detail Photo

Figure J-11b. SWMU No. 11, Secondary Oil Skimmer Detail Photo

Figure J-12b. SWMU No. 12, CWWCS Detail Photo

Figure J-13b. SWMU No. 13, Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds Detail Photo

Attachment J-1

Approval Documentation

L.0 CERTIFICATION

In accordance with the *New Mexico Administrative Code*, Title 20, Chapter 4, Part 1, Subpart IX, §270.11(d), revised January 1, 1997, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Carl Shook, Executive Vice President, Operations
Giant Industries Inc.
23733 N. Scottsdale Road
Scottsdale, Arizona 85255

3/16/2000
Date

RCRA
PART A AND PART B
POST-CLOSURE
PERMIT APPLICATION

LAND TREATMENT UNIT
GIANT REFINING COMPANY
CINIZA REFINERY

VOLUME II
APPENDICES A THROUGH H

SUBMITTED TO:	NEW MEXICO ENVIRONMENT DEPARTMENT HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU P.O. BOX 26110 SANTA FE, NEW MEXICO 87502
DATE SUBMITTED:	MARCH 2000
PREPARED BY:	CINIZA REFINERY ROUTE 3, BOX 7 GALLUP, NEW MEXICO 87301

APPENDICES

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C	Land Treatment Unit Historical Information and Data
D	Land Treatment Demonstration Engineering Report
E	Post-Closure Monitoring Plan
F	*Deleted*
G	Well Construction Logs
H	Financial Test and Corporate Guarantee (Closure and Post-Closure)

ACRONYMS AND ABBREVIATIONS

%C	percent of completeness
%R	percent recovery
20 NMAC 4.1	Title 20 *New Mexico Administrative Code*, Chapter 4, Part 1
ASO	acid-soluble oil
BFB	4-bromofluorobenzene
BTEX	benzene, toluene, ethyl benzene, and xylene
BTZ	below the treatment zone
CAP	Corrective Action Plan
CEC	carbon exchange capacity
CFR	*Code of Federal Regulations*
Ciniza	Giant Refining Company—Ciniza Refinery
CME	comprehensive monitoring evaluation
C:N:P	carbon:nitrogen:phosphorous
COC	chain of custody
CWWCS	Contact Wastewater Collection System
DMP	detection monitoring plan
DOT	U.S. Department of Transportation
EDP	early detection plan
EDS	early detection system
EDW	early detection well
EM	environmental manager
EPA	U.S. Environmental Protection Agency
FR	*Federal Register*
FRP	facility response plan
Giant	Giant Refining Company
I-40	Interstate-40
LCS	laboratory control sample
LTD	land treatment demonstration
LTU	land treatment unit
MDL	method detection limit
MW	monitoring well
NFA	no further action
NMAC	*New Mexico Administrative Code*
NMED	New Mexico Environment Department
NMED/HRMB	New Mexico Environment Department/Hazardous and Radioactive Material Bureau
NMOCD	New Mexico Oil Conservation Division
PHC	principal hazardous constituents
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	Resource Conservation Recovery Act Facility Assessment
RFI	Resource Conservation Recovery Act Facility Investigation
RPD	relative percent difference
SAL	screening action level
SAP	sampling and analysis plan

SMW	shallow monitoring wells
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
TEGD	*RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986)
U.S.C.	*United States Code*
UST	underground storage tank
VCAP	Voluntary Corrective Action Plan
VOA	volatile organic analyte
VOC	volatile organic compound
WAP	waste analysis plan
ZOI	zone of incorporation

APPENDIX B

Waste Analysis Plan

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APPENDIX E

POST-CLOSURE MONITORING PLAN

Zone of Incorporation
Treatment Zone
Chinle Slope
Sonsela Aquifer

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ACRONYMS AND ABBREVIATIONS

%C	numerical expression of the completeness
%R	percent recovery
BFB	4-bromofluorobenzene
BTZ	below treatment zone
Ciniza	Ciniza Refinery
COC	chain-of-custody
DMP	Detection Monitoring Plan
DOT	U.S. Department of Transportation
DQO	data quality objective
EDP	Early Detection Plan
EDS	early detection system
EM	environmental manager
EPA	U.S. Environmental Protection Agency
Giant	Giant Refining Company
LCS	laboratory control sample
LTD	land treatment demonstration
LTU	land treatment unit
MDL	method detection limit
MW	monitoring well
NMED/HRMB	New Mexico Environment Department/Hazardous and Radioactive Materials Bureau
PHC	principal hazardous constituent
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RPD	relative percent difference
SAL	screening action level
SOP	standard operating procedure
SMW	shallow monitoring well
SVOC	semivolatile organic compound
TEGD	*RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986)
VOA	volatile organic analyte
VOC	volatile organic compound
ZOI	zone of incorporation

1.0 INTRODUCTION

1.1 Overview

During the post-closure care period Ciniza proposes a Post-Closure Monitoring Program that encompasses two monitoring sequences: the early detection monitoring for monitoring subsurface conditions to "determine whether hazardous constituents have migrated out of the treatment zone" as required by 20 NMAC 4.1, Subpart V, §264.278, and detection monitoring for monitoring groundwater to protect human health and the environment as required by 20 NMAC 4.1, Subpart V, §264.97. The early detection monitoring works in concert with the detection monitoring for protection of the groundwater resources at Ciniza.

The combination of early detection monitoring and detection monitoring provide the procedures necessary to: define monitoring team responsibilities, define sampling and analytical techniques, specify sample identity, and establish precision and accuracy of reported data.

It is essential to ensure that data generated from these monitoring programs are valid. For data to be valid, they must be supported by documented procedures so that they can be used with confidence to support and defend regulatory decisions. The overall objective for the Land Treatment Unit (LTU) monitoring plan, during the post-closure care period, is to collect accurate and defensible data sufficient to assess the concentrations, if any, of subsurface constituents below the LTU.

1.2 Purpose

This appendix provides instructions for sample collection, water level monitoring, data management, and reporting of annual data; identifies analytical parameters selected for assessing the quality of soil and groundwater; and establishes personnel responsibilities for the LTU soil and groundwater monitoring program. Because quality assurance (QA) is an integral component of the soil and groundwater sampling, analysis, and reporting process, quality assurance/quality control (QA/QC) elements and associated data acceptance criteria are provided to the laboratory(ies) performing sample analysis.

Detailed instructions for performing field activities that will be conducted in conjunction with the post-closure monitoring plan are provided in field operating procedures maintained by the Ciniza Environmental Manager (EM). Detailed procedures are provided for each aspect of the soil and groundwater sampling process, including water-level measurement, sampling equipment operation, field water-quality

measurements, and sample collection. These procedures are intended to support proper field sampling expertise. Samples will be taken under the supervision and direction of qualified engineers, scientists, or other technical personnel.

1.3 Site Location

Ciniza is a crude oil refining facility located in McKinley County, New Mexico, at Township 15 North, Range 15 West, Sections 28 and 33. Ciniza is just north of Interstate 40 (I-40) and approximately 17 miles east of Gallup, New Mexico.

The LTU is located within the Ciniza Refinery property boundary. The LTU consists of three 480-ft x 240-ft sections. Each section is diked and contains 2.6 acres (1.0 hectare) of surface. The LTU treatment zone of soil extends 5 ft deep from the original soil surface. This depth is shallow enough to ensure the treatment zone is more than 3 ft above the seasonal high water table. The zone of incorporation (ZOI) within the treatment zone is the volume of soil to which the waste is directly applied. The ZOI is the top 12 in. of the treatment zone. The LTU was designed and constructed with a continuous berm, which surrounds the LTU at an elevation of approximately 2 ft above the natural grade.

1.4 Geologic and Hydrologic Characteristics

Ciniza is located on a layered geologic formation, which slopes gently to the northwest. Surface soils consist of varied fluvial and alluvial deposits (clay, silt, sand) and imported fill. Below is the Chinle formation, which consists of very low-permeability clays and shales, and effectively serves as an aquiclude, or confinement layer that lies directly above the Sonsela sandstone. The Sonsela sandstone is a water saturated unit and represents the uppermost aquifer in the region. The clays and shales of the Chinle aquiclude have a hydraulic conductivity of 10^{-9} centimeters per second.

