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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 P.O. BOX 26110 SANTA FE, NEW MEXICO 87502
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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
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
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.

C.2 Waste Analysis Plan [20 NMAC 4.1, Subpart V, §264.13(b) and (c); Subpart VIII, §268.7; and Subpart IX, §270.14(b)(2)]

The waste analysis plan (WAP) (provided as Appendix B) describes the waste characterization methods used at Ciniza for the hazardous waste streams treated at the LTU. The waste analysis information contained in the WAP is specific to land treatment activities at the LTU and includes analytical parameters, parameter rationales, sampling methods, sampling frequencies, and analytical methods.

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.

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 as 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, below the treatment zone (BTZ), 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 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 and PHCs, collectively referred to as the modified Skinner List.

The sampling schedule (Figure E-1) for the ZOI, treatment zone, BTZ, 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	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, 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. 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 and Below the Treatment Zone Sampling

Ciniza will sample the treatment zone and BTZ 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 and BTZ 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 and BTZ sampling frequency is parallel to the frequency of ZOI sampling. The treatment zone and BTZ 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. 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 and/or the BTZ. The characterization, if required, will include all organics and metals in the modified Skinner List. 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 may be of the sampling schedule 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(a)(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, 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 F.

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 0.055 tap	1700
1,1,2,2-Tetrachloroethane[b]	8260	GC/MS	G	4°C	14	0.55 ~~0.43 (tap)~~	0.37
Tetrachloroethene[b]	8260	GC/MS	G	4°C	14	5	4.9
Toluene	8260	GC/MS	G	4°C	14	1000 750 wqcc	520
1,1,1-Trichloroethane	8260	GC/MS	G	4°C	14	200 60 wqcc	710
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 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 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
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	0.2	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4°C	14	[e] 7300	[e] 2400 MSSL
Chrysene[a]	8270	GC/MS	G	4°C	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4°C	14	[e] 2,9000	[e] 4,9000 MSSL
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
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	8270	GC/MS	G	4°C	14	30	55
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	0.006 0.0056	0.04
Benzenethiole	8270	GC/MS	G	4°C	14	[e]	[e]
Phenol	8270	GC/MS	G	4°C	14	22000 5 WQCC	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	10.0 0.0092	0.062
Dichlorobenzene[b]	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	10.0 730 MSSL	1200

Table E-1B. Modified Skinner List 8270 Semivolatile Organics 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	1200 120 MISS
remove — Indene[d]	–	–	–	–	–	[e]	[e]
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

[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 and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Use a non-SW-846 method to analyze for indene because there is no established SW-846 method.
[e]No regulatory limit provided.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

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

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	100 So WQCC	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	20 So WQCC	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 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

Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
Reporting Limit	NA	0.025	50	0.05	50
Sample Number / 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 NA pH units	Total Phosphorus 0.025 mg/Kg	Oil & Grease 50 mg/Kg	Total Organic Carbon 0.05 %	Total Kjeldahl Nitrogen 50 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	-	-

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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

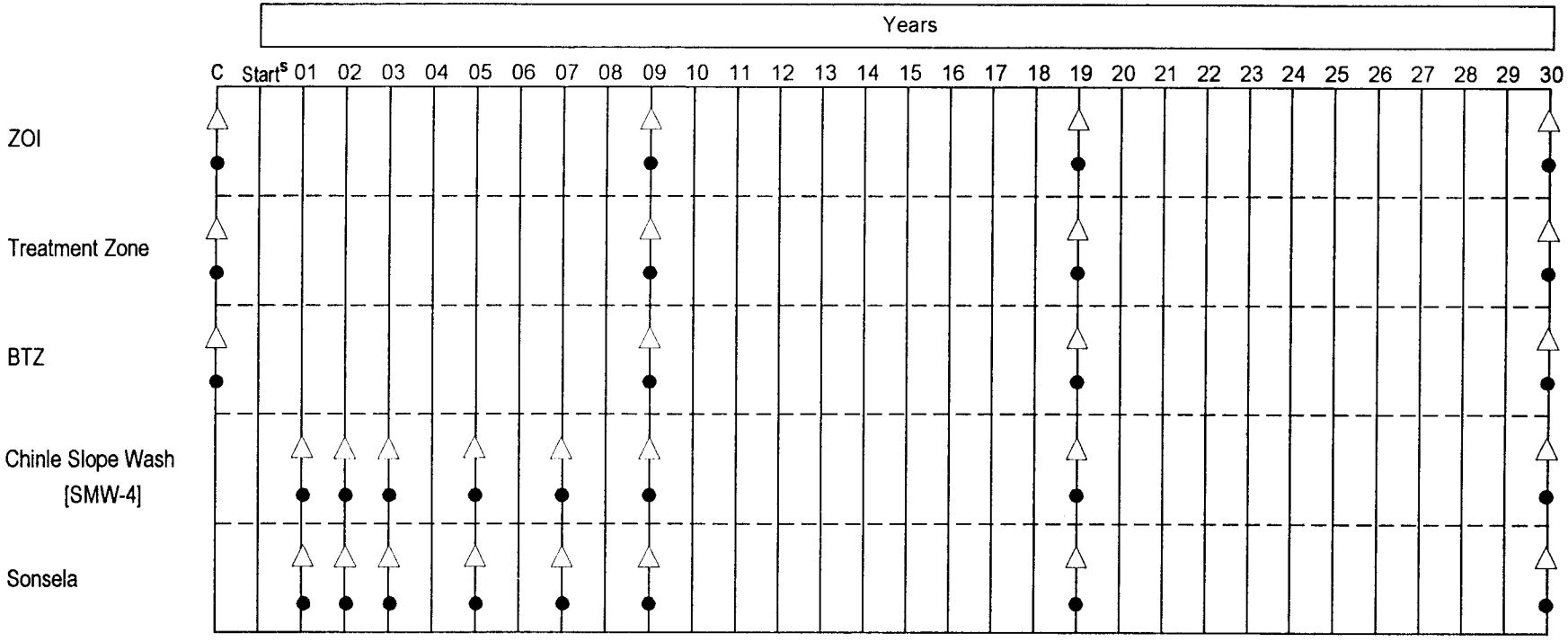
NOTES:

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 is plowed and disked to encourage aerobic microbial activity and improve chemical reaction rates. During

treatment, soil nutrients are 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) continuing in-situ treatment operations for hazardous wastes and waste residues; 2) maintaining the runon and runoff systems of the LTU; 3) controlling wind dispersal of hazardous waste; 4) continuing unsaturated zone monitoring; 5) maintaining the groundwater monitoring system; 6) establishing and maintaining a vegetative cover over

the closed LTU; and 7) 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 ~~final plan~~ 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 will describe the proposed change in operation or LTU design. A copy of the amended ~~plan~~ permit will be submitted with each notification or request. Ciniza will submit a written ~~notification of or~~ a 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 plan~~ 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, §264.143(i) 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 of 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

- Continue treatment operations that are necessary to maintain or enhance completion of degradation and transformation processes of remaining waste residues. Sustain effective immobilization of any hazardous constituents that migrate to the treatment zone.
- 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 support biological treatment and attain residual constituent concentration targets. 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. Further measures to minimize exposure potential consist of restricting final cover plant species to those varieties not known to be a primary food source for local native wildlife.

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, below the treatment zone (BTZ), and Chinle slope wash.

I.4.3.2 Zone of Incorporation, Treatment Zone, and Below the Treatment Zone Soil-Core Monitoring. Ciniza will continue a soil-core monitoring program to collect analytical data from soils in the ZOI, treatment zone, and the BTZ 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 care Monitoring in accordance with 20 NMAC 4.1, Subpart V, § 264.99 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, treatment zone, and BTZ 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 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 and preparation of a 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. Monitoring activities are flexible to respond to routine changes in activities, when needed, to minimize time-consuming and costly administrative modifications.

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.

For organic and metal constituents, in situ treatment will continue as required by 20 NMAC 4.1, Subpart V, §264.273(a). The vegetative top cover will not substantially impede degradation, transformation, or immobilization of hazardous constituents in surface soils. Ciniza will use a biological test (such as Microtox), to confirm phytotoxicity. Once it has been determined that 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 4-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									•	•	•
BTZ									•	•	•
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
BTZ	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 $118,200		$ 29,550
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 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			$258,290
Overhead			$ 25,829
Contingency			$ 25,829
TOTAL			**$309,948**

Mgal. = million gallons
ZOI = Zone of Incorporation
BTZ = Below Treatment Zone

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

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 is 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 is plowed and disked to encourage aerobic microbial activity and improve chemical reaction rates. During

treatment, soil nutrients are 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) continuing in-situ treatment operations for hazardous wastes and waste residues; 2) maintaining the runon and runoff systems of the LTU; 3) controlling wind dispersal of hazardous waste; 4) continuing unsaturated zone monitoring; 5) maintaining the groundwater monitoring system; 6) establishing and maintaining a vegetative cover over

the closed LTU; and 7) 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 final plan 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 will describe the proposed change in operation or LTU design. A copy of the amended plan will be submitted with each notification or request. Ciniza will submit a written notification of or a 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 plan 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, §264.143(i) 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 of 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

- Continue treatment operations that are necessary to maintain or enhance completion of degradation and transformation processes of remaining waste residues. Sustain effective immobilization of any hazardous constituents that migrate to the treatment zone.
- 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 support biological treatment and attain residual constituent concentration targets. 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. Further measures to minimize exposure potential consist of restricting final cover plant species to those varieties not known to be a primary food source for local native wildlife.

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, below the treatment zone (BTZ), and Chinle slope wash.

I.4.3.2 Zone of Incorporation, Treatment Zone, and Below the Treatment Zone Soil-Core Monitoring. Ciniza will continue a soil-core monitoring program to collect analytical data from soils in the ZOI, treatment zone, and the BTZ at appropriate depths, locations, and numbers of samples to provide adequate detection of any statistically significant constituent concentrations in these zones. Ciniza 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, treatment zone, and BTZ soil-core monitoring and Chinle slope wash monitoring provides ample means to maintain and monitor the LTU integrity in the post-closure 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 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 and preparation of a 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. Monitoring activities are flexible to respond to routine changes in activities, when needed, to minimize time-consuming and costly administrative modifications.

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.

For organic and metal constituents, in situ treatment will continue as required by 20 NMAC 4.1, Subpart V, §264.273(a). The vegetative top cover will not substantially impede degradation, transformation, or immobilization of hazardous constituents in surface soils. Ciniza will use a biological test (such as Microtox), to confirm phytotoxicity. Once it has been determined that 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 4-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									•										•											•
BTZ									•										•											•
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
BTZ	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 $118,200		$ 29,550
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 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			$258,290
Overhead			$ 25,829
Contingency			$ 25,829
TOTAL			**$309,948**

Mgal. = million gallons
ZOI = Zone of Incorporation
BTZ = Below Treatment Zone

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

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 as 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, below the treatment zone (BTZ), 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 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 and PHCs, collectively referred to as the modified Skinner List.

The sampling schedule (Figure E-1) for the ZOI, treatment zone, BTZ, 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 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, 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. 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 and Below the Treatment Zone Sampling

Ciniza will sample the treatment zone and BTZ 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 and BTZ 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 and BTZ sampling frequency is parallel to the frequency of ZOI sampling. The treatment zone and BTZ 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. 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 and/or the BTZ. The characterization, if required, will include all organics and metals in the modified Skinner List. 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 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(a)(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, Subpart V, §264.97 requires that the quality of the groundwater passing the point of compliance in the uppermost aquifer be monitored. 20 NMAC, 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 F.

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	1000	520
1,1,1-Trichloroethane	8260	GC/MS	G	4°C	14	200	710
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 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 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
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	0.2	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4°C	14	[e]	[e]
Chrysene[a]	8270	GC/MS	G	4°C	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4°C	14	[e]	[e]
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
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	8270	GC/MS	G	4°C	14	30	55
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	0.006	0.04
Benzenethiole	8270	GC/MS	G	4°C	14	[e]	[e]
Phenol	8270	GC/MS	G	4°C	14	22000	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	10.0	0.062
Dichlorobenzene[b]	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	10.0	1200

Table E-1B. Modified Skinner List 8270 Semivolatile Organics 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	1200
Indene[d]	–	–	–	–	–	[e]	[e]
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

[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 and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Use a non-SW-846 method to analyze for indene because there is no established SW-846 method.
[e]No regulatory limit provided.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

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

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	100	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	20	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 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

Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
Reporting Limit	NA	0.025	50	0.05	50
Sample Number 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	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 CEIL 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-Dimethyiphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.44	-	-
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

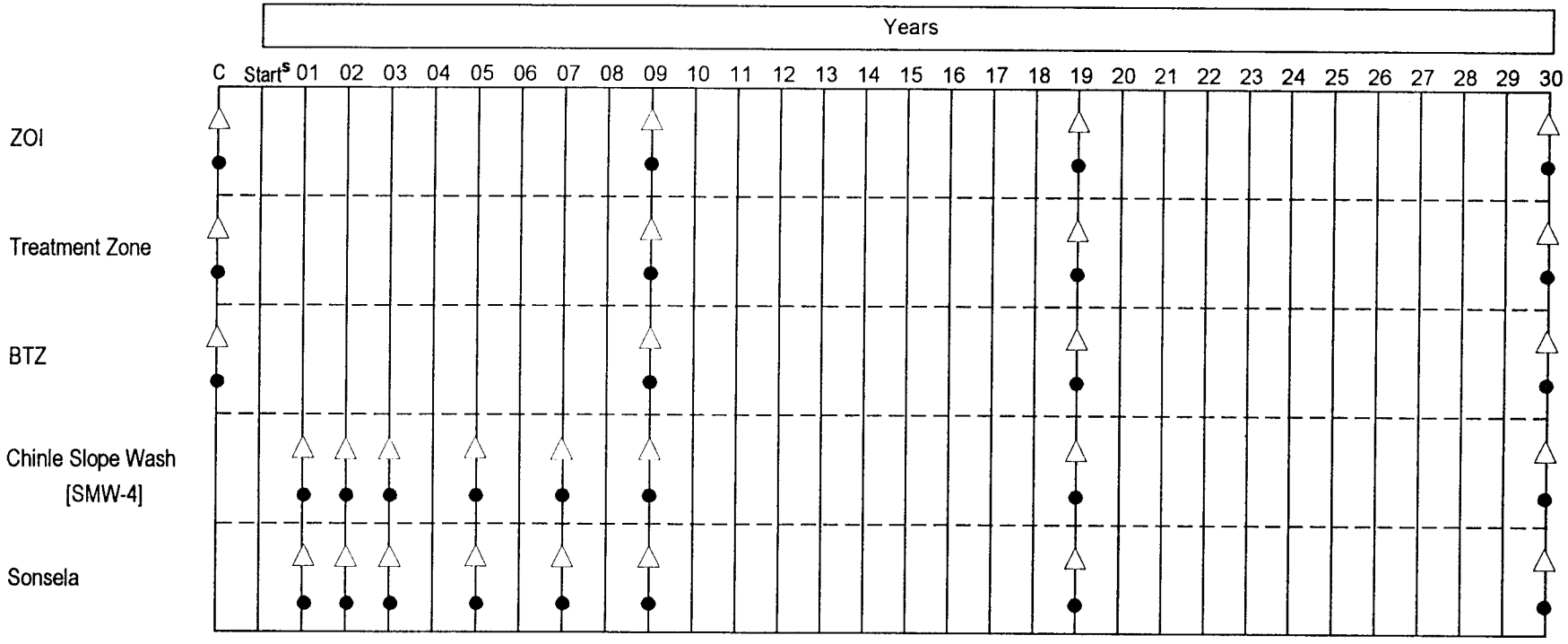
NOTES:

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

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.

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.

Attachment J-1

Approval Documentation

Attachment J-1

Approval Documentation

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

The following are not considered SWMUs:

- Buildings or structures, unless the sites are or were used for storage, treatment, or disposal of solid waste or unless the site is contaminated with hazardous constituents to the point of being inherently waste-like
- Active underground product storage tanks
- One-time releases or spills
- Product storage areas having no evidence of routine releases
- Soil beneath existing or former buildings or structures, or surrounding underground storage tanks (USTs) that have been removed, and that have no visible evidence of contamination and no record of routine releases
- Hazardous waste management units subject to other statutory authority (e.g., Toxic Substances Control Act, Clean Air Act, Clean Water Act)
- Areas for which there is no substantial evidence to indicate the existence of a SWMU (e.g., abandoned structures that were not used for the treatment, storage, or disposal of solid wastes; septic tank systems used only for the treatment of domestic waste)

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 applicaation 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

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

The following are not considered SWMUs:

- Buildings or structures, unless the sites are or were used for storage, treatment, or disposal of solid waste or unless the site is contaminated with hazardous constituents to the point of being inherently waste-like
- Active underground product storage tanks
- One-time releases or spills
- Product storage areas having no evidence of routine releases
- Soil beneath existing or former buildings or structures, or surrounding underground storage tanks (USTs) that have been removed, and that have no visible evidence of contamination and no record of routine releases
- Hazardous waste management units subject to other statutory authority (e.g., Toxic Substances Control Act, Clean Air Act, Clean Water Act)
- Areas for which there is no substantial evidence to indicate the existence of a SWMU (e.g., abandoned structures that were not used for the treatment, storage, or disposal of solid wastes; septic tank systems used only for the treatment of domestic waste)

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

L.0 CERTIFICATION

In accordance with the *New Mexico Administrative Code*, Title 20, Chapter 4, Part 1, Subpart IX, §270.11(d), revised November 1, 1995, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to 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.

_____ _____

Leroy Crow, Senior Vice President, Operations
Giant Industry Inc.
23733 N. Scottsdale Road
Scottsdale, Arizona 85255

Date

L.0 CERTIFICATION

In accordance with the *New Mexico Administrative Code*, Title 20, Chapter 4, Part 1, Subpart IX, §270.11(d), revised November 1, 1995, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to 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.

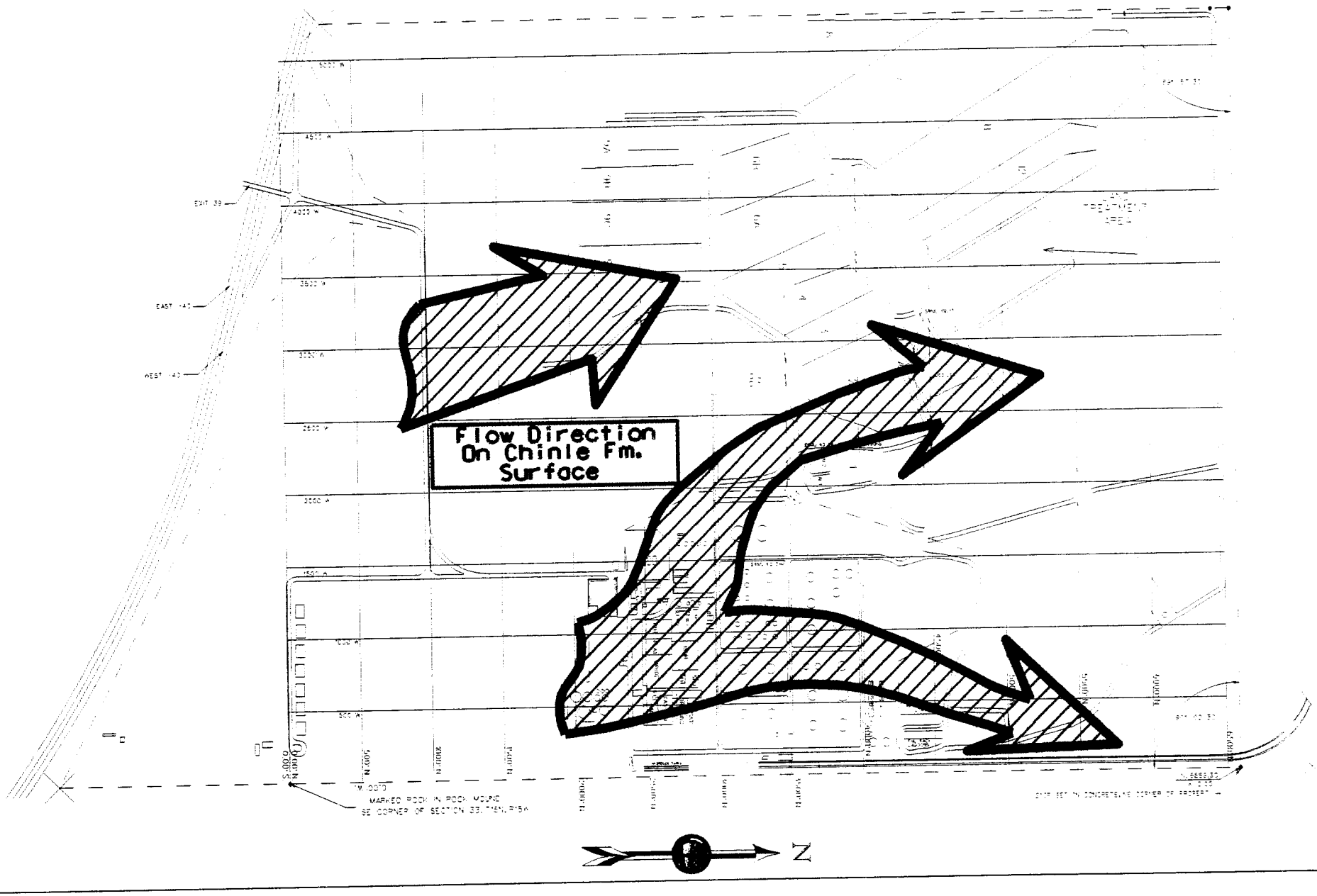
_____ _____

Leroy Crow, Senior Vice President, Operations
Giant Industry Inc.
23733 N. Scottsdale Road
Scottsdale, Arizona 85255

Date

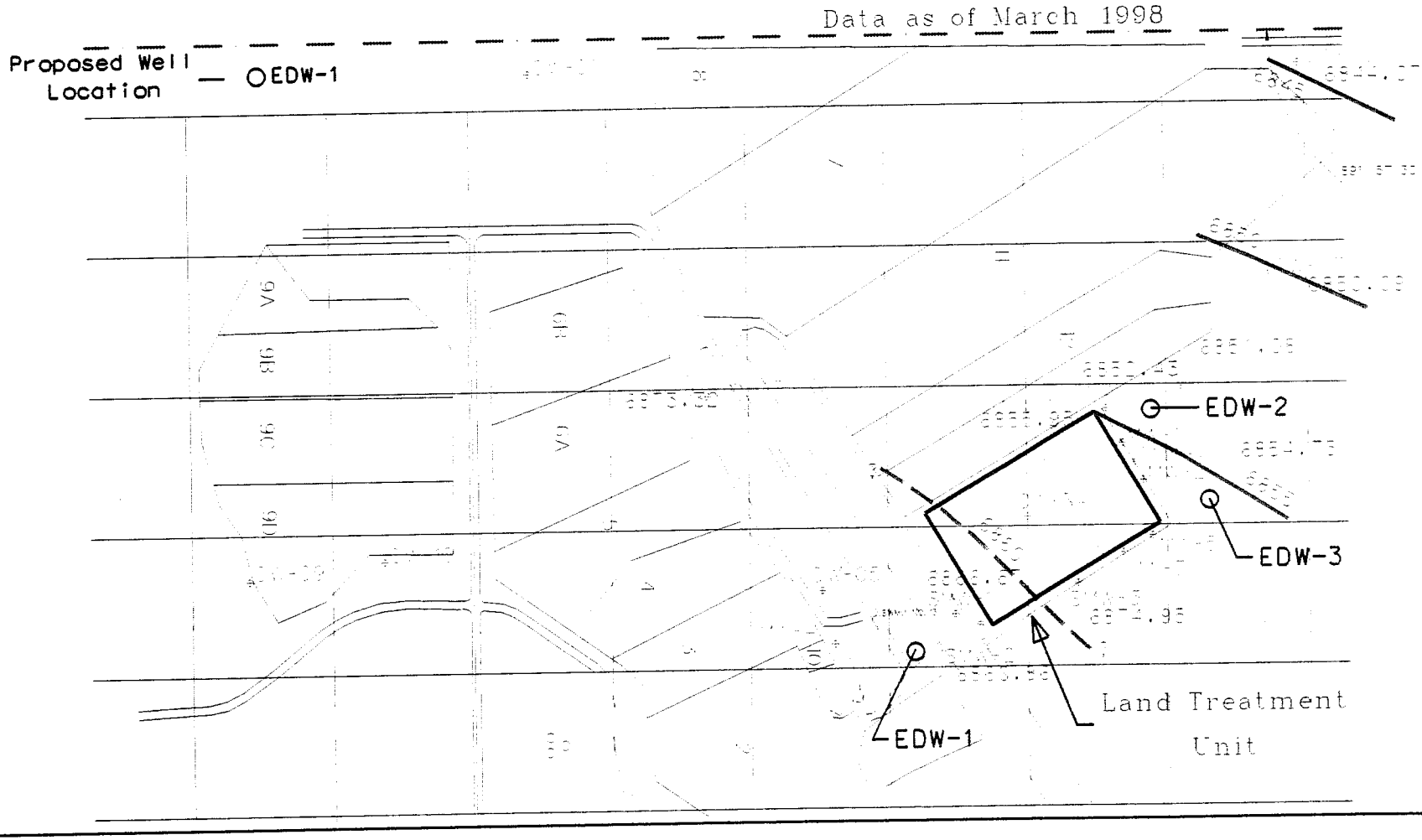
CINIZA REFINERY

Flow Direction on Top of The Chinle Formation



CINIZA REFINERY

Alluvial Wash Piezometric Surface At the LTU- Figure 2-1b



Attachment I-2

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

EPA Region 6

Human Health

Media-Specific Screening Levels

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202

Screening Levels
Uses and Limitations

- A consultation with a Risk Assessor should take place before making a final decision in the corrective/remedial action process.
- The screening levels should only used in the preliminary stages of the investigations, i.e., screen.
- All values are risk-based with exceptions and their respective basis for the calculations/values noted.
- Risk-based concentrations for carcinogens were calculated at the following risk levels: Class A or B = 10^{-6}, Class C = 10^{-5}, "Blank" = 10^{-6}.
- The screening levels only address human health protection.
- Values do not account for chemical mixtures. If more than one non-carcinogen is expected, than the non-carcinogenic chemical screening level should be divided by 10.
- Exceedance of a screening level does not indicate a required action.
- Unrestricted land use, i.e., residential values should be considered in the initial screening of sites for which future residential land use cannot be definitively ruled out.
- The selection of constituents of potential concern (COPC's) can be conducted against these values once the screening levels for the non-carcinogenic compounds are divided by a factor of 10 to account for chemical mixtures.

- Sources used to compile the screening levels were:

Region IX Preliminary Remediation Goals (PRGs)
- Tap Water Values, Direct soil exposure values.

EPA Region III Risk-Based Concentration Table
- Tap Water and Soil Values labeled "I", Ambient Air Values, Fish Values, Soil Screening Levels

EPA's *Draft Soil Screening Level Guidance*
- Soil screening levels.

EPA Region 6 Current and Proposed National Primary and Secondary Drinking Water Regulations Table
- Drinking values labeled MCL's.

Risk Assessment Guidance for Superfund (RAGS), Health Effects Assessment Summary Tables (HEAST), Agency for Toxic Substances and Disease Registry Toxicological Profiles, and *EPA Provisional Guidance*
- Technical reference documents.

Region 6 Draft Supplemental Guidance to RAGS
- Technical reference documents.

OSWER Directives
- Policy documents, e.g., residential soil lead screening level.

Elemental Composition of Surficial Materials in the Conterminous United States and *OSWER Regional Toxics Coordinators Memorandum* titled "Background Metals in Soil" dated March 14, 1989.
- Soil regional background values.

- The Screening Levels Table is "write" protected and will be updated on a regular basis.

- Specific questions on the table should be directed to Maria Martinez (6PD-NB) at 5-2230.

- The *Media-Specific Screening Levels Table* is in WordPerfect format.

- The user can either type "search" for a chemical name or scroll the list of chemicals.

- Once in the tables portion of the table the user can either view the file on the screen or print the table (by single page or the full [redacted] page document).