Just above the Chinle aquiclude is a zone of water bearing, weathered alluvium known as the Chinle slope wash. Based on hydrologic investigations performed at the site, it has been determined that the Chinle slope wash is hydraulically interconnected with water located in shallow, localized sand lenses (Precision Engineering 1996) located between the Chinle slope wash and the ground surface. Unlike the shallow, localized sand lenses, the Chinle slope wash is continuous and saturated throughout the region underneath the LTU. However, the Chinle slope wash does not meet the regulatory definition of the uppermost aquifer. The water table above the aquiclude slopes to the northwest at a gradient of 0.01 ft/ft. Chinle slope wash

flow direction is depicted in Figure 1-1. The rate of water movement in these claystones is estimated to be less than 1 ft per year (Hazardous Waste Facility Permit).

The Sonsela aquifer is considered to be the uppermost aquifer even though it does not meet the water quality standards for drinking water. The Sonsela aquifer potentiometric surface is shown in Figure 1-2. The Sonsela aquifer is a bed of fine-to-medium grained sandstone, 12 to 15 ft thick, within the upper part of the Chinle formation. The top of the unit is at 100 to 112 ft, and it is overlain by reddish-brown, weathered claystones and sandy claystones. Groundwater in the uppermost aquifer is under artesian confinement in the vicinity of the LTU. The potentiometric surface for groundwater in the aquifer is 70 to 100 ft above the top of the aquifer, or 9 to 31 ft below the surface. The direction of flow in the Sonsela aquifer is northwest and the potentiometric gradient is approximately 0.01 ft/ft directly beneath the Ciniza Refinery. The average linear velocity for water in the uppermost aquifer beneath the LTU is 8.2 ft per year (Giant Refining Company 1984).

The Sonsela Sandstone bed is separated from lower aquifers by a thick sequence of mudstones and siltstones, with a few beds of sandstone and conglomerate. There appears to be no significant hydraulic connection between the Sonsela aquifer from the lower aquifers (Shinarump Member of the Chinle Formation, the Moendopi Formation, and the Permian-age San Andres Limestone-Glorieta Sandstone aquifer). The lower aquifers lie at depths greater than 700 ft. Figure I-1 of the Ciniza Part B Post-Closure Permit Application depicts the stratigraphy beneath the LTU.

2.0 POST-CLOSURE MONITORING PLAN - OVERVIEW

2.1 Scope

Ciniza developed the post-closure monitoring plan to monitor subsurface conditions to "determine whether hazardous constituents have migrated out of the treatment zone" as required by 20 NMAC 4.1, Subpart V, §264.278. The post-closure monitoring plan is comprised of early detection monitoring and detection monitoring. This appendix addresses monitoring of soils and liquids which lie between the LTU, including the Sonsela aquifer. The Sonsela is the uppermost aquifer and is monitored in accordance with detection monitoring procedures. Early detection monitoring involves monitoring the ZOI, and treatment zone, and works in concert with detection monitoring to employ a multi-tiered approach that confirms, at a high level of certainty, the integrity of the LTU.

Early detection monitoring involves sampling the ZOI, treatment zone, and the Chinle slope wash. The Chinle slope wash is contiguous beneath the LTU and may provide a potential pathway for any releases to move beyond the point of compliance. Therefore, in order to be fully protective of human health and the environment, Ciniza developed an early detection monitoring sequence to monitor the Chinle slope wash.

The detection monitoring for the Sonsela aquifer consists of four monitoring wells (MWs). These wells include one MW located upgradient of the LTU to measure background, and three additional MWs located at the point of compliance at the downgradient edge of the LTU. These MWs will be sampled to determine whether the LTU has released hazardous constituents BTZ. This monitoring plan provides economical feasibility and environmental protection while ensuring the technical adequacy of the approach.

2.2 Background Values

2.2.1 Background Soil Samples.

Background soil samples were collected in 1981 from the LTU, prior to any waste application, as part of Ciniza's Ground Water Monitoring Program. In 1987, Ciniza was issued a Short-term Land Treatment Demonstration Permit to conduct a hazardous waste land treatment demonstration (LTD). The LTD included sampling of both ZOI and BTZ soils. In 1988, Ciniza was issued a Hazardous Waste Facility Permit (NMED 1988). Sampling of ZOI and BTZ soils was established as a condition of the permit. Permitted sampling provides ten years of LTU soil data. Cell 3 of the LTU, which has not received hazardous waste at any time, has been routinely sampled during this time. Data from the 1981 sampling and Cell 3 sampling has been used historically as the background. Samples obtained from Cell 3 and analyzed in accordance with the early detection monitoring will be used as the background for determining statistically significant increases in hazardous constituents as required by 20 NMAC 4.1, Subpart V, §264.278(f). Background values for Chinle slope wash samples are not established. Detection of any constituents from Table 2A through 2D may generate additional sampling in consultation with NMED.

2.2.2 Background Sonsela Groundwater Samples

Samples obtained from MW-4 and analyzed in accordance with the detection monitoring will be used as background for determining statistically significant increases in hazardous constituents in the Sonsela aquifer as required by 20 NMAC 4.1, Subpart V, §264.97(a). MW-4 is located between the LTU and the evaporation ponds directly to the south of the LTU. Using MW-4 as background will ensure that any potential impacts from the evaporation ponds can be identified and evaluated in comparison to the other MW sampling data.

2.3 Monitoring Wells

To ensure that post-closure monitoring will provide the best quality data in the future, Ciniza will utilize shallow monitoring well (SMW)-4 to sample the Chinle slope wash, and MW-1, MW-2, MW-4, and MW-5 to sample the Sonsela. MW-4 is located upgradient of the LTU to provide background values. Wells MW-1, MW-2 and MW-5 are located downgradient of the LTU at the point of compliance. The well locations ensure detection of any release from the LTU. All well locations are based on current potentiometric surfaces. Figure 2-1 shows the locations for the wells.

2.3.1 Well Siting

The wells are sited following guidance in the U.S. Environmental Protection Agency (EPA) *Groundwater Monitoring Technical Enforcement Guidance Document*, and the groundwater flow characteristics at the site. In September 1985, shallow monitoring wells were installed around the LTU perimeter as part of early detection monitoring. The shallow monitoring wells were installed in pockets of sand above the Chinle formation that exist as thin lenses above the Chinle shale between the ground surface and the top of the Sonsela sandstone. The shallow monitoring wells, SMW-1, SMW-2, SMW-3, SMW-4, SMW-5 and SMW-6 have performed poorly because it has been discovered that they were completed within different sand lenses, which does not allow them to produce consistent data applicable to the LTU. MW-1, MW-2, MW-5 are completed in the Sonsela aquifer and are located directly downgradient of the LTU, as shown on Figures 2-1A and 2-1B. Figure 1-1 shows the direction of groundwater flow. The locations of the three downgradient wells were selected to intercept the groundwater flow moving downgradient of the LTU. The upgradient well, MW-4 – completed in the Sonsela, is also located based on groundwater flow vectors derived using the potentiometric surface across the site.

2.3.2 Well Construction Specification

SMW-4 was completed using mud rotary drilling techniques following established well construction guidance from *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986) (TEGD). The well is drilled into the Chinle slope wash and screened across the water-bearing zone within the unit. The well was logged during drilling and completed using an appropriately sized gravel pack and screen slot size. The screened interval is isolated from the remainder of the well using a low permeability annular seal to prevent cross contamination.

Four MWs were installed and completed in October 1981, pursuant to 40 *Code of Federal Regulations* Part 265. Construction of the LTU monitoring wells began in October 1981, and was completed in April 1984.

Current flow patterns in the Sonsela aquifer suggest the configuration of the LTU monitoring well system will provide sound, defensible data throughout the post-closure monitoring period.

The four MWs were constructed using mud rotary drilling techniques following established well construction guidance from *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986) (TEGD). The wells were drilled into the Sonsela aquifer and screened across the water-bearing zone within the unit. The wells were logged during drilling and completed using an appropriately sized gravel pack and screen slot size. The screened interval is isolated from the remainder of the well using a low permeability annular seal to prevent cross contamination.

3.0 RESPONSIBILITIES

3.1 Responsibilities

The importance of defining responsibilities for the implementation of the procedures must be stressed. All individuals involved with the monitoring program must clearly understand their responsibilities so the procedures detailed in this plan will be conducted successfully and efficiently.