EPA Region 6
Human Health
Media-Specific Screening Levels

Legend: MCL = Maximum Contaminant Level SAT = risk-based value above expected saturation point max = maximum concentration PEST = Pesticide Herb = Herbicide VOC = Volatile Organic Compound SVOC = Semi-Volatile Organic Compound "Blank" = Missing data for generation of value.				— /	Basis: C= carcinogenic effects N = non-carcinogenic effects E = EPA draft Soil Screening Level S = soil saturation concentration M' = EPA MCL I = Ingestion route only						
					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Acephate	PEST	C			77 C	7.2 C	3.6 C	510 C	2200 C		
Acetaldehyde					94N I	0.81 C					
Acetochlor	PEST				730 N	73N	27 N	1300 N	14000 N		
Acetone	VOC				610 N	370 N	140 N	2000 N	8400 N	62000 E	8 E
Acetone cyanohydrin					2600 N	150 N	95 N	4600 N	48000 N		
Acetonitrile	VOC				220 N	52 N	8.1 N	390 N	4100 N		
Acetophenone	SVOC				0.04 N	0.021 N	140 N	5600 N	45000N		
Acifluorfen	PEST				470 N	47 N	18 N	850 N	8900 N		
Acrolein	PEST				730 N	0.021 N	27 N	1300N	12000N		
Acrylamide		B2			0.015 C	0.0014 C	0.0007 C	0.098 C	0.41 C		
Acrylic acid					18000 N	1 N	680 N	32000N	SAT		
Acrylonitrile	VOC	B1			0.12 C I	0.026 C	0.0058 C	0.13 C	0.30 C		
Alachlor	PEST			2	0.8 C	0.078 C	0.039 C	5.5 C	24 C		
Alar	PEST				5500 N	550 N	200 N	9800 N	SAT	570 S	0.036 M'
Aldicarb	PEST			7	37 N	3.7 N	1.4 N	65 N	680 N		
Aldicarb sulfone	PEST	B2		7	37 N	3.7 N	1.4 N	65N	680 N	0.5 E	0.005 E
Aldrin					0.004 C	0.00037 C	0.00019 C	0.026C	0.11 C		
Ally					9100 N	910 N	340 N	16000N	SAT		

EPA Region 6
Human Health
Media-Specific Screening Levels

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
					Tap Water (Residential Scenario: Ingestion, & Inhalation.)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*			
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Allyl alcohol	VOC				180 N	18 N	6.8 N	330 N	3400 N		
Allyl chloride	VOC		45,000		1800 N	1 N	68 N	3300 N	34000N		
Aluminum					37000 N	3700 N	1400 N	77000 N	SAT		
Aluminum phosphide	PEST				15 N	1.5 N	0.54 N	31N	680 N		
Amdro	PEST				11 N	1.1 N	0.41 N	21N	200 N		
Ametryn	PEST				330 N	33 N	12 N	590 N	6100 N		
m-Aminophenol	PEST				2600 N	260 N	95 N	4600 N	48000N		
4-Aminopyridine	PEST				0.73 N	0.073 N	0.027 N	1.3N	14 N		
Amitraz					91 N	9.1 N	3.4 N	160 N	1700 N		
Ammonia	PEST				1000 NI	100 N					
Ammonium sulfamate	SVOC	B2			7300 N	730 N	270 N	13000 N	SAT	45 N	0.031 N
Aniline					11 N	1 N	0.55 C	19 C	200 C		
Antimony and compounds				6	15 N	1.5 N	0.54 N	31 N	680 N		
Antimony pentoxide					18 N	1.8 N	0.68 N	38 N	850 N		
Antimony potassium tartrate					33 N	3.3 N	1.2 N	69 N	1500 N		
Antimony tetroxide	PEST				15 N	1.5 N	0.54 N	31 N	680 N		
Antimony trioxide					15 N	1.5 N	0.54 N	31 N	680 N		
Apollo					470 N	47 N	18 N	850 N	8900 N		

EPA Region 6
Human Health
Media-Specific Screening Levels

Legend: MCL = Maximum Contaminant Level
SAT = risk-based value above expected saturation point
max = maximum concentration
PEST = Pesticide Herb = Herbicide
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
"Blank" = Missing data for generation of value.

Basis: C= carcinogenic effects N = non-carcinogenic effects
E = EPA draft Soil Screening Level S = soil saturation concentration
M = EPA MCL I = Ingestion route only

Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc./Range (mg/kg)	Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
				Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Industrial	Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aramite Arsenic (noncancer) Arsenic (as carcinogen)	PEST	B2 A	1.1-16.7	50	2.7 C 23 N I 0.04 C	0.25 C 1.1 N 0.00041 C	0.13 C 0.41 N 0.0021 C	18 C 22 N 0.32 C	76 C 610 N I 2.0 C	380 E 380 E	15 E 15 E
Amine Assure Asulam	PEST PEST				0.52 N I 330 N 1800 N	0.052 N 33 N 180 N	12 N 68 N	590 N 3300 N	6100 N 34000 N		
Atrazine Avermectin B1 Azobenzene	PEST PEST	B2		3	0.3 C 15 N 0.61 C	0.028 C 1.5 N 0.058 C	0.014 C 0.54 N 0.029 C	2.0 C 26 N 4.0 C	8.6 C 270 N 17 C		
Barium and compounds Baygon Bayleton	PEST PEST		430	2000	2600 N 150 N 1100 N	0.52 N 15 N 110 N	95 N 5.4 N 41 N	5300 N 260 N 2000 N	SAT 2700N 20000N	SAT	32 E
Baythroid Benefin Benomyl	PEST PEST PEST				910 N 11000 N 1800 N	91 N 1100 N 180 N	34 N 410 N 68 N	1600 N 20000 N 3300 N	17000 N SAT 34000 N		
Bentazon Benzaldehyde Benzene	PEST VOC			5	91 N 610 N I 0.4 C	9.1 N 370 N 0.22 C	3.4 N 140 N 0.11 C	160 N 6500 N 1.4 C	1700 N 68000 N 3.2 C	0.5 E	0.02 E

EPA Region 6
Human Health
Media-Specific Screening Levels

Legend: MCL = Maximum Contaminant Level SAT = risk-based value above expected saturation point max = maximum concentration PEST = Pesticide Herb = Herbicide VOC = Volatile Organic Compound SVOC = Semi-Volatile Organic Compound "Blank" = Missing data for generation of value					Basis: C= carcinogenic effects N = non-carcinogenic effects E = EPA draft Soil Screening Level S = soil saturation concentration M' = EPA MCL I = Ingestion route only						
					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Benzenethiol	SVOC	A			0.37 N I 0.0003 C 150000 N	0.037 N 0.00003 C 15000 N	0.014 N 0.00001 C 5400 N	0.78 N I 0.002 C SAT	20 N I 0.008 C SAT	1.3 C 320 S	1.1E-06 C 280 E
Benzidine	SVOC										
Benzoic acid											
Benzotrichloride	SVOC	B2			0.0052 C 11000 N 0.066 C	0.00048 C 1100 N 0.037 C	0.00024 C 410 N 0.019 C	0.034 C 20000 N 1.4 C	0.150 C SAT 3.9 C	0.012 C 0.5 C	0.000073 C 0.00036 C
Benzyl alcohol		B2									
Benzyl chloride											
Beryllium and compounds		B2	0.5-2	4	0.02 C 3.7 N 550 N	0.00075 C 0.37 N 55 N	0.00073 C 0.14 N 20 N	0.14 C 6.5 N 980 N	1.10 C 68 N 10000 N	690 E	180 E
Bidrin	PEST										
Biphenthrin (Talstar)											
1,1-Biphenyl	SVOC	B2			1800 N 0.0098 C 0.27 C	180 N 0.0054 C 0.18 C	68 N 0.0029 C 0.045 C	3300 N 0.07 C 3.9 C	34000 N 0.17 C 12 C	9000 S 0.3 E	110 N 0.0003 E
Bis(2-chloroethyl)ether											
Bis(2-chloroisopropyl)ether											
Bis(chloromethyl)ether	SVOC	A			0.00005 C 0.96 C 4.8 C	0.00003 C 0.089 C 0.45 C	0.00001 C 0.045 C 0.23 C	0.0001 C 6.3 C 32 C	0.0003 C 27 C 140 C	0.00004 C 210 E	1.0E-07 C 11 E
Bis(2-chloro-1-methylethyl)ether											
Bis(2-ethylhexyl)phthalate (DEHP)											
Bisphenol A			2-100		1800 N 3300 N 7.3 N I	180 N 21 N 0.73 N	68 N 120 N	3300 N 5900 N	34000 N 61000 N		
Boron (and borates)											
Boron trifluoride											

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max = maximum concentration
PEST = Pesticide Herb = Herbicide
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
					Tap Water (Residential Scenario: Ingestion, & Inhalation,)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*			
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Bromodichloromethane	VOC	D			0.18 C	0.1 C	0.051 C	1.4 C	3.4 C	1800E	0.3 E
Bromoethene (vinyl bromide)	VOC	B2			0.1 C	0.057 C		0.45 C	1.0 C	46 E	0.5 E
Bromoform (tribromomethane)					2.4 C I	1.6 C	0.4 C	56 C	240 C		
Bromomethane	VOC				8.7 N I	5.2 N	1.9 N	15 N	57 N	2 E	0.1 E
4-Bromophenyl phenyl ether	SVOC				2100 N I	210 N	78 N	4500 N I	120000 N I		
Bromophos					180 N	18 N	6.8 N	330 N	3400 N		
Bromoxynil	PEST				180 N	73 N	27 N	1300 N	14000 N		
Bromoxynil octanoate	PEST				730 N	73 N	27 N	1300 N	14000 N	0.0013 C	0.000072 e
1,3-Butadiene		B2			0.011 C	0.0064 C		0.009 C	0.02 N		
1-Butanol	VOC				3700 N	370 N	140 N	6500 N	68000 N	9700 E	8 E
Butyl benzyl phthalate					7300 N	730 N	270 N	13000 N	SAT	530 E	68 E
Butylate					1800 N	180 N	68 N	3300 N	34000 N		
sec-Butylbenzene	VOC				61 N I	37 N	14 N	780 N I	20000 N I	80 S	0.27 M
tert-Butylbenzene	VOC				61 N I	37 N	14 N	780 N I	20000 N I		0.27 M
Butylphthalyl butylglycolate					37000 N	3700 N	1400 N	65000 N	SAT		
Cacodylic acid	PEST		0.01-1.0	5	110 N	11 N	4.1 N	200 N	2000 N	920 E	6 E
Cadmium and compounds					18 N	0.00099 C	0.68 N	38 N	850 N		
Caprolactam					18000 N	1800 N	680 N	33000 N	SAT		

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*			
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Captafol	PEST				7.8 C	0.73 C	0.37 C	52 N	220 C		
Captan	PEST				19 C	1.8 C	0.9 C	130 C	550 C	0.34 S	23 N
Carbaryl	PEST				3700 N	370 N	140 N	6500 N	68000 N		
Carbofuran	SVOC			40	180 N	18 N	6.8 N	330 N	3400 N	11 E	14 E
Carbon disulfide					21 N	730 N	140 N	16 N	52 N	0.2 E	0.03 E
Carbon tetrachloride				5	0.2 C	0.12 C	0.024 C	0.47 C	1.1 C		
Carbosulfan	PEST				370 N	37 N	14 N	650 N	6800 N		
Carboxin	PEST				3700 N	370 N	140 N	6500 N	68000 N		
Chloral					73 N	7.3 N	2.7 N	130 N	1400 N		
Chloramben	PEST				550 N	55 N	20 N	980 N	10000 N		
Chlornail					0.17 C	0.016 C	0.0078 C	1.1 C	4.7 C		
Chlordane	PEST			2	0.05 C	0.0049 C	0.0024 C	0.34 C	1.5 C	10 E	2 E
Chlorimuron-ethyl					730 N	73 N	27 N	1300 N	14000 N		
Chlorine	PEST				3700 N	370 N	140 N	7700 N	SAT		
Chlorine dioxide					2.1 NI	0.21 N					
Chloroacetaldehyde					250 NI	25 N	9.3 N	540 NI	14000 NI		
Chloroacetic acid					73 N	7.3 N	2.7 N	130 N	1400 N		
2-Chloroacetophenone					0.05 N	0.031 N		0.07 N	0.27 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc./Range (mg/kg)*	*Drinking Water (MCL's)*	*Tap Water (Residential Scenario: Ingestion, & Inhalation.)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		
								Residential	*Industrial*	*Air* / *Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg* / *mg/kg*
4-Chloroaniline Chlorobenzene Chlorobenzilate	SVOC VOC PEST				150 N 39 N 0.25 C	15 N 21 N 0.023 C	5.4 N 27 N 0.012 C	260 N 160 N 1.6 C	2700 N 570 N 7.1 C	1200 S 94 E / 0.3 E 0.6 E
p-Chlorobenzoic acid 4-Chlorobenzotrifluoride 2-Chloro-1,3-butadiene					7300 N 730 N 14 N	730 N 73 N 7.3 N	270 N 27 N 27 N	13000 N 1300 N 6.3 N	SAT 14000 N 21 N	86 N / 7.5 N
1-Chlorobutane Chlorodibromomethane 1-Chloro-1,1-difluoroethane	VOC VOC				2400 N 0.13 C I 87000 N	1500 N 0.075 C 52000 N	540 N 0.038 C	810 S 7.6 C I	810 S 68 C I	1900 E / 0.2 E
Chlorodifluoromethane Chloroethane 2-Chloroethyl vinyl ether	VOC VOC VOC				87000 N 8600 N 150 N I	52000 N 10000 N 91 N	540 N 84 N	350 S 31000 N I 2000 N I	350 S SAT 51000 N I	2600 S / 33 N
Chloroform Chloromethane 4-Chloro-2,2-methylaniline hydrochloride	VOC VOC	B2			0.16 C 1.5 C 0.15 C	0.078 C 0.99 C 0.014 C	0.51 C 0.24 C 0.0069 C	0.53 C 2.0 C 0.77 C	1.1 C 4.3 C 3.3 C	0.2 E / 0.3 E 0.063 C / 0.0066 C
4-Chloro-2-methylaniline beta-Chloronaphthalene o-Chloronitrobenzene	SVOC				0.12 C 2900 N 0.42 C I	0.011 C 290 N 0.25 C	0.0054 C 110 N 0.13 C	0.97 C 5200 N 18 C	4.1 C 55000 N 76 C	2.8 S / 140 N