3.2 Environmental Manager

The EM is responsible for the overall design and implementation of this post-closure monitoring plan. The EM develops and approves specific procedures for the conduct of all post-closure monitoring plan activities, and reviews and approves reports. The EM oversees interactions between Ciniza Refinery and the New Mexico Environment Department/ Hazardous and Radioactive Materials Bureau (NMED/HRMB) regarding environmental monitoring of the LTU. The EM appoints a post-closure monitoring plan team leader and field team, assigning responsibilities as described below.

3.3 Team Leader

The team leader, either the EM or a designee, will coordinate and oversee field sampling activities, ensuring that sampling and associated procedures are followed and that quality assurance/quality control (QA/QC) and safety guidelines are met. The team leader reviews and evaluates sample data, prepares and reviews LTU reports, and assures that appropriate samples are collected and analyzed.

3.4 Field Team

The LTU field team consists of one or more scientists, engineers, or technicians, who are responsible for sample collection, handling, shipping, and preparation and maintenance of appropriate data sheets, and completion of sample tracking documentation under the direction of the team leader, in accordance with this post-closure monitoring plan and associated Ciniza field procedures. The field team will inspect, maintain, and ensure proper calibration of equipment prior to use at the LTU, while ensuring that site health and safety requirements are met at all times. The field team will communicate any problems or project changes to the team leader.

3.5 Analytical Laboratory

The contract laboratory used for sample analysis is responsible for supplying sample collection containers and sample shipping containers to the field team. Sample collection containers supplied by the laboratory will be certified as clean by either the laboratory or their supplier. The contract laboratory is responsible for performing analysis in accordance with this post-closure monitoring plan and the data are supported by adequate documentation that meet NMED and U.S. Environmental Protection Agency (EPA) requirements. The laboratory will maintain documentation of sample handling and custody, analytical results, and internal QC data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside laboratory acceptance limits will trigger an inquiry and, if appropriate, corrective action, as directed by the EM. The laboratory will report the result of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one contract laboratory is used (e.g., for different analyses), each one has the responsibilities described above.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Overview

Ciniza Refinery developed this QA/QC program to ensure that data integrity and quality are maintained for all samples collected and that equipment and records are maintained in accordance with NMED/HRMB guidance. The QA/QC program identifies data quality objectives (DQOs), processes for assuring sample quality, and processes for generating and maintaining quality records. Detailed QA/QC parameters are described in Tables 1A and 1B.

4.1.1 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of data required to support post-closure care decisions. DQOs are established to ensure that the data collected are of a sufficient and known quality for their intended uses. The overall DQO for the post-closure care of the LTU is to collect accurate and defensible data of known quality that are sufficient to assess the concentrations of constituents in the groundwater underlying the LTU.

4.2 Quality Assurance Objectives

The analytical data generated during the post-closure care period will be specified in terms of accuracy, precision, completeness, representativeness, and comparability. This data will support decisions regarding identification, if any, of hazardous constituent concentrations found BTZ, changes in the monitoring system, and development of characterization and remediation activities as necessary to protect human health and the environment. Each QA/QC objective of the Ciniza QA plan is described below:

4.2.1 Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. Measurements of accuracy for laboratory activities will include analysis of calibration standards, laboratory control samples (LCSs), matrix spike samples, and surrogate spike samples. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{\textit{measured sample concentration}}{\textit{true concentration}} * 100 \qquad (4\text{-}1)$$

4.2.1.1 Accuracy Objectives for Field Sampling Activities. For field sampling activities, accuracy will be measured through the use of equipment and trip blanks. Equipment blanks will be analyzed to check for contamination due to improper/insufficient decontamination procedures. These blanks will be used for nondedicated boring and sampling equipment.

To ensure equipment has been sufficiently decontaminated, deionized water will be poured over and through the sampling equipment, caught in a clean stainless steel bowl, and poured into the sample bottles. One equipment blank will be taken randomly during each monitoring event involving nondedicated equipment.

One trip blank will be used for each monitoring event involving analysis for volatile organic compounds (VOCs). The trip blank will be prepared and labeled by the laboratory. One 40-mL septum vial will be filled with reagent grade water, transported to the site with the empty sample bottles, carried with the sample bottles during all sampling and shipping activities, and returned to the laboratory for analysis. The trip blank shall not be opened at any time prior to analysis.

4.2.1.2 Accuracy Objectives for Laboratory Measurements. Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, LCSs, laboratory blanks, matrix and surrogate spike samples. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and is prescribed in appropriate laboratory standard operating procedures (SOPs).

4.2.2 Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of true value. Precision of data will be derived from duplicate field and laboratory measurements.

4.2.2.1 Precision Objectives for Field Sampling Activities. To measure the precision of field sampling activities, duplicate samples will be collected and analyzed. Duplicates will be collected at a frequency of one duplicate sample for each sampling event. Duplicates will be analyzed for all parameters.

In order to evaluate the precision of the analysis, it is necessary to calculate the relative percent difference (RPD) between the two results of the duplicate analysis. The RPD calculation is as follows:

$$RPD = \frac{(S1 - S2)}{(S1 + S2)/2} \times 100 \qquad (4\text{-}2)$$

where:

$S1$ = Sample Result 1
$S2$ = Sample Result 2

RPD should be less than or equal to 10 percent for values five times greater than the method detection limit (MDL) and plus or minus the detection limit for values less than five times the MDL.

4.2.2.2 Precision Objectives for Laboratory Measurements. Precision of laboratory analyses will be assessed by performing the analyses on two aliquots extracted from one sample or on a matrix spike and matrix spike duplicate with each analytical batch assessed at a minimum frequency of 1 in 20 samples. The laboratory will determine analytical precision control limits by performing replicate analyses of control samples. Precision measurements will be expressed as RPD. Laboratory analytical precision is also parameter dependent and is prescribed in laboratory SOPs.

4.2.2.3 Contamination. In addition to measurements of accuracy and precision, QC checks for contamination will be performed. QC samples including trip blanks, equipment blanks, field blanks, calibration and method blank will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents, glassware, and equipment. Trip blanks are used to assess VOC sample contamination during shipment and handling and will be collected and analyzed at a frequency of one sample per sample shipment. Field blanks are used to assess field sample collection methods and will be collected and analyzed at a frequency of one per 20 samples (five percent of the samples collected). Method blanks are used to assess contamination resulting from the analytical process and will be analyzed at a frequency of each preparation batch or every 20 samples, whichever is more frequent. Sample blanks will be evaluated following EPA *National Functional Guidelines for Organic Data Review* (EPA 1991) and *Functional Guidelines for Evaluating Inorganics Analyses* (EPA 1988). Only method blanks will be analyzed by classical chemistry methods. The criteria for evaluating method blanks will be established as follows: If method blank results exceed specified detection limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in blank samples may be used to disqualify some samples, requiring resampling and additional analyses on a case-by-case basis.

4.2.3 Completeness

Completeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for post-closure monitoring will be accomplished through implementing approved sampling procedures and the use of validated analytical methods.

Occurrences that reduce the amount of data collected include sample container breakage in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost data whenever possible. The completeness objective for noncritical measurements (i.e., field measurements) is 90 percent and 100 percent for critical measurements

(i.e., compliance data). If completeness objective is not met, the Ciniza EM will determine the need for resampling on a case-by-case basis. Numerical expression of the completeness (%C) of data is as follows:

$$\%C = \frac{number\ of\ samples\ with\ valid\ results}{total\ number\ of\ samples\ taken} * 100 \qquad (4\text{-}3)$$

4.2.4 Representativeness

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this early detection monitoring will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures are designed to minimize factors affecting the integrity of the samples. Groundwater samples will only be collected after well purging criteria have been met. The analytical methods selected are those that will most accurately and precisely represent the true concentration of analytes of interest.

4.2.5 Comparability

Comparability is the extent to which one set of data can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measure dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals
- Micrograms per liter (μg/L) for VOCs and semi-VOCs (SVOCs)

4.3 Design Control

The monitoring system is designed to meet requirements in 20 NMAC 4.1, Subpart V, §264.97 and §264.278. The specific components are described in Section 5.0.

4.4 Instructions, Procedures, and Drawings

Provisions and responsibilities for the preparation and use of instructions and procedures during the post-closure care period of the LTU are detailed in Ciniza Refinery LTU *Implementing Procedures, Sample Control, and Quality Assurance Requirements* (Ciniza 1998). Quality-affecting activities performed by or on behalf of Ciniza for monitoring are required to be performed in accordance with documented and approved procedures which meet the intent of 20 NMAC 4.1, Subpart V, §264.97 for groundwater and 20 NMAC 4.1, Subpart V, §264.278 for soils.

Technical procedures developed for the predetection monitoring activities at the LTU are maintained by the Environmental Department at Ciniza Refinery. The procedures are sufficiently detailed and include, when applicable, quantitative or qualitative acceptance criteria.

4.5 Document Control

Document control of procedures, used in performing soil and groundwater monitoring functions, is maintained by the Environmental Department at Ciniza Refinery. This control ensures that the latest approved version of procedures is used during monitoring and maintenance activities at the LTU.

4.6 Monitoring and Data Collection Equipment

Data collection equipment is controlled and calibrated to ensure continued accuracy of monitoring data. Results of calibrations, maintenance, and repair are documented. Calibration records identify the reference standard and the relationship to national standards or nationally accepted measurement systems. Records are maintained to track uses of monitoring and data collection equipment. If the equipment is found to be out of tolerance, the equipment is tagged and it is not used until corrections are made.

4.7 Quality Assurance Records

The EM at Ciniza Refinery outlines the policy regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records.

QA and Resource Conservation and Recovery Act (RCRA) records document the results of the early detection monitoring implementing procedures and are sufficient to demonstrate that all quality-related aspects are valid. The records will be identifiable, legible, and retrievable in accordance with Ciniza Refinery Records Management Plan.

5.0 POST-CLOSURE MONITORING PLAN - DESCRIPTION

The monitoring plan is designed to meet the monitoring requirements of 20 NMAC 4.1, Subpart V §264.90 through §264.101 and 20 NMAC 4.1, Subpart V, §264.278. Monitoring locations will be selected in order to adequately determine if hazardous constituents have migrated out of the LTU. The number and depth of samples in this plan have been selected to adequately detect potential migration of hazardous constituents and determine successful treatment, degradation, and immobilization in the treatment zone.

5.1 Pre-Sampling Operations

Ciniza will notify the NMED/HRMB a minimum of two weeks prior to a monitoring event. The contract laboratory should be notified of the monitoring event so that they may allocate the personnel and equipment necessary to meet the demands of the sample analyses. The lab should specify and provide the adequate materials, (i.e., coolers, bottles, custody seals, chain of custody [COC] forms, trip blanks) for the monitoring event. Field team personnel should review the field checklists (Attachment 1) to assure that all equipment is available and operational.

5.2 Early Detection: Soil Monitoring

The purpose of monitoring the ZOI and treatment zone is to detect potential migration of hazardous constituents and to ensure that treatment of hazardous constituents within the treatment zone has been successfully completed.

5.2.1 Soil Monitoring Locations

Sampling accuracy will be achieved by randomly selecting six soil monitoring locations over Cell 1 and Cell 2 of the LTU. The locations will be randomly selected each time soil samples are collected. Prior to each sampling time, the six locations are selected as follows:

- Grid the sample area into 6-ft squares and establish the coordinate at the southeast corner of the LTU.
- Using a random number table or generator, select four sampling locations taking care to locate at least one location in each cell.

At least 6-in. of topsoil will be added to the LTU surface during closure activities. ZOI samples will be taken from the 12 in. below the topsoil-ZOI surface. The treatment zone is identified as the top 5 ft of soil and is defined as the environmental control level. Both ZOI and treatment zone samples will be taken from the boring. Sample volumes required by analytical protocol will be collected, taking care not to sample beyond the defined sampling depths.

5.2.2 Soil Monitoring Frequency

The frequency for the monitoring of LTU soils will be conducted as described in Volume I, Section E.0.

5.2.3 Number of Soil Samples

For each monitoring event a total of two samples will be taken from each boring; one sample from the ZOI, and one sample from the treatment zone. A sample is defined as the amount of soil necessary to secure analyses for all of the parameters identified in Section 5.2.2. This results in a total of 12 LTU samples per event. This total does not include QC samples required in Section 4.0. Samples will not be composited for analysis. The samples will be analyzed for Modified Skinner List and TPH as GRO and DRO.

5.3 Early Detection: Chinle Slope Wash Monitoring

The purpose of sampling the SMW-4, completed in the Chinle slope wash, is to detect the migration of hazardous constituents before they reach the point of compliance.

5.3.1 Groundwater Monitoring Locations

Groundwater samples will be collected from SMW-4. SMW-4 is screened only in the Chinle slope wash. Figure 2-1 shows the location of SMW-4 in relation to the LTU. Sample volume will be determined based on analytical protocols specified by the contract laboratory.

5.3.2 Groundwater Monitoring Frequency

The Chinle slope wash sampling frequency is parallel with the detection monitoring of the Sonsela aquifer. The sampling frequency for the Chinle slope wash is summarized in Volume I, Section E.0. Samples will be analyzed for the parameters listed in the modified Skinner list, Table 2A and 2B.

If any sampling event indicates that there has been a statistical increase in the hazardous constituents, then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed, appropriate notification to NMED will be provided and a permit modification may be required for further characterization. The characterization, if required, will include all organics and metals in the modified Skinner List. The sampling frequency for the Chinle slope wash is summarized in Volume I, Figure 5-1.

5.4 Sonsela Groundwater Monitoring

Ciniza will sample the MWs completed in the Sonsela aquifer to detect the migration of hazardous constituents if they reach the point of compliance.

5.4.1 Groundwater Monitoring Locations

Groundwater samples will be collected from the four MWs completed in the Sonsela aquifer. Figure 2-1 shows the location of the MWs in relation to the LTU. Sample volume will be determined based on analytical protocols specified by the contract laboratory.

5.4.2 Groundwater Monitoring Frequency

The Sonsela aquifer will be sampled based on the frequency described in Volume I, Figure E-1. Samples will be analyzed for both organics and metals in the modified Skinner list shown in Tables 2A through 2D.

If any sampling event indicates that there has been a statistical increase in the hazardous constituents, then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the Sonsela aquifer. The characterization, if required, will include all organics and metals in the modified Skinner List. Ciniza will establish a compliance monitoring program in the Sonsela aquifer in accordance with 20 NMAC 4.1, Subpart V, §264.99. The sampling frequency for the Sonsela aquifer is summarized in Volume I, Figure 5-1.

5.4.3 Number of Groundwater Samples

One sample will be collected from each MW per sampling event. This results in four groundwater samples per event for the detection monitoring program. This number does not include the QC samples required in Section 4.0.

5.5 Analytical Parameters

Selection of analytical parameters is based on the contaminants expected to be present in the waste and their associated degradation products. Tables 2A through 2D contain the parameters that will be analyzed for during the various phases of sampling operations.

5.6 Sample Collection

Groundwater samples will be collected following the groundwater procedures presented in Section 7.0. These samples will be sent to contract laboratories and analyzed for metals and constituents of concern identified in Tables 2A through 2D. These hazardous constituents are specific to the waste applied to the LTU from 1988 to 1990 during its operational phase.

5.7 Laboratory Analysis

Samples will be analyzed by a commercial laboratory that participates in EPA's Contract Laboratory Program. Methods are specified in Ciniza procurement documents and are selected to be consistent with EPA-recommended procedures in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA 1997) (SW-846). Data analysis is to provide an objective and reliable means for interpreting data in relation to the objectives of the data collection program. For these monitoring programs, the principal goal of data analysis is the comparison of a data point or data set to a fixed standard or to equivalent data collected at another location and time (such as during operational phase of the LTU, background data, or data collected at a control location). Additional detail on analytical techniques and methods are given in laboratory SOPs.

5.8 Statistical Evaluation of Laboratory Data

As required by 20 NMAC 4.1, Subpart V, §264.97 and §264.278, data collected during monitoring will be evaluated using appropriate statistical techniques. Ciniza has been evaluating the groundwater monitoring data using Cochran's approximation to the Behrens-Fisher Student's T-test for its existing groundwater monitoring program. Ciniza plans to using this methodology to evaluate soil and groundwater monitoring data during the post-closure period. Cochran's approximation to the Behrens-Fisher Student's T-test is shown below:

$$t* = \frac{X_a - X_b}{\sqrt{\frac{S_m^2}{N_m} + \frac{S_b^2}{N_b}}} \tag{5-1}$$

where:

$t*$ = t star
X_a = mean of the sample
X_b = mean of the background
S_m^2 = variance of the sample
S_b^2 = variance of the background
N_m = number of samples
N_b = number of backgrounds

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m} \tag{5-2}$$

where:

t_c = comparison t-star
W_b = variance/number of backgrounds

t_b = t-table with (N_b-1) degrees of freedom at the 0.05 level of significance
W_m = variance/number of samples
t_m = t-table with (N_m-1) degrees of freedom at the 0.05 level of significance

The t-star (t^*) is compared to the comparison t-star (t_c) using the following decision rule.