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-4} C= 10^{-5} Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
					Tap Water (Residential Scenario: Ingestion, & Inhalation,)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
p-Chloronitrobenzene 2-Chlorophenol 2-Chloropropane	SVOC				0.59 C I 180 N 170 N	0.35 C 18 N 100 N	0.18 C 6.8 N	25 C 330 N 350 N	110 C 3400 N 1300 N	53000 E 22 N	2 E 0.64 N
Chlorothalonil o-Chlorotoluene Chlorpropham	PEST PEST				6.1 C 120 N 7300 N	0.57 C 73 N 730 N	0.29 C 27 N 270 N	41 C 340 N 13000 N	170 C 1600 S SAT	1200 N	5.6 N
Chlorpyrifos Chlorpyrifos-methyl Chlorsulfuron	PEST PEST PEST				110 N 370 N 1800 N	11 N 37 N 180 N	4.1 N 14 N 68 N	200 N 650 N 3300 N	2000 N 6800 N 34000 N		
Chlorthiophos Total Chromium (1/6 ratio Cr VI/Cr III) Chromium VI and compounds		A	38	100	29 N 37000 N I 180 N	2.9 N 0.0021 N 0.00015 C	1.1 N 1400 N 6.8 C	52 N 210 N 31 C	550 N 1600 N 230 C	140 E	19 E
Coal tar Cobalt Coke Oven Emissions	PEST	A	8		2200 N I	0.0028 C 220 N 0.0029 C	81 N	4700 N I	SAT		
Copper and compounds Crotonaldehyde Cumene		C	20		1400 N 0.006 C 19 N	150 N 0.033 C 9.4 N	54 N 0.017 C 54 N	2800 N 0.1 C 49 N	63000 N 0.3 C 160 N	81 N	65 N

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*		*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
				Drinking Water (MCL's)	*Tap Water (Residential Scenario: Ingestion, & Inhalation.)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Cyanides: Barium cyanide Calcium cyanide					3700 N 1500 N	370 N 150 N	140 N 54 N	7700 N 3100 N	SAT 68000 N		
Copper cyanide Cyanazine Cyanogen	PEST				180 N 0.08 C 1500 N	18 N 0.0075 C 150 N	6.8 N 0.0038 C 54 N	380 N 130 C 2600 N	8500 N 2.3 C 27000 N		
Cyanogen bromide Cyanogen chloride Free cyanide					3300 N 1800 N 730 N	330 N 180 N 73 N	120 N 68 N 27 N	5900 N 3300 N 1300 N	SAT 34000 N 14000 N		
Hydrogen cyanide Potassium cyanide Potassium silver cyanide					6.2 N 1800 N 7300 N	3.1N 180 N 730 N	27 N 68 N 270 N	1600 N I 3300 N 13000 N	41000 N I 34000 N SAT		
Silver cyanide Sodium cyanide Thiocyanate					3700 N 1500 N 730 N I	370 N 150 N 73 N	140 N 54 N 27 N	6500 N 2600 N 1600 N I	SAT 27000 N 41000 N I		
Zinc cyanide Cyclohexanone Cyclohexylamine					1800 N 180000 N 7300 N	180 N 18000 N 730 N	68 N 6800 N 270 N	3300 N SAT 13000 N	34000 N SAT SAT		

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Basis: C= carcinogenic effects N = non-carcinogenic effects
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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
				Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation.)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		
								Residential	Industrial	Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Cyhalothrin/Karate	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Cypermethrin	PEST				370 N	37 N	14 N	650 N	6800 N		
Cyromazine					270 N	27 N	10 N	490 N	5100 N		
Dacthal	PEST			200	370 N I	37 N	14 N	33000 N	SAT		
Dalapon	HERB				1100 N	110 N	41 N	2000 N	20000 N		
Dinitol					18 N	91 N	34 N	33 N	340 N		
DDD	PEST	B2			0.28 C	0.026 C	0.013 C	1.9 C	7.9 C	37 S	0.7 E
DDE	PEST	B2			0.2 C	0.018 C	0.0093 C	1.3 C	5.6 C	10 S	0.5 E
DDT	PEST	B2			0.2 C	0.018 C	0.0093 C	1.3 C	5.6 C	80 E	1 E
Decabromodiphenyl ether	PEST				61 N I	37 N	14 N	650 N	6800 N		
Demeton	PEST				1.5 N	0.15 N	0.054 N	2.6 N	27 N		
Diallate					0.17 C I	0.1 C	0.052 C	7.3 C	31 C		
Diazinon	PEST				33 N	3.3 N	1.2 N	59 N	610 N	5400 S	2.8 N
Dibenzofuran	SVOC				150 N	15 N	5.4 N	260 N	2700 N	120 S	120 S
1,4-Dibromobenzene					61 N I	37 N	14 N	650 N	6800 N		
1,2-Dibromo-3-chloropropane	VOC	B2			0.048 C	0.21 N	0.0023 C	0.32 C	1.4 C	1.9 N	0.00061 M'
1,2-Dibromoethane	VOC				0.00076 C	0.0081 C	0.00004 C	0.005 C	0.02 C	0.0058 C	0.00018 M'
Dibutyl phthalate					3700 N	370 N	140 N	6500 N	68000 N	100 E	120 E

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
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								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,3-Dichloropropene	PEST	B2			0.081 C	0.048 C	0.018 C	0.51 C	1.2 C	0.1 E	0.001 E
Dichlorvos	PEST	B2			0.23 C	0.022 C	0.011 C	1.5 C	6.6 C	3.5 C	0.00072 C
Dicofol	PEST				0.15 C	0.014 C	0.0072 C	1.0 C	4.3 C		
Dicyclopentadiene	PEST	B2			0.42 N	0.21 N	41 N	2300 N I	61000 N I	2 E	0.001 E
Dieldrin					0.0042 C	0.00039 C	0.0002 C	0.03 C	0.12 C		
Diesel emissions					52 N I	5.2 N					
Diethyl phthalate	SVOC				29000 N	2900 N	1100 N	52000 N	SAT	520 E	110 E
Diethylene glycol, monobutyl ether					210 N	21 N		370 N	3900 N		
Diethylene glycol, monoethyl ether					73000 N	7300 N	2700 N	SAT	SAT		
Diethylformamide				400	400 N	40 N	15 N	720 N	7500 N		
Di(2-ethylhexyl)adipate					56 N	5.2 C	2.6 C	370 C	1600 C		
Diethylstilbestrol					0.00001 C	1.3E-06 C	7.0E-07 C	9.5E-05 C	4.1E-04 C		
Difenzoquat (Avenge)	PEST				2900 N	290 N	110 N	5200 N	55000 N		
Diflubenzuron	PEST				730 N	73 N	27 N	1300 N	14000 N		
1,1-Difluoroethane					69000 N	42000 N					
Diisopropyl methylphosphonate (DIMP)	PEST				2900 N	290 N	110 N	5200 N	55000 N		
Dimethipin	PEST				730 N	73 N	27 N	1300 N	14000 N		
Dimethoate					7.3 N	0.73 N	0.27 N	13 N	140 N		

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				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
3,3'-Dimethoxybenzidine Dimethylamine 2,4-Dimethylaniline hydrochloride	SVOC PEST				4.8 C 0.04 N 0.12 C	0.45 C 0.021 N 0.011 C	0.23 C 0.0054 C	32 C 0.062 N 0.8 C	140 C 0.23 N 3.3 C		
2,4-Dimethylaniline N-N-Dimethylaniline 3,3'-Dimethylbenzidine	SVOC				0.09 C 73 N 0.0073 C	0.0083 C 7.3 N 0.00068 C	0.0042 C 2.7 N 0.00034 C	0.6 C 130 N 0.05 C	2.5 C 1400 N 0.21 C	29 C	0.00039 C
N,N-Dimethylformamide 1,1-Dimethylhydrazine 1,2-Dimethylhydrazine					3700 N 0.026 C 0.0018 C	31 N 0.0018 C 0.00017 C	140 N 0.0012 C 0.00009 C	6500 N 0.17 C 0.01 C	68000 N 0.73 C 0.05 C		
2,4-Dimethylphenol 2,6-Dimethylphenol 3,4-Dimethylphenol	SVOC				730 N 22 N 37 N	73 N 2.2 N 3.7 N	27 N 0.81 N 1.4 N	1300 N 39 N 65 N	14000 N 410 N 680 N	5400 S	3 E
Dimethyl phthalate Dimethyl terephthalate 1,2-Dinitrobenzene	SVOC SVOC				370000 N 3700 N 15 N	37000 N 370 N 1.5 N	14000 N 140 N 0.54 N	SAT 6500 N 26 N	SAT 68000 N 270 N	1600 E	1200 E
1,3-Dinitrobenzene 1,4-Dinitrobenzene 4,6-Dinitro-o-cyclohexyl phenol	SVOC SVOC				3.7 N 15 N 73 N	0.37 N 1.5 N 7.3 N	0.14 N 0.54 N 2.7 N	6.5 N 26 N 130 N	68 N 270 N 1400 N		

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2,4-Dinitrophenol Dinitrotoluene mixture 2,4-Dinitrotoluene	SVOC SVOC SVOC	B2			73 N 0.099 C 73 N	7.3 N 0.0092 C 7.3 N	2.7 N 0.0046 C 2.7 N	130 N 0.65 C 130 N	1400 N 2.8 C 1400 N	360 N 120 S	0.1 E 0.2 E
2,6-Dinitrotoluene Dinoseb di-n-Octyl phthalate	SVOC HERB SVOC			7	37 N 37 N 730 N	3.7 N 3.7 N 73 N	1.4 N 1.4 N 27 N	65 N 65 N 1300 N	680 N 680 N 14000 N	370 S SAT	0.1 E SAT
1,4-Dioxane Diphenamid Diphenylamine	VOC PEST SVOC	B2			1.0 C 1100 N 910 N	0.57 C 110 N 91 N	0.29 C 41 N 34 N	14 C 2000 N 1600 N	37 C 20000 N 17000 N		
1,2-Diphenylhydrazine Diquat Direct black 38	SVOC PEST	B2		20	0.084 C 80 N 0.0078 C	0.0081 C 8 N 0.00073 C	0.0039 C 3 N 0.00037 C	0.6 C 140 N 0.05 C	2.4 C 1500 N 0.2 C		
Direct blue 6 Direct brown 95 Disulfoton	PEST				0.0013 C 0.0072 C 1.5 N	0.00077 C 0.00067 C 0.15 N	0.00039 C 0.00034 C 0.054 N	0.06 C 0.05 C 2.6 N	0.2 C 0.2 C 27 N		
1,4-Dithiane Diuron Dodine	PEST PEST				370 N 73 N 150 N	37 N 7.3 N 15 N	14 N 2.7 N 5.4 N	650 N 130 N 260 N	6800 N 1400 N 2700 N		

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Human Health
Media-Specific Screening Levels

Legend: MCL = Maximum Contaminant Level SAT = risk-based value above expected saturation point max = maximum concentration PEST = Pesticide Herb = Herbicide VOC = Volatile Organic Compound SVOC = Semi-Volatile Organic Compound "Blank" = *Missing data for generation of value.*					*Basis: C= carcinogenic effects N = non-carcinogenic effects* *E = EPA draft Soil Screening Level S = soil saturation concentration* *M' = EPA MCL I = Ingestion route only*						
					Risk-Based Screening Levels					*Soil Screening Level Transfers from Soil to:*	
Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Tap Water (Residential Scenario: Ingestion, & Inhalation.)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Endosulfan Endothall Endrin	PEST PEST PEST			100 2	1.8 N 730 N 11 N	22 N 73 N 1.1 N	8.1 N 2711 0.41 N	3.3 N 1300 N 21 N	34 N 14000 N 200 N	1 S 16 S	3 E 0.4 E
Epichlorohydrin 1,2-Epoxybutane Ethephon (2-chloroethyl phosphonic acid)	VOC PEST	B2			2.0 N 210 N 180 N	1 C 21 N 18 N	0.32 C 6.8 N	8.6 C 370 N 330 N	31 C 3900 N 3400 N		
Ethion 2-Ethoxyethanol acetate 2-Ethoxyethanol	PEST				18 N 11000 N 15000 N	1.8 N 1100 N 210 N	0.68 N 410 N 540 N	33 N 20000 N 26000 N	340 N SAT SAT		
Ethyl acrylate EPTC (S-Ethyl dipropylthiocarbamate) Ethyl acetate	 VOC				0.23 C 910 N 33000 N	0.13 C 91 N 3300 N	0.066 C 34 N 1200 N	0.5 C 1600 N 59000 N	1.0 C 17000 N SAT		
Ethylbenzene Ethylene cyanohydrin Ethylene diamine	VOC			70	1300 N 11000 N 730 N	1000 N 1100 N 73 N	140 N 410 N 27 N	2900 S 20000 N 1300 N	3100 S SAT 14000 N	260 E	5 E
Ethylene glycol Ethylene glycol, monobutyl ether Ethylene oxide	 VOC				73000 N 210 N 0.024 C	7300 N 21 N 0.018 C	2700 N 0.0031 C	130000 N 370 C 0.12 C	SAT 3900 C 0.3 C		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc./Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air* / *Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg* / *mg/kg*
Ethylene thiourea (ETU) Ethyl ether Ethyl methacrylate	VOC				0.11 C 1200 N 550 N	0.053 C 730 N 330 N	0.027 C 270 N 120 N	0.7 C 3800 S 340 S	3.2 C 3800 S 340 S	
Ethyl p-nitrophenyl phenylphosphorothioate Ethylnitrosourea Ethylphthalyl ethyl glycolate					0.37 N 0.00048 C I 110000 N	0.037 N 0.00005 C 11000 N	0.014 N 0.00002 C 4100 N	0.7 N 0.005 C I SAT	6.8 N 0.041 C I SAT	
Express Fenamiphos Fluometuron	PEST PEST PEST				290 N 9.1 N 470 N	29 N 0.91 N 47 N	11 N 0.34 N 18 N	520 N 16 N 850 N	5500 N 170 N 8900 N	
Fluoride Fluoridone Fluprimidol	PEST PEST			4000	2200 N 2900 N 730 N	220 N 290 N 73 N	81 N 110 N 27 N	3900 N 5200 N 1300 N	41000 N 55000 N 14000 N	
Flutolanil Fluvalinate Folpet	PEST PEST PEST	B2			2200 N 370 N 19 C	220 N 37 N 1.8 C	81 N 14 N 0.9 C	3900 N 650 N 130 C	41000 N 6800 N 550 C	
Fomesafen Fonofos Formaldehyde	PEST PEST	C			3.5 C 73 N 5500 N	0.33 C 7.3 N 0.14 C	0.17 C 2.7 N 270 N	23 C 130 N 9800 N	100 C 1400 N SAT	

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Industrial	Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Formic Acid	PEST				73000 N	7300 N	2700 N	SAT	SAT		
Fosetyl- Al					110000 N	11000 N	4100 N	SAT	SAT		
Furan					37 N	3.7 N	1.4 N	65 N	680 N		
Furazolidone	PEST				0.018 C	0.0016 C	0.00083 C	0.12 C	0.5 C		
Furfural					110 N	52 N	4.1 N	200 N	2000 N		
Furfuran					0.0013 C	0.00013 C	0.00006 C	0.009 C	0.04 C		
Furmecyclox		B2			2.2 C	0.21 C	0.11 C	15 C	64 C		
Glufosinate-ammonium					15 N	1.5 N	0.54 N	26 N	270 N		
Glycidaldehyde					15 N	1 N	0.54 N	26 N	270 N		
Glyphosate	PEST			700	3700 N	370 N	140 N	6500 N	68000 N		
Haloxyfop-methyl					1.8 N	0.18 N	0.068 N	3.3 N	34 N		
Harmony	PEST				470 N	47 N	18 N	850 N	8900 N		
HCH (alpha)	PEST	B2			0.011 C	0.00099 C	0.0005 C	0.07 C	0.3 C	0.9 E	0.0004 E
HCH (beta)	PEST	C			0.37 C	0.035 C	0.018 C	3 C	11 C	16 E	0.002 E
HCH (gamma) Lindane	PEST			0.2	0.05 C	0.0048 C	0.0024 C	0.34 C	1.5 C	4.2 C	0.006 E
HCH-technical	PEST	B2			0.037 C	0.0035 C	0.0018 C	0.3 C	1.1 C		
Heptachlor	PEST	B2		0.1	0.2 C	0.0014 C	0.0007 C	0.1 C	0.4 C	0.3 E	0.06 E
Heptachlor epoxide	PEST	B2		0.2	0.007 C	0.00069 C	0.00035 C	0.05 C	0.2 C	1 E	0.03 E

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Legend: MCL = Maximum Contaminant Level
SAT = risk-based value above expected saturation point
max = maximum concentration
PEST = Pesticide Herb = Herbicide
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
"Blank" = Missing data for generation of value.

Basis: C= carcinogenic effects N = non-carcinogenic effects
E = EPA draft Soil Screening Level S = soil saturation concentration
M' = EPA MCL I = Ingestion route only

Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
				Drinking Water	*Tap Water*	*Ambient Air*	*Fish*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		
					(Residential Scenario: Ingestion, & Inhalation,)	*(Residential Scenario)*	*(Recreational Fishing Scenario)*	*Residential*	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Hexabromobenzene	PEST	B2		1	12 N I	7.3 N	2.7 N	130 N	1400 N		
Hexachlorobenzene	VOC	C			0.04 C	0.0039 C	0.002 C	0.3 C	1.2 C	1 E	0.8 E
Hexachlorobutadiene					8.6 C	0.81 C	0.4 C	57 C	240 C	1 E	0.1 E
Hexachlorocyclopentadiene	PEST			50	260 N	0.073 N	9.5 N	450 N	4700 N	2 E	10 E
Hexachlorodibenzo-p-dioxin mixture		B2			0.00001 C	1.4E-06 C	5.0E-07 C	7.2E-05 C	3.1E-04 C		
Hexachloroethane	VOC	C			48 C	4.5 C	2.3 C	320 C	1400 C	49 E	0.2 E
Hexachlorophene	SVOC	C			11 N	1.1 N	0.41 N	20 N	200 N		
Hexahydro-1,3,5-trinitro-1,3,5-triazine					6.1 C	0.57 C	0.29 C	40 C	170 C		
1,6-Hexamethylene diisocyanate					0.1 N	0.01 N					
n-Hexanex	PEST				350 N I	210 N	81 N	4700 N I	SAT	32 N	13 N
Hexazinone		B2			1200 N	120 N	45 N	2200 N	22000 N		
Hydrazine, hydrazine sulfate					0.022 C	0.00037 C	0.0011 C	0.2 C	0.6 C		
Hydrogen chloride					210 N I	21 N					
Hydrogen sulfide					1.8 N	1 N	4.1 N	6100 N I	230 N I		
Hydroquinone					1500 N	150 N	54 N	2600 N	27000 N		
Imazalil	PEST				470 N	47 N	18 N	850 N	8900 N		
Imazaquin	PEST				9100 N	910 N	340 N	16000 N	SAT		
Iprodione	PEST				1500 N	150 N	54 N	2600 N	27000 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-4}* *C= 10^{-5}* *Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Iron	VOC	C			11000 N I	1100 N	410 N	23000 N I	SAT		
Isobutanol	PEST				1800 N I	1100 N	410 N	20000 N	SAT	3400 E	0.2 E
Isophorone					710 C	66 C	33 C	4700 C	20000 C		
Isopropalin	PEST				550 N	55 N	20 N	980 N	10000 N		
Isopropyl methyl phosphonic acid					3700 N	370 N	140 N	6500 N	68000 N		
Isoxaben					1800 N	180 N	68 N	3300 N	34000 N		
Lead			10-18		(Uptake	Biokinetic	Model)	400 N	2000 N		
Kepone	PEST				0.0037 C	0.00035 C	0.00018 C	0.03 C	0.1 C		
Lactofen	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Linuron	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Lithium					730 N	73 N	27 N	1500 N	34000 N		
Londax	PEST				7300 N	730 N	270 N	13000 N	SAT		
Malathion	PEST				730 N	73 N	27 N	1300 N	14000 N		
Maleic anhydride	SVOC				3700 N	370 N	140 N	6500 N	68000 N		
Maleic hydrazide	PEST				18000 N	1800 N	680 N	33000 N	SAT		
Malononitrile	VOC				0.73 N	0.073 N	0.027 N	1.3 N	14 N		
Mancozeb	PEST				1100 N	110 N	41 N	2000 N	20000 N		
Maneb	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Manganese and compounds			389-850		180 N	0.052 N	6.8 N	380 N	8300 N		

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Mephosfolan	PEST				3.3 N I	0.33 N	0.12 N	5.9 N	180 N I		
Mepiquat chloride	PEST				1100 N I	110 N	41 N	2000 N	61000 N I		
Mercuric chloride					11 N I	1.1 N	0.41 N	23 N I	610 N I		
Mercury (inorganic)			0.10	2	11 N	0.31 N	0.41 N	23 N	510 N	7 E	3 E
Mercury (methyl)					3.7 N I	0.37 N	0.14 N	20 N	200 N I		
Merphos	PEST				1.1 N	0.11 N	0.041 N	2.0 N	21 N		
Merphos oxide	PEST				1.1 N	0.11 N	0.041 N	2.0 N	20 N		
Metalaxyl	PEST				2200 N	220 N	81 N	3900 N	41000 N		
Methacrylonitrile	VOC				1.0 N	0.73 N	0.14 N	1.3 N	5.1 N		
Methamidophos	PEST				1.8 N	0.18 N	0.068 N	3.3 N	34 N		
Methanol	VOC				18000 N	1800 N	680 N	33000 N	SAT		
Methidathion	PEST				37 N	3.7 N	1.4 N	65 N	680 N		
Methomyl	PEST				910 N	91 N	34 N	1600 N	17000 N		
Methoxychlor	PEST			40	180 N	18 N	6.8 N	330 N	3400 N	41 S	62 E
2-Methoxyethanol acetate					73 N	7.3 N	2.7 N	130 N	1400 N		
2-Methoxyethanol					37 N	21 N	1.4 N	65 N	680 N		
2-Methoxy-5-nitroaniline					1.5 C	0.14 C	0.069 C	9.7 C	41 C		
Methyl acetate					6100 N	3700 N	1400 N	20000 N	84000 N		

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-4} C= 10^{-5} Blank= 10^{-6}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Industrial	Soil Screening Level Transfers from Soil to: Air	Ground Water
				ug/L	ug/L	ug/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Methyl acrylate 2-Methylaniline hydrochloride 2-Methylaniline					1100 N I 0.37 C 0.28 C	110 N 0.035 C 0.026 C	41 N 0.018 C 0.013 C	150 N 2.5 C 1.9 C	520 N 11 C 7.9 C		
Methyl chlorocarbonate 4-(2-Methyl-4-chlorophenoxy) butyric acid 2-Methyl-4-chlorophenoxyacetic acid	 HERB HERB				37000 N 370 N 18 N	3700 N 37 N 1.8 N	1400 N 14 N 0.68 N	65000 N 650 N 33 N	SAT 6800 N 340 N		
2-(2-Methyl-1,4-chlorophenoxy)propionic acid Methylcyclohexane Methylene bromide	HERB				37 N 31000 N 61 N I	3.7 N 3100 N 37 N	1.4 N 14 N	65 N 56000 N 650 N	680 N SAT 6800 N	60 S	1500 N
Methylene chloride 4,4'-Methylene bis(2-chloroaniline) 4,4'-Methylenebisbenzeneamine	VOC				4.3 C 0.52 C 0.27 C	3.8 C 0.048 C 0.025 C	0.42 C 0.024 C 0.013 C	11 C 3.4 C 1.8 C	25 C 15 C 7.6 C	7 E	0.01 E
4,4'-Methylene bis(N,N'-dimethyl)aniline 4,4'-Methylenediphenyl isocyanate Methyl ethyl ketone		B2			1.5 C 0.035 N I 1900 N	0.14 C 0.021 N 1000 N	0.069 C 810 N	9.7 C 0.37 N 8700 N	41 C 3.9 N 34000 N		
Methyl hydrazine Methyl isobutyl ketone Methyl methacrylate	VOC				0.061 C 2900 N 2900 N	0.0057 C 84 N 290 N	0.0029 C 110 N 110 N	0.4 C 5200 N 5200 N	1.7 C 55000 N 55000 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-4}* *C= 10^{-5}* *Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
2-Methyl-5-nitroaniline	SVOC				2 C 9.1 N	0.19 C 0.91 N	0.096 C 0.34 N	13 C 16 N	58 C 170 N	28 S	0.041 N
Methyl parathion	SVOC				1800 N	180 N	68 N	3300 N	34000 N	12000 S	6 E
2-Methylphenol (o-cresol)											
3-Methylphenol (m-cresol)	SVOC				1800 N	180 N	68 N	3300 N	34000 N		
4-Methylphenol (p-cresol)	SVOC				180 N	18 N	6.8 N	330 N	3400 N	100 N	1 N
Methyl styrene (mixture)					60 N	42 N	8.1 N	220 N	1200 N		
Methyl styrene (alpha)					430 N	260 N	95 N	1800 N	8100 N	8.8 S	7.5 N
Methyl tertbutyl ether (MTBE)	VOC				180 N	3100 N	6.8 N	330 N	3400 N		
Metolaclor (Dual)	PEST				5500 N	550 N	200 N	9800 N	SAT		
Metribuzin	PEST				910 N	91 N	34 N	1600 N	17000 N		
Mirex	PEST				0.037 C	0.0035 C	0.0018 C	0.25 C	1.1 C		
Molinate	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Molybdenum					180 N	18 N	6.8 N	310 N	8500 N		
Monochloramine					3700 N	370 N	140 N	6500 N	68000 N		
Naled	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
2-Naphthylamine	SVOC				0.00052 C I	0.00005 C	0.00002 C	0.005 C I	0.04 C I		
Napropamide	PEST				3700 N	370 N	140 N	6500 N	68000 N		
Nickel refinery dust		A				0.0075 C					

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation.)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Nickel and compounds Nickel subsulfide Nitrapyrin	PEST	A	16	100	730 N 55 N	73 N 0.0037 C 5.5 N	27 N 2 N	1500 N 98 N	34000 N 39000 C 1000 N	6900 E	21 E
Nitrate Nitric Oxide Nitrite				10000 1000	58000 N 3700 N 3700 N	5800 N 370 N 370 N	2200 N 140 N 140 N	SAT 6500 N 6500 N	SAT SAT SAT		
2-Nitroaniline 3-Nitroaniline 4-Nitroaniline	SVOC SVOC SVOC				2.2 N 110 N I 110 N I	0.21 N 11 N 11 N	0.081 N 4.1 N 4.1 N	3.9 N 230 N I 230 N I	41 N 6100 N I 6100 N I		
Nitrobenzene Nitrofurantoin Nitrofurazone	VOC				3.4 N I 2600 N 0.045 C	2.1 N 260 N 0.00067 C	0.68 N 95 N 0.0021 C	33 N 4600 N 0.3 C	340 N 48000 N 1.3 C	110 E	0.09 E
Nitrogen dioxide Nitroguanidine 4-Nitrophenol					37000 N I 3700 N 2300 N I	3700 N 370 N 230 N	1400 N 140 N 84 N	SAT 6500 N 4800 N I	SAT 68000 N SAT		
2-Nitropropane N-Nitrosodi-n-butylamine N-Nitrosodiethanolamine	VOC VOC	B2 B2			35 C 0.012 C 0.024 C	0.00067 C 0.0011 C 0.0022 C	0.00058 C 0.0011 C	0.08 C 0.2 C	0.4 C 0.7 C		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Lev's* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
N-Nitrosodiethylamine	SVOC	B2			0.00045 C	0.00004 C	0.00002 C	0.003 C	0.01 C		
N-Nitrosodimethylamine	SVOC	B2			0.0013 C	0.00013 C	0.00006 C	0.009 C	0.04 C		
N-Nitrosodiphenylamine	SVOC	B2			14 C	1.3 C	0.64 C	91 C	390 C	29 C	0.2 E
N-Nitroso di-n-propylamine	SVOC	B2			0.0096 C	0.00089 C	0.00045 C	0.06 C	0.3 C	0.014 C	0.00002 E
N-Nitroso-N-methylethylamine		B2			0.0031 C	0.00028 C	0.00014 C	0.02 C	0.09 C		
N-Nitrosopyrrolidine		B2			0.032 C	0.0029 C	0.0015 C	0.2 C	0.9 C		
m-Nitrotoluene					61 N I	37 N	14 N	650 N	6800 N	460 S	0.42 N
o-Nitrotoluene					61 N I	37 N	14 N	780 N I	20000 N I	460 S	0.42 N
p-Nitrotoluene					61 N I	37 N	14 N	650 N	6800 N	460 S	0.42 N
Norflurazon	PEST				1500 N I	150 N	54 N	31000 N I			
NuStar	PEST				26 N	2.6 N	0.95 N	46 N	480 N		
Octabromodiphenyl ether					110 N	11 N	4.1 N	200 N	2000 N		
Octahydro-1357-tetranitro-1357-tetrazocine					1800 N	180 N	68 N	3300 N	34000 N		
Octamethylpyrophosphoramide	SVOC				73 N	7.3 N	2.7 N	130 N	1400 N		
Oryzalin	PEST				1800 N	180 N	68 N	3300 N	34000 N		
Oxadiazon	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Oxamyl	PEST			200	910 N	91 N	34 N	1600 N	17000 N		
Oxyfluorfen	PEST				110 N	11 N	4.1 N	200 N	2000 N		