- If t^* is equal to or larger than t_c then conclude that there most likely has been a significant increase in this parameter.
- If t^* is less than t_c then conclude that there most likely has not been a change in this parameter.

6.0 SAMPLE DOCUMENTATION AND CUSTODY

The integrity of samples from the time of collection through reporting date, sample collection, handling, and custody must be documented. Standardized forms used to document sample management include identification numbers, sample labels, custody tape, the sample tracking logbooks, and the COC form. The forms are briefly defined in the following subsections. All sample documentation will be completed for each sample and reviewed by the team leader for completeness and accuracy.

6.1 Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. The team leader will assign the numbers prior to sample collection. The sample identification numbers are used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory will be identified with a label affixed to it. Sample label information will be completed in permanent, indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

6.1.1 Sample Identification Numbering System

The sample identification numbering system is used to identify individual samples. Sample numbers may include a code number or letter attached to the end to identify the type of sample.

Samples for a typical sampling event would be labeled as:

EQUATION

(1) ZOI = Zone of Incorporation
TZ = Treatment Zone

	MW1	=	Monitoring Well # 1
(2)	*234*	=	Grid cell number (enter 000 for well sample)
(3)	1	=	Monitoring event number (for the year)
(4)	98	=	Year (1998)
(5)	*D*	=	Duplicate
	E	=	Equipment Blank
	B	=	Trip Blank

If no letter appears here, it is the original sample

6.2 Custody Seals

Custody seals are used to detect sample tampering from collection through analysis. The custody seals are adhesive-backed strips that are destroyed when removed or when the container is opened. The seal is dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals are affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal invalidates the sample.

6.3 Sample Logbook Record

Field team personnel will record critical information in the sample logbook for each sample collected. The information recorded will include:

- Sample location (well number or boring location)
- Sample identification number
- Date and time of sampling
- Sampling personnel
- Sample collection method
- Field measurements
- COC number
- Date sample(s) were sent to the lab
- Laboratory name
- Comments and observations

It is important that specific observations be recorded concerning site conditions. These include:

- Weather conditions
- Physical surrounding (water, plant growth)
- Evidence of contamination
- Odors or color abnormalities

Sample logbook information is completed in the field by the sampling team and checked by the team leader. When samples are shipped, the information remains in the custody of the EM for sample tracking purposes.

6.4 Chain of Custody

A COC form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. The COC form is signed and dated each time the sample custody is transferred. A sample is considered to be in a person's custody if: the sample in his/her physical possession; a sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's bill number serves as custody verification. Upon receipt of the samples at the laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the COC. The completed COC is returned to the team leader with the laboratory analytical report and becomes part of the permanent record of the sampling event. The COC also may contain specific instructions to the laboratory for sample analysis, potential hazards, and disposal instruction.

The COC shall include the following information:

- Facility name
- Type and number of samples
- Sample location and ID
- Collection dates/times
- Analysis required
- Number of containers for each sample
- Additional remarks or comments as needed
- Sampler's signature
- Signatures of all individuals involved in the chain of possession
- Inclusive dates and times of possession

The original COC must accompany the samples. One copy of the COC form will be kept in the project files.

7.0 FIELD OPERATIONS

This section describes equipment and supplies; and provides general instructions for sample collection, preservation, packaging, and shipping; decontamination; and documentation. By following these instructions sampling personnel will ensure that the sample collected is representative of the soil and groundwater, thus providing scientifically valid and legally defensible analytical data.

The ZOI, treatment zone, Chinle slope wash and the Sonsela aquifer are routinely sampled and monitored. These activities are detailed in Section 7.1 and 7.2. Monitoring related activities include soil collection,

lithologic logging, borehole filling, static water level measurements; equipment calibration; field water quality analyses; and sample handling, shipping, and management. A typical sampling event is depicted on Figure 7-1.

7.1 Soil Procedures

7.1.1 Boreholes/Core Samples.

Boreholes for samples will be advanced by a drilling rig employing hollow-stem augers. There will be no compositing of soil samples. Core samplers are used in conjunction with hollow-stem augers to collect soil samples. A 5 ft, 2.5 in.-diameter, split core barrel will be placed in the lead auger. The tube is pushed into the soil at the same drilling rate as the auger. After the tube is pulled from the soil, it is detached from the drill rod and opened to remove the soil core. The sample must be transferred to the sample container in a timely manner in order to maintain the integrity of the sample and to prevent the potential loss of VOCs if present. Only after the sample has been collected should field observations and measurements (such as photoionization detector [PID] readings) be completed. Split core barrels will be used for obtaining samples of consolidated soil and to penetrate some types of rock.

7.1.2 Soil Screening

Should visual inspection or detection of odors warrant its use, a PID will be used to screen for volatiles. Since prior sampling has not shown significant contamination, the use of a PID is not expected. If the PID is used, all readings will be recorded in the logbook.

7.1.3 Lithologic Logging

Detailed logs will be maintained for each boring. Listed below is a general description of terms to be used to describe the soil characteristics for each boring.

- Lithology
- Color (i.e., light, dark, mottled, mixed)
- Size (fine, medium, coarse)
- Moisture (dry, moist, wet)
- Odor (or no odor)
- Other Descriptive Terms:
  - Lens <1 in.
  - Layer >1 in.
  - Interbedded
  - Slickensided - Soils having inclined planes of weakness, glossy in appearance

Lithologic logs of the entire core shall be used. Samples for VOCs shall be obtained before logging to preclude potential loss of VOCs.

7.1.4 Disposition of Soils

All drill cuttings generated by borehole advancement for soil samples will be spread within the LTU.

7.1.5 Backfill of Borings

All boring shall be backfilled with bentonite clay to prevent migration from the treatment zone.

7.1.6 Soil Sample Collection

To ensure that soil samples obtained for monitoring of LTU post-closure are of a consistently high quality, the following procedure will be used for their collection.

- Use an amber glass bottle to protect the sample from ultraviolet light.
- When sampling wet soils, leave enough headspace in the bottle to allow for expansion.
- Take extreme care to avoid contaminating the bottles or caps. Remove the cap just before filling and replace it as soon as possible after filling. Avoid touching the inside of the bottle or cap. See Section 7.3 for specific guidelines for organic analytes in soil.

7.1.7 Soil Sample Preservation

Appropriate preservation of collected samples is critical for ensuring analytical results are not impacted during transportation and handling before analyses. To ensure that LTU samples are properly preserved the following procedure will be followed:

- If required by analytical protocol, place the container in a cooler. Maintain the samples at or below 4°C.
- Do not expose the sample to extreme hot or cold temperatures or intense sunlight, even if no specific preservation is recommended.
- Deliver the samples to the contract laboratory as soon as practicable.

7.2 Groundwater Procedures

Ciniza sampling personnel will follow the guidelines outlined below for collecting groundwater samples. These samples consist of both field measurements and samples to be sent to the contract laboratory.

7.2.1 Groundwater Level Monitoring

The static groundwater level elevation will be measured in each well prior to well evacuation. This will be accomplished through the use of a steel tape, acoustic well probe or other approved methodology.

7.2.2 Well Purging

The wells will be purged prior to the collection of any groundwater samples, to ensure that a representative sample of the groundwater can be collected. This will be accomplished using a sufficiently low flow rate to minimize the possibility of stripping VOCs from the groundwater recharging the well. To eliminate the possibility of cross-contamination between wells, a dedicated pump for each well will be used to complete the well purging.

One of two methods will be used to complete the well purging. The first method is to remove three well volumes prior to sampling. The well volumes will be calculated based on the measured water level elevation and the size of well bore and gravel pack used during well construction. Because the wells are hydraulically low-yield wells, alternative sampling methods and reporting requirements exist. If sampling results indicate that SMW-4 is dry, this result will be recorded and reported to NMED. Other well water samples will be field measured for pH, temperature, and specific conductance to establish the conditions within the well bore. Then, the necessary samples will be collected and containerized in the order of the parameters' volatilization sensitivity. Once the necessary samples have been collected, the conditions within the well bore will be rechecked for stability by additional field measurements of pH, temperature, and specific conductance. If the field measurements show that conditions have not remained stable within the well bore during the sampling event, additional samples will be collected and the same process of field measurements will be conducted.