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Risk-Based Screening Levels*						*Soil Screening Level Transfers from Soil to:*
				Drinking Water (MCL's)	*Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		
								Residential	*Industrial*	*Air* / *Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg* / *mg/kg*
Paclobutrazol	PEST				470 N	47 N	18 N	850 N	8900 N	
Paraquat	PEST				160 N	16 N	6.1 N	290 N	3100 N	
Parathion	PEST				220 N	22 N	8.1 N	390 N	4100 N	110 S / 3.9 N
Pebulate	PEST				1800 N	180 N	68 N	3300 N	34000 N	
Pendimethalin	PEST				1500 N	150 N	54 N	2600 N	27000 N	
Pentabromo-6-chloro cyclohexane					2.9 C	0.27 C	0.14 C	19 C	83 C	
Pentabromodiphenyl ether					73 N	7.3 N	2.7 N	130 N	1400 N	
Pentachlorobenzene					4.9 N I	2.9 N	1.1 N	52 N	550 N	570 N / 48 N
Pentachloronitrobenzene	SVOC				0.041 C I	0.024 C	0.012 C	1.7 C	7.3 C	
Pentachlorophenol	PEST			1	0.56 C	0.052 C	0.026 C	2.5 C	7.9 C	7.9 C / 0.2 E
Permethrin	PEST				1800 N	180 N	68 N	3300 N	34000 N	
Phenmedipham	PEST				9100 N	910 N	340 N	16000 N	SAT	
Phenol	SVOC				22000 N	2200 N	810 N	39000 N	SAT	
m-Phenylenediamine	SVOC				220 N	22 N	8.1 N	390 N	4100 N	21000 S / 49 E
p-Phenylenediamine	SVOC				6900 N	690 N	260 N	12000 N	SAT	
Phenylmercuric acetate					2.9 N	0.29 N	0.11 N	5.2 N	55 N	
2-Phenylphenol					35 C	3.2 C	1.6 C	230 C	980 C	
Phorate	PEST				7.3 N	0.73 N	0.27 N	13 N	140 N	

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					Risk-Based Screening Levels					*Soil Screening Level Transfers from Soil to:*	
Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-6}* *C= 10^{-5}* *Blank= 10^{-4}*	*Soil Regional Background Conc./Range (mg/kg)*	*Drinking Water (MCL's)*	*Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Phosmet	PEST				730 N	73 N	27 N	1300 N	14000 N		
Phosphine					11 N	0.31 N	0.41 N	20 N	200 N		
Phosphoric acid					100 N I	10 N					
Phosphorus (white)	SVOC				0.73 N I	0.073 N	0.027 N	1.6 N I	41 N I		
p-Phthalic acid					37000 N I	3700 N	1400 N	SAT	SAT		
Phthalic anhydride					73000 N I	130 N	2700 N	SAT	SAT		
Picloram	PEST				2600 N	260 N	95 N	4600 N	48000 N		
Pirimiphos-methyl	PEST				370 N	37 N	14 N	650 N	6800 N		
Polybrominated biphenyls					0.0076 C	0.0007 C	0.00035 C	0.05 C	0.2 C		
Polychlorinated biphenyls (PCBs)	SVOC	B2		0.5	0.009 C	0.00081 C	0.00041 C	0.07 C	0.3 C		
Aroclor 1016					2.6 N	0.26 N	0.095 N	4.9 N	65 N		
Aroclor 1254					0.73 N	0.073 N	0.027 N	1.4 N	19 N		
Polychlorinated terphenyls (PCTs)	SVOC				0.015 C I	0.0014 C	0.0007 C	0.14 C I	1.3 C I	SAT	
Polynuclear aromatic hydrocarbons					370 N	220 N	81 N	360 S	360 S	120 S	200 E
Acenaphthene					1800 N	1100 N	410 N	19 S	19 S	6.8 S	4300 E
Anthracene	SVOC	B2			0.092 C	0.01 C	0.0043 C	0.6 C	2.6 C	27 S	0.7 E
Benz[a]anthracene	SVOC				0.092 C	0.01 C	0.0043 C	0.6 C	2.6 C	23 S	4 E
Benzo(b)fluoranthene	SVOC										

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				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Benzo[k]fluoranthene	SVOC	B2		0.2	0.92 C	0.1 C	0.043 C	6.1 C	26 C		4 E
Benzo[a]pyrene	SVOC	B2			0.0092 C	0.001 C	0.00043 C	0.06 C	0.3 C	11 S	4 E
Carbazole	SVOC				3.4 C I	0.31 C	0.16 C	32 C I	290 C I	11 S	0.5 E
Chrysene	SVOC				9.2 C	1 C	0.43 C	24 S	24 S	3.6 S	1 E
Dibenz[a,h]anthracene	SVOC				0.0092 C	0.001 C	0.00043 C	0.06 C	0.3 C	7.2 S	11 E
Fluoranthene	SVOC				1500 N	150 N	54 N	2600 N	27000 N	68 S	980 E
Fluorene	SVOC				240 N	150 N	54 N	300 S	300 S	89 S	160 E
Indeno[1,2,3-cd]pyrene	SVOC	B2			0.092 C	0.01 C	0.0043 C	0.6 C	2.6 C	280 S	35 E
Naphthalene	SVOC				240 N	150 N	54 N	800 S	800 S	180 S	30 E
Pyrene	SVOC				1100 N	110 N	41 N	2000 N	20000 N	56 S	1400 E
Prochloraz	PEST	C			4.5 C I	0.42 C	0.21 C	30 C	130 C		
Profluralin					220 N	22 N	8.1 N	390 N	4100 N		
Prometon	PEST				550 N	55 N	20 N	980 N	10000 N		
Prometryn	PEST				150 N	15 N	5.4 N	260 N I	2700 N		
Pronamide	PEST				2700 N	270 N	100 N	4900 N	51000 N		
Propachlor	PEST				470 N	47 N	18 N	850 N	8900 N		
Propanil	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Propargite	PEST				730 N	73 N	27 N	1300 N	14000 N		

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Industrial	Soil Screening Level Transfers from Soil to: Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Propargyl alcohol	VOC				73 N	7.3 N	2.7 N	130 N	1400 N		
Proparzine	PEST				730 N	73 N	27 N	1300 N	14000 N		
Propham	PEST				730 N	73 N	27 N	1300 N	14000 N		
Propiconazole	PEST				470 N	47 N	18 N	850 N	8900 N		
Propylene glycol					730000 N	73000 N	27000 N	SAT	SAT		
Propylene glycol, monoethyl ether					26000 N	2600 N	950 N	46000 N	SAT		
Propylene glycol, monomethyl ether		B2			26000 N	2100 N	950 N	46000 N	SAT		
Propylene oxide					0.22 C	0.49 C	0.013 C	2.7 C I	24 C I		
Pursuit	PEST				9100 N	910 N	340 N	16000 N	SAT		
Pydrin	PEST				910 N	91 N	34 N	1600 N	17000 N		
Pyridine	VOC				37 N	3.7 N	1.4 N	65 N	680 N		
Quinalphos	PEST				18 N	1.8 N	0.68 N	33 N	340 N		
Quinoline	PEST				0.0056 C	0.00052 C	0.00026 C	0.04 C	0.2 C		
Resmethrin	PEST				1100 N	110 N	41 N	2000 N	20000 N		
Ronnel	PEST				1800 N	180 N	68 N	3300 N	34000 N		
RDX (Cyclonite)		C			6.1 C	0.6 C		40 C	170 C		
Rotenone	PEST				150 N	15 N	5.4 N	260 N	2700 N		
Savey	PEST				910 N	91 N	34 N	1600 N	17000 N		
Selenious Acid					180 N	18 N	6.8 N	330 N	3400 N		

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								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Selenium			0.2	50	180 N	18 N	6.8 N	380 N	8500 N		3 E
Selenourea					180 N	18 N	6.8 N	330 N	3400 N		
Sethoxydim	PEST				3300 N	330 N	120 N	5900 N	61000 N		
Silver and compounds			0.01-5		180 N	18 N	6.8 N	380 N	8500 N		
Simazine	PEST			4	0.6 C	0.052 C	0.026 C	3.7 C	16 C		
Sodium azide					150 N	15 N	5.4 N	260 N	2700 N		
Sodium diethyldithiocarbamate					0.25 C	0.023 C	0.012 C	1.6 C	7.1 C		
Sodium fluoroacetate	PEST				0.73 N	0.073 N	0.027 N	1.3 N	14 N		
Sodium metavanadate					37 N	3.7 N	1.4 N	65 N	680 N		
Strontium, stable					22000 N	2200 N	810 N	46000 N	SAT		
Strychnine	PEST				11 N	1.1 N	0.41 N	20 N	200 N		
Styrene	VOC			100	1600 N	1000 N	270 N	2200 S	2200 S	1400 E	2 E
Systhane	PEST				910 N	91 N	34 N	1600 N	17000 N		
2,3,7,8-TCDD (dioxin)				3E-08	4.5E-07 C	5.4E-08 C		3.8E-06 C	2.4E-05 C		
Tebuthiuron	PEST				2600 N	260 N	95 N	4600 N	48000 N		
Temephos	PEST				730 N	73 N	27 N	1300 N	14000 N		
Terbacil	PEST				470 N	47 N	18 N	850 N	8900 N		
Terbufos	PEST				0.91 N	0.091 N	0.034 N	1.6 N	17 N		

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								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Terbutryn	PEST				37 N	3.7 N	1.4 N	65 N	680 N	91 N	0.69 N
1,2,4,5-Tetrachlorobenzene	SVOC	C			11 N	11 N	0.41 N	20 N	200 N		
1,1,1,2-Tetrachloroethane	VOC				4.3 C	2.4 C	1.2 C	48 C	120 C		
1,1,2,2-Tetrachloroethane	VOC	C		5	0.55 C	0.31 C	0.16 C	9 C	24 C	0.4 E	0.001 E
Tetrachloroethylene (PCE)	VOC				1.1 C	3.1 C	0.061 C	7 C	25 C	11 E	0.04 E
2,3,4,6-Tetrachlorophenol	SVOC				1100 N	110 N	41 N	2000 N	20000 N		
p,a,a,a-Tetrachlorotoluene					0.00053 C I	0.00031 C	0.00016 C	0.02 C	0.1 C		
Tetrachlorvinphos	PEST				2.8 C	0.26 C	0.13 C	19 C	79 C		
Tetraethyldithiopyrophosphate	PEST				18 N	1.8 N	0.68 N	33 N	340 N		
Tetraethyl lead					0.0037 N	0.00037 N	0.00014 N	0.006 NI	0.07 N	0.00068 N	0.000034 N
1,1,1,2-Tetrafluoroethane					140000 N I	84000 N					
Thallic oxide					2.6 N	0.26 N	0.095 N	5.4 N	120 N		
Thallium				20							0.4 E
Thallium acetate					3.3 N	0.33 N	0.12 N	6.9 N	150 N		
Thallium carbonate					2.9 N	0.29 N	0.11 N	6.1 N	140 N		
Thallium chloride					2.9 N	0.29 N	0.11 N	6.1 N	140 N		
Thallium nitrate					3.3 N	0.33 N	0.12 N	6.9 N	150 N		
Thallium selenite					3.3 N	0.33 N	0.12 N	6.9 N	150 N		

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								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Thallium sulfate	PEST				2.9 N	0.29 N	0.11 N	6.1 N	140 N		
Thiobencarb					370 N	37 N	14 N	650 N	6800 N		
2-(Thiocyanomethylthio)-benzothiazole					1100 N	110 N	41 N	2000 N	20000 N		
Thiofanox	PEST				11 N	1.1 N	0.41 N	20 N	200 N		
Thiophanate-methyl	PEST				2900 N	290 N	110 N	5200 N	55000 N		
Thiram					180 N	18 N	6.8 N	330 N	3400 N		
Tin and compounds	VOC		122	1000	22000 N	2200 N	810 N	46000 N	SAT	520 E	5 E
Toluene					720 N	420 N	270 N	1900 N	2700 S		
Toluene-2,4-diamine					0.021 C	0.002 C	0.00099 C	0.1 C	0.6 C		
Toluene-2,5-diamine					22000 N	2200 N	810 N	39000 N	SAT		
Toluene-2,6-diamine					7300 N	730 N	270 N	13000 N	SAT		
p-Toluidine					0.35 C	0.033 C	0.017 C	2.3 C	10 C		
Toxaphene	PEST	B2		3	0.061 C	0.0056 C	0.0029 C	0.4 C	1.7 C	5 B	0.04 E
Tralomethrin	PEST				270 N	27 N	10 N	490 N	5100 N		
Triallate	PEST				470 N	47 N	18 N	850 N	8900 N		
Trisulfuron	PEST				370 N	37 N	14 N	650 N	6800 N		
1,2,4-Tribromobenzene					30 N I	18 N	6.8 N	330 N	3400 N		
Tributyltin oxide (TBTO)	PEST				1.1 N	0.11 N	0.041 N	2 N	20 N		

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Media-Specific Screening Levels

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Industrial	Soil Screening Level Transfers from Soil to: Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2,4,6-Trichloroaniline hydrochloride 2,4,6-Trichloroaniline 1,2,4-Trichlorobenzene	VOC			70	2.3 C 2.0 C 190 N	0.22 C 0.18 C 210 N	0.11 C 0.093 C 14 N	15 C 13 C 620 N	66 C 56 C 5900 N	240 E	2 E
1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethylene (TCE)	VOC VOC VOC			200 5 5	1300 N 0.2 C 1.6 C	1000 N 0.11 C 1 C	120 N 0.055 C 0.29 C	3200 N 1.4 C 7.1 C	3000 S 3.3 C 17 C	980 E 0.8 E 3 E	0.9 E 0.01 E 0.02 E
Trichlorofluoromethane 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol	VOC SVOC SVOC	B2			1300 N 3700 N 6.1 C	730 N 370 N 0.57 C	410 N 140 N 0.29 C	710 N 6500 N 40 C	2400 N 68000 N 170 C	790 N 8200 S 150 C	13 N 120 E 0.06 E
2,4,5-Trichlorophenoxyacetic acid 2-(2,4,5-Trichlorophenoxy)propionic acid 1,1,2-Trichloropropane	PEST PEST				370 N 290 N 30 N	37 N 29 N 18 N	14 N 11 N 6.8 N	650 N 520 N 51 N	6800 N 5500 N 190 N	13 N	0.14 N
1,2,3-Trichloropropane 1,2,3-Trichloropropene 1,1,2-Trichloro-1,2,2- trifluoroethane					0.0015 C I 31 N 59000 N	0.00089 C 18 N 31000 N	0.00045 C 6.8 N 41000 N	0.007 C 75 N 3600 S	0.02 C 290 N 3600 S	0.00003 C 2400 S	6.0E-06 C 3100 N
Tridiphane Triethylamine Trifluralin	PEST PEST	C			110 N 12 N 87 C	11 N 7.3 N 8.1 C	4.1 N 4.1 C	200 N 22 N 580 C	2000 N 80 N 2500 C		

EPA Region 6
Human Health
Media-Specific Screening Levels

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-6}* *C= 10^{-5}* *Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation.)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
1,2,4-Trimethylbenzene	VOC				300 N I	180 N	68 N	3900 N I	SAT		
1,3,5-Trimethylbenzene	VOC				300 N I	180 N	68 N	3900 N I	SAT	98 S	0.26 M
Trimethyl phosphate					1.8 C	0.17 C	0.085 C	12 C	52 C		
1,3,5-Trinitrobenzene	SVOC				1.8 N	0.18 N	0.068 N	3.3 N	34 N		
Trinitrophenylmethylnitramine					370 N	37 N	14 N	650 N	6800 N		
2,4,6-Trinitrotoluene		C			22 C	2.1 C	1.1 C	480 C	640 C		
Uranium (soluble salts)					110 N	11 N	4.1 N	230 N	5100 N		
Vanadium			66		260 N	26 N	9.5 N	540 N	12000 N		
Vanadium pentoxide					330 N	33 N	12 N	690 N	15000 N		
Vanadium sulfate					730 N	73 N	27 N	1500 N	34000 N		
Vernam	PEST				37 N	3.7 N	1.4 N	65 N	680 N		
Vinclozolin	PEST				910 N	91 N	34 N	1600 N	17000 N		
Vinyl acetate	VOC				37000 N	210 N	1400 N	65000 N	SAT	370 E	84 E
Vinyl bromide					5.2 N I	3.1 N				2 N	0.018 N
Vinyl chloride	VOC			2	0.02 C	0.021 C	0.0017 C	0.005 C	0.01 C	0.002 E	0.01 E
Warfarin	PEST				11 N	1.1 N	0.41 N	20N	200 N	0.046 N	1800 N
m-Xylene	VOC				1400 N	730 N	2700 N	980 S	980 S	950 S	240 M
o-Xylene	VOC				1400 N	730 N	2700 N	980 S	980 S	730 S	150 M

EPA Region 6
Human Health
Media-Specific Screening Levels

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*		*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
				Drinking Water	*Tap Water*	*Ambient Air*	*Fish*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*			
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
p-Xylene	VOC		22-50	10000	520 N I	310 N	2700 N	980 S	980 S	1000 S	220 M
Xylene (mixed)	VOC				1400 N	7300 N	410 N	980 S	980 S	320 E	74 E
Zinc					11000 N	1100 N		23000 N	SAT		42000 E
Zinc phosphide	PEST				11 N	1.1 N	0.41 N	23 N	510 N		
Zineb	PEST				1800 N	180 N	68 N	3300 N	34000 N		

REGION 6 DEVELOPMENT OF MINIMUM QUANTIFICATION LEVELS

INTRODUCTION

The development of water quality based permit limits to protect numeric criteria for toxics has focused attention on the analytical sensitivity used when these toxic parameters are measured. Currently, there is not a consistent benchmark to determine the sensitivity of chemical analyses. Analytical results are characterized by a number of different terms, including Method Detection Level, Instrument Detection Level, Practical Quantification Level and Minimum Levels. These "detection levels" convey different information about the analysis. Several EPA-approved methods are cited for most toxic parameters, with varying levels of sensitivity. The permitting authority must then deal with three questions. The parameter by which to judge sensitivity must be clearly defined. The level of analytical sensitivity required of the discharger when effluent data accompanies a permit application must be chosen. Further, a quantitation level to monitor compliance for permit limits below analytical levels must be established.

EPA's Office of Wastewater Enforcement and Compliance (OWEC) has formed a workgroup to address the issue of detection limits. The Office of Research and Development (ORD) is working to standardize detection and quantitation levels within and across environmental media. Region 6 undertook the study described below to provide an interim approach and set of quantitation values with which defensible permits could be written.

OBJECTIVE

The available statistics and terms were examined to select an analytical parameter or benchmark to judge sensitivity of chemical measurements. The next goal was to select a minimum level of sensitivity for each of the priority pollutants listed in 40 CFR 122 (Tables II and III). Then, EPA approved methods that could be expected to achieve these minimum levels were identified.

PROCEDURE

Selection of an Analytical Benchmark for Sensitivity

Analytical data is characterized by a number of different terms. A true detection limit connotes the lowest concentration that a given instrument can record. A quantitation limit is the lowest concentration that can be measured with known accuracy. The parameters evaluated by Region 6 were the Method Detection Level (MDL) defined by EPA at 40 CFR 136 Appendix B, Instrument Detection Level (IDL) defined by EPA Method 1620[1], the Limit of

Attachment 1

Detection (LOD) and Limit of Quantification (LOQ) described by the American Chemical Society[2] the Practical Quantification Level (PQL), and the Minimum Level (ML) defined by EPA in 40 CFR 136 "1600" Series. LOD and MDL are statistically derived from the results of replicate analyses. LOD, IDL, and MDL are described as approximately three times the standard deviation obtained from replicate measurements, and may be described as that value determined to be statistically significant from the measurement of a reagent blank. An IDL is determined from the analysis of a chemical in a reagent water matrix, and MDL may be determined in either reagent or sample matrix. LOQ and PQL are the products of an LOD or MDL and a constant factor and attempt to define a level of analyte that may be repeatedly measured. The ML is defined as the concentration in a sample equivalent to the concentration of the lowest point on the calibration curve.

The concept of a Minimum Level, or the lowest point on the calibration curve, was judged to be a true quantitation limit. The comparison of instream waste concentrations to criteria or effluent concentrations to permit limits are both quantitative exercises best done with a measured level of a pollutant rather than an indication of its presence. Region 6 has elected to define a minimum quantification level (MQL) as the lowest concentration at which a particular substance can be quantitatively measured. The most straightforward estimator of a minimum quantitation level currently available is the lowest concentration used in the calibration of a measurement system. This method of evaluating acceptable limits of quantification has been used by EPA in other cases, namely the development of the 1624 and 1625 organic analysis methods[3], the regulation of dioxin from pulp and paper mills[4], and the development of Organic Chemical effluent guidelines[5].

Establishing MQLs for Priority Pollutants

A literature review was made of analytical methods that have been characterized by a low calibration point or minimum level. These sources of information were used to arrive at appropriate low calibration points for the available analytical methods.

Volatile and Semivolatile Organics

The first step in the development of a water quality-based permit is to obtain the best analytical scan of the toxic priority pollutants that is reasonably available to the broad spectrum of dischargers. Gas chromatograph-mass spectroscopy (GC-MS) as detailed in 40 CFR 136 Methods 624 and 625 are appropriate and cost-effective methods to screen an effluent for the entire set of volatile and semivolatile priority pollutants. There were two sources of information that could be used to set appropriate low calibration points or MQLs for these methods. The contract

Laboratory Program (CLP) administered under CERCLA contains a list of priority pollutants and associated Contract Required Quantitation Levels (CRQL)[6]. These quantitation levels were developed under the assumption that 624 and 625 GC-MS were used to perform analyses on the target compounds. Region 6 used the CRQL as the primary basis for establishing its own MQLs for organic pollutants. The Minimum Levels found in the federal regulations describing the similar GC-MS 1624 and 1625 methods were then used as a cross reference[3].

The CRQL was used to establish the MQL for sixty-seven of the eighty-four volatile and semivolatile pollutants. For sixty-five of these compounds, the CRQL and the ML were equal. The MQLs for the remaining seventeen pollutants were taken from the ML value. Some priority pollutants are not target compounds under the CERCLA program, these being acrolein, acrylonitrile, 2-chloroethyl vinyl ether, benzidine and 1,2 diphenlyhydrazine. The MLs for three halogenated aliphatic hydrocarbons, hexachloroethane, 2-nitrophenol, benzopyrylene, indenopyrene, dibenzoanthracene, and three nitrosoamines are higher than the CRQL by a factor of 2 to 5, although in the same order of magnitude. These higher MLs were used as the basis for the regional MQL in recognition of the difficulty in recovery and identification of these pollutants.

Pesticides

Gas chromatography is the most sensitive analytical method for pesticides, it is also relatively inexpensive and readily available. CRQLs have been established for pesticides, the required quantitation level assumes analyses the gas chromatography method as detailed in 40 CFR 136 Method 608. Region 6 chose to base the MQL on the CRQL for priority pollutant pesticides, with the exception of the pesticide chlordane. The regional Environmental Services Division Laboratory in Houston, Texas provided professional guidance in setting the MQL for chlordane at 0.2 ug/l. A CRQL has been established at .05 ug/l for pure alpha and gamma chlordane isomers. The pesticide listed as a priority pollutant and encountered in wastewaters is technical grade chlordane, which does not provide as strong and distinctive chromatographic response as the pure isomers and is more reliably quantified at this higher level.

Metals

Region 6 used the Contract Required Detection Level (CRDL) described for metals in CERCLA CLP[7] as the primary basis for MQLs. The EPA-approved methods for the measurement of priority pollutant metals include graphite furnace and flame atomic absorption spectrometry (AA) and inductively coupled plasma (ICP). Each of these methods has a different level of

sensitivity. The CRDLs reflect acceptable ICP analysis of some metals and the more sensitive graphite furnace measurement of the remainder of the set of priority metals.

The CRDL served as the basis for the MQL for four metals (Arsenic, Mercury, Selenium, and Thallium) and Cyanide and represents analysis by the most sensitive available technique. CRDLs were used to establish MQLs for Antimony, Tri- and Hexavalent Chromium, and Zinc at levels of sensitivity attainable by ICP analysis but sufficient to demonstrate compliance with water quality standards. The MQL for Beryllium was based on the CRDL attainable by ICP analysis. In that Beryllium is not regulated by the states in Region 6, more sensitive measurement of this pollutant is not currently necessary for water quality decisions.

The CRDL for Nickel is sufficient to protect water quality when discharges to freshwater are being evaluated and will be used as the value of the MQL in that scenario. However, the ambient marine criteria for Nickel are two orders of magnitude lower than the freshwater standards. To adequately assess nickel discharges to marine waters, a lower MQL predicating the use of graphite furnace analysis will be necessary. Region 6 selected an MQL for Nickel of 5 ug/l for use in marine discharges, based on the optimum concentration range described in EPA Method 249.2[9].

Similarly, the MQL for Cadmium, Lead and Silver were based on the optimum lower range described in the graphite furnace methods for these pollutants[9]. Silver is governed by a low water quality criteria, the MQL was set to reflect the most sensitive analyses available. The lower end of the optimum range for Lead was slightly higher than CRDL and was used to reflect the difficulty in overcoming background contamination of this metal. The optimum concentration range for Cadmium reflected a sensitivity protective of the water quality criteria for this metal and was used to set the MQL.

The CRDL has a direct relation to the low calibration standard for atomic absorption methods. The QA/QC control requirements[4] in the CLP state that one AA calibration standard must be at the CRDL for all metals except mercury. For mercury and for ICP measurements in which the lowest calibration point may not be directly related to quantitation, a demonstration of sensitivity may be made by measurement of a "check standard" equal to the CRDL. The measured value should be within ten per cent of the known concentration.

Attachment 1

Discharger-Specific Quantification Levels

The process of setting MQLs for the pollutants described above is a general approach , describing the minimum sensitivity that would be acceptable in evaluating discharges. The MQLs for organic pollutants have been set to evaluate scans of the entire list of priority pollutants by GC-MS. The measure of individual organic pollutants at trace levels may be made with greater sensitivity in many cases by a specific gas chromatography technique. This is, however, dependent on the pollutant and the matrix. If application information indicates that a specific pollutant regulated at a trace level is being discharged, appropriate evaluation will include a comparison of the sensitivity of GC-MS and GC tests for that specific pollutant and matrix. The most sensitive method may then be required for analysis. A matrix specific Method Detection level may be determined for the pollutant as described in 40 CFR 136 Appendix B. The MDL and LOD[2] being similar descriptors and both equivalent to three standard deviations about replicate measurements, a relationship between the MDL and the LOQ is drawn as follows:

LOD = 3 s.d.
LOQ = 10 s.d.
LOQ = 10/3 LOD
LOD = MDL

Minimum Quantitation Level= 3.3 MDL

Summary

EPA has embraced Minimum Levels (defined as the lowest calibration point) as a valid scientific and regulatory concept for establishing water quality-based limits in the Dioxin Permitting Strategy. A national workgroup has been formed to address the issue of permit limits below analytical quantification levels. A goal of this workgroup is to publish Minimum Levels reflecting matrix effects for all of the EPA-approved analytical methods for wastewater. Until this exercise is completed, the states and regions must have some benchmark of required analytical sensitivity.

Region 6 have developed MQLs in an effort to obtain reliable data with which to evaluate our universe of dischargers and protect water quality standards. In stipulating these calibration points to the permittee, we establish an easily identified baseline for quantitation on which the decision to impose a limit can be made.