7.2.3 Groundwater Sample Collection

To ensure that LTU groundwater samples are of a consistently high quality, the following procedure will be used for their collection.

- Take extreme care to avoid contaminating the sample containers or caps. Remove the cap just before filling and replace it as soon as possible after filling. Avoid touching the inside of the bottle or cap.
- Do not filter the sample unless specified by analytical personnel.

- Do not rinse the sample container.

- Slowly fill each container almost full, except volatile organic analyte (VOA) vials. See Section 7.3 for sampling guidelines for organic analytes.

7.2.4 Groundwater Sample Preservation

Appropriate preservation of collected samples is critical for ensuring analytical results are not impacted during transportation and handling before analyses. To ensure that LTU samples are properly preserved the following procedure will be followed:

- If directed by analytical personnel, add the prescribed preservative. After adding preservative, slowly invert the vial to mix.

- If required by protocol, place the sample in a cooler. Maintain the organic samples and solid metal samples at or below 4°C with frozen Blue Ice. Avoid freezing the sample by packing it with vermiculite to prevent contact between the coolant and the sample container. Aqueous metal samples must not be cooled. Refer to tables 2A through 2D for preservation methods.

- Do not expose the sample to extreme hot or cold temperatures and intense sunlight, even if no specific preservation is recommended.

- Deliver the samples to the contract laboratory as soon as practicable.

7.3 Specific Sampling Guidelines for Organic Analytes in Aqueous or Solid Matrices

Special precautions must be taken to maintain sample integrity when analyzing for VOCs or semi-VOCs. In addition to the general sampling guidelines described for aqueous and solids in Sections 7.1.6, 7.1.7, 7.2.3 and 7.2.4 of this Appendix, sampling personnel follow the guidelines outlined below for collecting aqueous or solid matrix samples to be analyzed for organic analytes:

7.3.1 Volatile Organic Compound Sampling

- To monitor possible contamination, prepare a trip blank from organic-free reagent water before leaving for the sampling site. Carry the trip blank throughout sampling, storage, and transportation.

- Do not collect or store samples in the presence of exhaust fumes from vehicles, equipment, or machinery.

- Collect only grab samples. Compositing samples poses an unknown safety risk; do not composite samples of unknown wastes with suspect organic components.

- *Liquids*. Use standard 40 ml glass, screw-cap VOA vials with Teflon-lined silicone septa for liquid samples. Introduce liquids into the vials gently to reduce agitation that might drive off volatile compounds. Pour aqueous samples into the VOA vial without introducing any air bubbles within

the vial as it is being filled. If bubbling occurs, discard the sample and collect another sample in a new VOA vial. Each VOA vial should be filled until a meniscus is over the lip of the vial. The vials should be completely filled at the time of sampling so that when the septum cap is fitted and sealed (Teflon side toward the sample) and the vial inverted, no headspace is visible. If there are any air bubbles, recollect the sample.

- *Solids*. Use standard 40-mL glass, screw-cap VOA vials with Teflon-lined silicone septa for samples with solid or semi-solid matrices. Introduce the solids into the vials gently to reduce agitation that might drive off VOCs. VOA vials should be completely filled. The VOA vials should be tapped slightly as they are filled to eliminate free air space.

- Seal each VOA vial in a separate plastic bag to prevent cross-contamination between samples, particularly if the sampled waste is suspected of containing high levels of volatile organics. VOA samples may also be contaminated by diffusion of VOCs through the septum during transportation and storage at the Ciniza facility.

7.3.2 Semivolatile Organic Compound Sampling

- Do not collect or store samples in the presence of exhaust fumes from vehicles, equipment, or machinery.

- Collect only grab samples. Compositing of samples poses an unknown safety risk; do not composite samples of unknown, suspect organic analytes.

- Containers used to collect SVOC samples should be specially cleaned with a soap and water wash followed by methanol or isopropanol rinsing. The sample containers should be glass or Teflon and have screw-caps with Teflon-lined septa. Plastic containers or lids may NOT be used. To avoid any possible contamination, sample containers should be filled with care to prevent any portion of the collected sample coming in contact with the sampler's glove.

7.4 Calibration

Proper calibration of equipment used to obtain samples and data for this early detection monitoring is critical for ensuring accuracy and precision of results. Due to changes in technology and subcontractors used for early detection monitoring activities, Ciniza will rely on manufacturer's specifications and instructions for proper calibration of equipment.

7.4.1 Sampling and Monitoring Equipment and Calibration

The equipment used to collect data for this monitoring plan is to be calibrated in accordance with manufacturers' specifications before use. The team leader is responsible for calibrating needed equipment on schedule, in accordance with specifications. The team leader is also responsible for maintaining current calibration records for each piece of equipment. Calibration records will include manufacturers' specifications and instructions for each piece of equipment used in sampling and monitoring.

7.5 Decontamination

The following procedures are applicable to decontamination of drilling equipment and vehicles and sampling equipment.

7.5.1 Drilling Equipment and Vehicles

Decontamination of large drilling equipment and vehicles is required to prevent cross contamination of boreholes from which samples will be retrieved for chemical analysis. This procedure also provides for the protection of personnel subsequent to demobilization from the LTU.

- Wash and mechanically clean augers and split spoon with biodegradable soap and brush. Rinse with potable water.
- Steam augers and split spoon
- Protect equipment, if necessary, when transporting drilling equipment between boreholes, by covering or shielding.

During decontamination of drilling equipment and accessories, it is especially critical to clean the inside of hollow-stem auger flights, drill rods, and bits. Decontamination can be limited to those parts that may come into direct contact with soil sample surfaces.

7.5.2 Sampling Equipment

Sampling equipment includes all sampling devices and containers that are used to collect or contain a sample prior to final sample analysis. Before its use, all sampling equipment that may contribute to the contamination of a sample must be thoroughly cleaned.

Sampling equipment can generally be cleaned by hand. The following procedure will be used for sampling equipment:

- Scrub with biodegradable soap and potable water
- Rinse with deionized water followed by isopropanol
- Allow to air-dry
- Protect, if necessary, to prevent contamination while transporting from borehole to borehole by covering or shielding

8.0 ANALYTICAL PROCEDURES

8.1 Methods

To adequately evaluate analytical data, EPA-approved methods have been selected and are listed in Tables 2A through 2D.

8.2 Detection Limits

It is imperative that the analytical procedures chosen have detection limits less than appropriate clean up standards or action levels to the intended use of the data and that are consistent with previous sampling events in the LTU. Clean up standards for this plan are included in Tables 2A through 2D.

8.3 Sample Container, Preservation, and Holding Times

Sample container selection, preservation techniques, and holding times must be addressed for every sampling activity to ensure that the sample does not deteriorate or become contaminated. Sample deterioration can occur through biological degradation or chemical precipitation. Sample contamination can occur through adsorption, absorption, or leaching effects due to the interaction of the sample and the container material. Sample container selection, preservation techniques, and holding times are listed in Tables 2A through 2D.

8.4 Sample Preparation

Proper sample preparation is an integral part of any analytical program. Sample preparation should be confirmed with the EM.

8.5 Laboratory QA/QC

A copy of the laboratory's QA/QC program as submitted to Ciniza is kept on file. The recommended QA/QC program submitted to Ciniza by the NMED is provided as Attachment 2. If necessary, Ciniza will request that the laboratory's QA/QC program be modified to conform to the NMED QA/QC program.

9.0 REPORTING

9.1 Laboratory Data Reports

Laboratory data are provided as hard copy reports to Ciniza. Laboratory data reports will be maintained by Ciniza and contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.

- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; dates of collection, receipt, preparation and analysis; and analyst's name.
- Analytical parameter, analytical result, reporting units, reporting limit, analytical method used.

- Results of QC sample analyses for all concurrently analyzed QC samples.

- Lab reports will be submitted to NMED as part of reporting requirements.

10.0 RECORDS MANAGEMENT

Records generated during early detection monitoring events will be maintained in Ciniza's project files. Project records include, but are not limited to:

- Sampling and Analysis Plans
- Operating Procedures
- COC Records
- Contract Analytical Laboratory Data Reports
- Instrument Maintenance and Calibration Records
- Control Charts and Calculations
- Raw Analytical Results
- Field Logbooks/Notes

11.0 REFERENCES

20 NMAC 4.1, Subpart V. Title 20, *New Mexico Administrative Code*, Chapter 4, Part 1, Subpart V, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," Santa Fe, New Mexico, New Mexico Environmental Improvement Board.

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NMEID. 1988. *Hazardous Waste Facility Permit.* NMD000333211, Santa Fe, New Mexico, New Mexico Environmental Improvement Department, November 4, 1988.

Precision Engineering. 1996. *LTU Stratigraphy Report.* Las Cruces, New Mexico, Precision Engineering.

Table 1A. Summary of Laboratory Quality Control Procedures for Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a]

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
BFB Tune	Before each initial calibration and calibration verification (every 12 hours).	Method 8260B, Table 4 acceptance criteria	Perform necessary instrument maintenance/repair and re-analyze.
Instrument calibration (minimum 5 standards)	Initially and as needed (calibration standards to contain all analytes and surrogates)	Not applicable	Not applicable.
System Performance Check Compounds (SPCCs)	Initial calibration: Immediately after calibration and before sample analysis	RFs: Chloromethane ≥ 0.10 1,1-Dichloromethane ≥ 0.10 Bromoform ≥0.10 Chlorobenzene ≥ 0.30 1,1,2,2-Tetrachloroethane ≥ 0.30	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.
	Calibration verification: At the beginning of each 12 hour analytical shift	As for initial calibration	Evaluate analytical system and perform corrective action. Re-analyze and recalibrate if necessary.
Calibration Check Compounds (CCCs)	Initial calibration: After calibration and before sample analysis	RSDs for CCCs ≤ 30% RSDs for target analytes ≤ 15%	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.
	Calibration verification: At the beginning of each 12 hour analytical	% difference or % drift ≤ 20% for CCCs and all target analytes	Evaluate analytical system and perform corrective action. Re-analyze and recalibrate if necessary.
Linearity of target analytes	After calibration and before sample analysis	RSD ≤ 15%	Recalibrate or use alternate calibration options provided in SW-846, Method 8000.
Retention Time (RT) windows	Initially, establish an absolute retention time for each analyte and surrogate compound according to established and documented procedures	Not applicable	Not applicable.
	Assess the retention times of target analytes in each calibration standard	± 0.06 relative retention times (RRT)	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.

Table 1A. Summary of Laboratory Quality Control Procedures for Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
	The center of the retention time window for analytes and surrogates is established from the calibration verification standard	Not applicable	Not applicable.
	Assess retention time of internal standards in the calibration verification standard	Within 30 secs of RT in the mid-point initial calibration standard	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Recalibrate as necessary.
Internal Standards (IS)	Assess IS response in the calibration verification standard	EICP area ≥ -50% or ≤ + 100% of most recent initial calibration	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Recalibrate as necessary.
Calibration Verification	At the beginning of each 12 hour analytical shift	See acceptance criteria for DFTPP, SPCCs, CCCs, method blank. RTs, IS	Evaluate analytical system, perform corrective action, re-calibrate as necessary.
Surrogates	Each field sample, blank, and QC sample	Laboratory established acceptance limits	Review surrogate recoveries in comparison with other QC sample results (MS/MSD, LCS). Re-extract and/or re-analyze samples, flag data.
Method blank (MB)	Immediately after the calibration verification standardWith every analytical batch (once per 20 samples prepared using the same procedures at the same time)	≤ 5% of the regulatory/contract required limit for the analytes. If no regulatory/contract limit applies, ≤ 3 x MDL	Identify and reduce the source of contamination. Re-extract/re-analyze samples associated with a contaminated blank. Recalibrate as necessary.
Matrix spike (pre-digestion) (MS) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b]	Flag data.
Matrix spike duplicate (pre-digestion) (MSD) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b] 0-20% RPD [b]	Flag data.

Table 1A. Summary of Laboratory Quality Control Procedures for Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Duplicates (D) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	0-20% RPD [b]	Flag data.
Surrogates	Each field sample, blank, and QC sample	Laboratory established acceptance limits for % recovery (R)	Review surrogate recoveries in comparison with other QC sample results (MS/MSD, LCS). Re-extract and/or re-analyze samples, flag data.
Laboratory Control Sample (LCS)	Once per analytical batch or every 20 samples whichever is more frequent	70-130% recovery (R)[b]	Identify and correct problem. Re-analyze all samples associated with failed LCS.
Method Detection Limit (MDL)	Annually, at a minimum.	≤ 5% regulatory/contract required detection limit	Review analytical protocol, rerun MDL samples, select an alternative method of analysis.

[a] U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*, Method 8260B and Method 8000B

[b] Laboratory developed in-house control limits must be used if available

[c] Requirement for analysis of duplicate/MS or MS/MSD is sample dependent; if samples are not expected to contain target analytes, MS/MSD should be used.

Table 1B. Summary of Laboratory Quality Control Procedures for Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a]

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
DFTPP Tune	Before initial each calibration and calibration verification (every 12 hours).	Method 8270C, Table 3	Perform necessary instrument maintenance/repair and re-analyze.
Column performance and injection port inertness	Before each initial calibration and calibration verification (every 12 hours).	DDT → DDE and DDD ≤ 20%	Perform necessary instrument maintenance/repair and re-analyze.
Instrument calibration (minimum 5 standards)	Initially and as needed (calibration standards to contain all analytes and surrogates)	Not applicable	Not applicable.
System Performance Check Compounds (SPCCs)	Initial calibration: Immediately after calibration and before sample analysis	RFs for SPCCs ≥ 0.050	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.
	Calibration verification: Before sample analysis and once every following 12 hour analytical shift	RFs for SPCCs ≥ 0.050	Evaluate analytical system and perform corrective action. Re-analyze and recalibrate if necessary.
Calibration Check Compounds (CCCs)	Initial calibration: After calibration and before sample analysis	%RSD for CCCs ≤ 30% % RSD for all target analytes ≤ 15%	Evaluate analytical system and perform corrective maintenance/repair. Re-analyze and recalibrate if necessary.
	Calibration verification: Before sample analysis and once every following 12 hour analytical shift	% difference or % drift ≤ 20% for CCCs and all target analytes	Evaluate analytical system and perform corrective maintenance/repair. Re-analyze and recalibrate if necessary.
Linearity of target analytes	After calibration and before sample analysis	RSD ≤ 15%	Recalibrate or use alternate calibration options provided in SW-846, Method 8000.
Retention Time (RT) windows	Initially, establish an absolute retention time for each analyte and surrogate compound according to established and documented procedures	Not applicable	Not applicable.
	Assess the retention times of target analytes in each calibration standard	± 0.06 relative retention times (RRT)	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.

Table 1B. Summary of Laboratory Quality Control Procedures for Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
	The center of the retention time window for analytes and surrogates is established from the calibration verification standard	Not applicable	Not applicable.
	Assess retention time of internal standards in the calibration verification standard	Within 30 secs of RT in the mid-point initial calibration standard	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Re-calibrate as necessary.
Internal Standards (IS)	Assess IS response in the calibration verification standard	EICP area >≥ -50% or ≤ + 100% of most recent initial calibration	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Recalibrate as necessary.
Calibration Verification	At the beginning of each 12 hour analytical shift	See acceptance criteria for DFTPP, SPCCs, CCCs, method blank. RTs, IS	Evaluate analytical system, perform corrective action. Re-calibrate as necessary.
Method blank (MB)	Immediately after the calibration verification standard With every analytical batch (once per 20 samples prepared using the same procedures at the same time)	≤ 5% of the regulatory/contract required limit for the analytes. If no regulatory/contract limit applies, ≤ 3 x MDL	Identify and reduce the source of contamination. Re-extract/re-analyze samples associated with a contaminated blank. Recalibrate as necessary.
Matrix spike (pre-digestion) (MS) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b]	Flag data.
Matrix spike duplicate (pre-digestion) (MSD) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b] 0-20% RPD [b]	Flag data.
Duplicates (D) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	0-20% RPD [b]	Flag data.

Table 1B. Summary of Laboratory Quality Control Procedures for Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Surrogates	Each field sample, blank, and QC sample	Laboratory established acceptance limits for % recovery (R)	Review surrogate recoveries with regard to other QC sample results (MS/MSD, LCS). Re-extract and/or re-analyze samples, flag data.
Laboratory Control Sample (LCS)	Once per analytical batch or every 20 samples, whichever is more frequent	70-130% recovery (R)[b]	Identify and correct problem. Re-analyze all samples associated with failed LCS.
Method Detection Limit (MDL)	Annually, at a minimum.	≤ 5% regulatory/contract required detection limit	Review analytical protocol, rerun MDL samples, select an alternative method of analysis.

[a] U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*, Method 8270C and Method 8000B.

[b] Laboratory developed in-house control limits must be used if available.

[c] Requirement for analysis of duplicate/MS or MS/MSD is sample dependent; if samples are not expected to contain target analytes, MS/MSD should be used.

Table 2A. Modified Skinner List 8260 Volatile Organics and PHCs[a]

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Reporting[c] Limit (µg/L)	Soil Reporting[c] Limit (mg/kg)
Benzene	8260	GC/MS	G	4°C	14	5	0.67
2-Butanone (MEK)	8260	GC/MS	G	4°C	14	1900	7000
Carbon Disulfide	8260	GC/MS	G	4°C	14	1000	350
Chlorobenzene	8260	GC/MS	G	4°C	14	39	54
Chloroform	8260	GC/MS	G	4°C	14	0.16	0.24
Chloromethane	8260	GC/MS	G	4°C	14	1.5	1.2
1,1 Dichloroethane	8260	GC/MS	G	4°C	14	25	580
1,2 Dichloroethane	8260	GC/MS	G	4°C	14	5	0.34
1,1 Dichloroethene	8260	GC/MS	G	4°C	14	5.0	0.053
trans-1,2-Dichloroethene	8260	GC/MS	G	4°C	14	100	63
1,4-Dioxane	8260	GC/MS	G	4°C	14	6.1	44
Ethylbenzene[a]	8260	GC/MS	G	4°C	14	700	230
Methylene Chloride	8260	GC/MS	G	4°C	14	4.3	8.6
Styrene	8260	GC/MS	G	4°C	14	100	1700
1,1,2,2-Tetrachloroethane[b]	8260	GC/MS	G	4°C	14	0.55	0.37
Tetrachloroethene[b]	8260	GC/MS	G	4°C	14	5	4.9
Toluene	8260	GC/MS	G	4°C	14	750	1000
1,1,1-Trichloroethane	8260	GC/MS	G	4°C	14	60	200
Trichloroethene	8260	GC/MS	G	4°C	14	5	2.7
Total Xylene[a, d]	8260	GC/MS	G	4°C	14	620	860
Ethylene Dibromide[b]	8260	GC/MS	G	4°C	14	0.1	0.005
Acetone	8260	GC/MS	G	4°C	14	610	1500

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

mg/kg = milligrams per kilogram
µg/L = microgram per liter
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry

Table 2B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Anthracene	8270	GC/MS	G	4°C	14	1800	16000
Acenaphthene	8270	GC/MS	G	4°C	14	370	2800
Benzo(a)Anthracene	8270	GC/MS	G	4°C	14	0.09	0.62
Benzo(b)Fluoranthene	8270	GC/MS	G	4°C	14	0.09	0.62
Benzo(k)Fluoranthene	8270	GC/MS	G	4°C	14	0.9	6.2
Benzo(a)Pyrene[a]	8270	GC/MS	G	4°C	14	0.0007	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4°C	14	7300	240
Chrysene[a]	8270	GC/MS	G	4°C	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4°C	14	29000	49000
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G	4°C	14	[e]	[e]
Dimethyl Phthalate	8270	GC/MS	G	4°C	14	370000	100000
Di-n-Octyl Phthalate	8270	GC/MS	G	4°C	14	730	1200
Fluoranthene	8270	GC/MS	G	4°C	14	1500	2300
Fluorene	8270	GC/MS	G	4°C	14	240	2000
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G	4°C	14	0.09	0.62
2-Methylnaphthalene[a]	8270	GC/MS	G	4°C	14	30	660
2-Methylphenol (Cresol)	8270	GC/MS	G	4°C	14	1800	3000
3/4-Methylphenol (Cresol)	8270	GC/MS	G	4°C	14	1980	3300
Naphthalene[g]	8270	GC/MS	G	4°C	14	30	55
Nitrobenzene	8270	GC/MS	G	4°C	14	3.4	17
4-Nitrophenol	8270	GC/MS	G	4°C	14	2300	3800
Phenanthrene[a]	8270	GC/MS	G	4°C	14	[e]	[e]
Pyrene[a]	8270	GC/MS	G	4°C	14	180	1700
Pyridine	8270	GC/MS	G	4°C	14	37	61
Quinoline	8270	GC/MS	G	4°C	14	0.0056	0.04
Benzenethiole	8270	GC/MS	G	4°C	14	[e]	[e]
Phenol	8270	GC/MS	G	4°C	14	5	36000
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G	4°C	14	6.0	35
Dibenz(a,j)acridine[b]	8270	GC/MS	G	4°C	14	[e]	[e]
Dibenz(a,h)-anthracene	8270	GC/MS	G	4°C	14	0.0092	0.062
Dichlorobenzene[b, f]	8270	GC/MS	G	4°C	14	675	410
Methyl Naphthalene	8270	GC/MS	G	4°C	14	30	[e]
2,4-Dimethylphenol	8270	GC/MS	G	4°C	14	730	1200
2,4-Dinitrotoluene	8270	GC/MS	G	4°C	14	73	120

Table 2B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a] (Continued)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
2,4-Dinitrophenol[b]	8270	GC/MS	G	4°C	14	73	120
Benzo(j)Fluoranthene	8270	GC/MS	G	4°C	14	[e]	[e]
2-Chlorophenol	8270	GC/MS	G	4°C	14	30	61
2,4,6-Trichlorophenol	8270	GC/MS	G	4°C	14	6.1	44
Di-n-Butyl Phthalate	8270	GC/MS	G	4°C	14	3700	6100
Benzyl Alcohol[b]	8270	GC/MS	G	4°C	14	11000	18000
Methyl Chrysene	8270	GC/MS	G	4°C	14	[e]	[e]
Total Cresol[a, f]	8270	GC/MS	G	4°C	14	3780	6300
TPH[h]	8015m	GS	G	4°C	7	—	1000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[e]No regulatory limit provided. Laboratory detection limit will be used.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.
[g]Total naphthalene plus monomethylnaphthalenes regulatory limit is < 30µg/L for aqueous samples.
[h]Total Petroleum Hydrocarbon as Gasoline Range Organics and Diesel Range Organics

µg/L = microgram per liter
mg/kg = milligram per kilogram
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry
GC = gas chromatography

Table 2C. Modified Skinner List Metals and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative [b]	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Antimony	7060(aq), 6010	GFAA/ICP	P or G	4°C	180	6.0	31
Arsenic	6010	ICP-AES	P or G	4°C	180	50	22
Barium	6010	ICP-AES	P or G	4°C	180	2000	5400
Beryllium	6010	ICP-AES	P or G	4°C	180	4.0	150
Cadmium	6010	ICP-AES	P or G	4°C	180	5.0	39
Chromium[a]	6010	ICP-AES	P or G	4°C	180	50	210
Cobalt	6010	ICP-AES	P or G	4°C	180	50	3400
Lead[a]	6010	ICP-AES	P or G	4°C	180	15	400
Nickel	6010	ICP-AES	P or G	4°C	180	100	1600
Selenium	6010	ICP-AES	P or G	4°C	180	50	390
Silver	6010	ICP-AES	P or G	4°C	180	50	390
Vanadium	6010	ICP-AES	P or G	4°C	180	260	550
Zinc	6010	ICP-AES	P or G	4°C	180	10000	23000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

µg/l = microgram per liter
mg/kg = milligram per kilogram
ICP-AES = Inductively Coupled Plasma - Atomic Emission Spectroscopy
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table 2D. Mercury[a] and Cyanide

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Mercury[a]	7470/7471	CVAA	P or G	4°C[b]	28	2.0	23.
Cyanide	335.3/ 9010, 9014	Colorimetry	P or G	4°C[d]	14	200	1200

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.

[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.

[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

[d]Aqueous samples are field adjusted to pH >12 with NaOH and refrigerated. Non-aqueous samples are cooled to 4°C.

µg/l = microgram per liter
mg/kg = milligram per kilogram
CVAA = cold vapor atomic absorption
G = glass
P = linear polyethylene, polypropylene, or Teflon

APPENDIX F

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