References

1. USEPA, 1989. Method 1620: Metals by ICP and AA Spectroscopy
2. Analytical Chemistry, 1983. 55(14):2210-2218.
3. 40 CFR 136, Methods 1624 and 1625
4. USEPA, May 21, 1990"Strategy for the Regulation of Discharges of PHDDs and PHDFs from Pulp and Paper Mills to Waters of the United States"
5. USEPA, 1987. Development Document for Effluent Guidelines and Standards for the Organic Chemicals, Plastics and Synthetic Fibers Point Source Category, volumes 1 and 2 (EPA 440/1-87/009)
6. USEPA, 1991. Contract Laboratory Program Statement of Work for Organic Analysis (OLM 01.10.2-.8)
7. USEPA, 1991. Contract Laboratory Program Statement of Work for Inorganic Analysis (ILM02.0)
8. USEPA, 1991. Contract Laboratory Program Statement of Work for Inorganic Analysis, Exhibit E, Quality Assurnace/Quality Control Requirements
9. USEPA, 1983. Methods for Chemical Analysis of Water and Wastes
Methods 249.2, 239.2, 213.2, 272.2. (EPA-600/4-79-020)

Attachment 1

MINIMUM QUANTIFICATION LEVELS (MQLs)

		REQUIRED MQL (µg/L)	EPA METHOD
METALS AND CYANIDE			
Antimony	(Total)[1]	60	200.7
Arsenic	(Total)[1]	10	206.2
Beryllium	(Total)[1]	5	200.7
Cadmium	(Total)[2]	1	213.2
Chromium	(Total)[1]	10	200.7
Chromium	(3+)[1]	10	200.7
Chromium	(6+)[1]	10	200.7
Copper	(Total)[2]	10	220.2
Lead	(Total)[2]	5	239.2
Mercury	(Total)[1]	.2	245.1
Molybdenum	(Total)9	30	200.7
Nickel	(Total)[1]	[Freshwater] 40	200.7
Nickel	(Total)[2]	[Marine] 5	249.2
Selenium	(Total)[1]	5	270.2
Silver	(Total)[2]	2	272.2
Thallium	(Total)[1]	10	279.2
Zinc	(Total[1]	20	200.7
Cyanide	(Total)[1]	10	335.2
DIOXIN			
2,3,7,8-Tetrachloro-dibenzo-p-dioxin (TCDD)[3]		.00001	1613
VOLATILE COMPOUNDS			
Acrolein[4]		50	624
Acrylonitrile[4]		50	624
Benzene[4]		10	624
Bromoform[5]		10	624
Carbon Tetrachloride[5]		10	624
Chlorobenzene[5]		10	624
Chlorodibromomethane[5]		10	624
Chloroethane[6]		50	624
2-Chloroethyl vinyl ether[4]		10	624
Chloroform[5]		10	624
Dichlorobromomethane[5]		10	624
1,1-Dichloroethane[5]		10	624
1,2-Dichloroethane[5]		10	624
1,1-Dichloroethylene[5]		10	624
1,2-Dichloropropane[5]		10	624
1,3-Dichloropropylene[5]		10	624
Ethylbenzene[5]		10	624

Attachment 1

Methyl Bromide [Bromomethane][6]	50	624
Methyl Chloride [Chloromethane][6]	50	624
Methylene Chloride[5]	20	624
1,1,2,2-Tetrachloroethane[5]	10	624
Tetrachloroethylene[5]	10	624
Toluene[5]	10	624
1,2-trans-Dichloroethylene[5]	10	624
1,1,1-Trichloroethane[5]	10	624
1,1,2-Trichloroethane[5]	10	624
Trichloroethylene[5]	10	624
Vinyl Chloride[5]	10	624
ACID COMPOUNDS		
2-Chlorophenol[5]	10	625
2,4-Dichlorophenol[5]	10	625
2,4-Dimethylphenol[7]	10	625
4,6-Dinitro-o-Cresol [2 methyl 4,6-dinitrophenol][8]	50	625
2,4-Dinitrophenol[5]	50	625
2-Nitrophenol[6]	20	625
4-Nitrophenol[5]	50	625
p-Chloro-m-Cresol [4 chloro-3-methylphenol][5]	10	625
Pentachlorophenol[5]	50	625
Phenol[5]	10	625
2,4,6-Trichlorophenol[5]	10	625
BASE/NEUTRAL COMPOUNDS		
Acenaphthene[5]	10	625
Acenaphthylene[5]	10	625
Anthracene[5]	10	625
Benzidine[4]	50	625
Benzo(a)anthracene[5]	10	625
Benzo(a)pyrene[5]	10	625
3,4-Benzofluoranthene[5]	10	625
Benzo(ghi)perylene[6]	20	625
Benzo(k)fluoranthene[5]	10	625
Bis(2-chloroethoxy) methane[5]	10	625
Bis(2-chloroethyl) ether[5]	10	625
Bis(2-chloroisopropyl) ether[5]	10	625
Bis(2-ethylhexyl) phthalate[5]	10	625
4-Bromophenyl phenyl ether[5]	10	625
Butyl benzyl phthalate[5]	10	625

2-Chloronapthalene[5]	10		625
4-Chlorophenyl phenyl ether[5]	10		625
Chrysene[5]	10		625
Dibenzo (a,h) anthracene[6]	20		625
1,2-Dichlorobenzene[5]	10		625
1,3-Dichlorobenzene[5]	10		625
1,4-Dichlorobenzene[5]	10		625
3,3'-Dichlorobenzidine[6]	50		625
Diethyl Phthalate[5]	10		625
Dimethyl Phthalate[5]	10		625
Di-n-Butyl Phthalate[5]	10		625
2,4-Dinitrotoluene[5]	10		625
2,6-Dinitrotoluene[5]	10		625
Di-n-octyl Phthalate[5]	10		625
1,2-Diphenylhydrazine[4]	20		625
Fluoranthene[5]	10		625
Fluorene[5]	10		625
Hexachlorobenzene[5]	10		625
Hexachlorobutadiene[5]	10		625
Hexachlorocyclopentadiene[5]	10		625
Hexachloroethane[6]	20		625
Indeno (1,2,3-cd) pyrene[6] (2,3-o-phenylene pyrene)	20		625
Isophorone[5]	10		625
Naphthalene[5]	10		625
Nitrobenzene[5]	10		625
N-nitrosodimethylamine[6]	50		625
N-nitrosodi-n-propylamine[6]	20		625
N-nitrosodiphenylamine[6]	20		625
Phenanthrene[5]	10		625
Pyrene[5]	10		625
1,2,4-Trichlorobenzene[5]	10		625
<u>PESTICIDES</u>			
Aldrin[7]		.05	608
Alpha-BHC[7]		.05	608
Beta-BHC[7]		.05	608
Gamma-BHC (Lindane)[7]		.05	608
Delta-BHC[7]		.05	608
Chlordane[7]		.2	608
4,4'-DDT[7]		.1	608
4,4'-DDE (p,p-DDX)[7]		.1	608
4,4'-DDD (p,p-TDE)[7]		.1	608

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Dieldrin[7]	.1	608
Alpha-endosulfan[7]	.1	608
Beta-endosulfan[7]	.1	608
Endosulfan sulfate[7]	.1	608
Endrin[7]	.1	608
Endrin aldehyde[7]	.1	608
Heptachlor[7]	.05	608
Heptachlor epoxide[7] (BHC-hexachlorocyclohexane)	.05	608
PCB-1242[7]	1.0	608
PCB-1254	1.0	608
PCB-1221	1.0	608
PCB-1232	1.0	608
PCB-1248	1.0	608
PCB-1260	1.0	608
PCB-1016	1.0	608
Toxaphene[7]	5.0	608

1 CRDL
2 Method 213.2, 239.2, 220.2, 272.2
3 Dioxin National Strategy
4 No CRQL established
5 CRQL basis, equivalent to ML
6 ML basis, higher than CRQL
7 CRQL basis, no ML established
8 CRQL basis, higher than ML
9 Based on 3.3 times IDL published in 40 CFR Part 136, Appeddix C

Attachment I-2

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

EPA Region 6

Human Health

Media-Specific Screening Levels

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202

Screening Levels
Uses and Limitations

- A consultation with a Risk Assessor should take place before making a final decision in the corrective/remedial action process.
- The screening levels should only used in the preliminary stages of the investigations, i.e., screen.
- All values are risk-based with exceptions and their respective basis for the calculations/values noted.
- Risk-based concentrations for carcinogens were calculated at the following risk levels: Class A or B = 10^{-6}, Class C = 10^{-5}, "Blank" = 10^{-6}.
- The screening levels only address human health protection.
- Values do not account for chemical mixtures. If more than one non-carcinogen is expected, than the non-carcinogenic chemical screening level should be divided by 10.
- Exceedance of a screening level does not indicate a required action.
- Unrestricted land use, i.e., residential values should be considered in the initial screening of sites for which future residential land use cannot be definitively ruled out.
- The selection of constituents of potential concern (COPC's) can be conducted against these values once the screening levels for the non-carcinogenic compounds are divided by a factor of 10 to account for chemical mixtures.

- Sources used to compile the screening levels were:

  Region IX Preliminary Remediation Goals (PRGs)
  - Tap Water Values, Direct soil exposure values.

  EPA Region III Risk-Based Concentration Table
  - Tap Water and Soil Values labeled "I", Ambient Air Values, Fish Values, Soil Screening Levels

  EPA's *Draft Soil Screening Level Guidance*
  - Soil screening levels.

  EPA Region 6 Current and Proposed National Primary and Secondary Drinking Water Regulations Table
  - Drinking values labeled MCL's.

  Risk Assessment Guidance for Superfund (RAGS), Health Effects Assessment Summary Tables (HEAST), Agency for Toxic Substances and Disease Registry Toxicological Profiles, and *EPA Provisional Guidance*
  - Technical reference documents.

  Region 6 Draft Supplemental Guidance to RAGS
  - Technical reference documents.

  OSWER Directives
  - Policy documents, e.g., residential soil lead screening level.

  Elemental Composition of Surficial Materials in the Conterminous United States and *OSWER Regional Toxics Coordinators Memorandum* titled "Background Metals in Soil" dated March 14, 1989.
  - Soil regional background values.

- The Screening Levels Table is "write" protected and will be updated on a regular basis.

- Specific questions on the table should be directed to Maria Martinez (6PD-NB) at 5-2230.

- The *Media-Specific Screening Levels Table* is in WordPerfect format.

- The user can either type "search" for a chemical name or scroll the list of chemicals.

- Once in the tables portion of the table the user can either view the file on the screen or print the table (by single page or the full [redacted] page document).

EPA Region 6
Human Health
Media-Specific Screening Levels

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/D= 10^{-4} C= 10^{-6} Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*		*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
				Drinking Water (MCL's)	*Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Acephate	PEST	C			77 C	7.2 C	3.6 C	510 C	2200 C		
Acetaldehyde					94N I	0.81 C					
Acetochlor	PEST				730 N	73N	27 N	1300 N	14000 N		
Acetone	VOC				610 N	370 N	140 N	2000 N	8400 N	62000 E	8 E
Acetone cyanohydrin					2600 N	150 N	95 N	4600 N	48000 N		
Acetonitrile	VOC				220 N	52 N	8.1 N	390 N	4100 N		
Acetophenone	SVOC				0.04 N	0.021 N	140 N	5600 N	45000N		
Acifluorfen	PEST				470 N	47 N	18 N	850 N	8900 N		
Acrolein	PEST				730 N	0.021 N	27 N	1300N	12000N		
Acrylamide		B2			0.015 C	0.0014 C	0.0007 C	0.098 C	0.41 C		
Acrylic acid					18000 N	1 N	680 N	32000N	SAT		
Acrylonitrile	VOC	B1			0.12 C I	0.026 C	0.0058 C	0.13 C	0.30 C		
Alachlor	PEST			2	0.8 C	0.078 C	0.039 C	5.5 C	24 C		
Alar	PEST				5500 N	550 N	200 N	9800 N	SAT	570 S	0.036 M'
Aldicarb	PEST			7	37 N	3.7 N	1.4 N	65 N	680 N		
Aldicarb sulfone	PEST	B2		7	37 N	3.7 N	1.4 N	65N	680 N	0.5 E	0.005 E
Aldrin					0.004 C	0.00037 C	0.00019 C	0.026C	0.11 C		
Ally					9100 N	910 N	340 N	16000N	SAT		

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								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Allyl alcohol	VOC				180 N	18 N	6.8 N	330 N	3400 N		
Allyl chloride	VOC		45,000		1800 N	1 N	68 N	3300 N	34000N		
Aluminum					37000 N	3700 N	1400 N	77000 N	SAT		
Aluminum phosphide	PEST				15 N	1.5 N	0.54 N	31N	680 N		
Amdro	PEST				11 N	1.1 N	0.41 N	21N	200 N		
Ametryn	PEST				330 N	33 N	12 N	590 N	6100 N		
m-Aminophenol					2600 N	260 N	95 N	4600 N	48000N		
4-Aminopyridine	PEST				0.73 N	0.073 N	0.027 N	1.3N	14 N		
Amitraz	PEST				91 N	9.1 N	3.4 N	160 N	1700 N		
Ammonia					1000 N I	100 N					
Ammonium sulfamate	PEST				7300 N	730 N	270 N	13000 N	SAT	45 N	0.031 N
Aniline	SVOC	B2			11 N	1 N	0.55 C	19 C	200 C		
Antimony and compounds				6	15 N	1.5 N	0.54 N	31 N	680 N		
Antimony pentoxide					18 N	1.8 N	0.68 N	38 N	850 N		
Antimony potassium tartrate					33 N	3.3 N	1.2 N	69 N	1500 N		
Antimony tetroxide					15 N	1.5 N	0.54 N	31 N	680 N		
Antimony trioxide					15 N	1.5 N	0.54 N	31 N	680 N		
Apollo	PEST				470 N	47 N	18 N	850 N	8900 N		

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-4} C= 10^{-5} Blank= 10^{-6}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aramite	PEST	B2	1.1-16.7	50	2.7 C	0.25 C	0.13 C	18 C	76 C	380 E	15 E
Arsenic (noncancer)		A			23 N I	1.1 N	0.41 N	22 N	610 N I	380 E	15 E
Arsenic (as carcinogen)					0.04 C	0.00041 C	0.0021 C	0.32 C	2.0 C		
Arsine	PEST				0.52 N I	0.052 N					
Assure	PEST				330 N	33 N	12 N	590 N	6100 N		
Asulam					1800 N	180 N	68 N	3300 N	34000 N		
Atrazine	PEST			3	0.3 C	0.028 C	0.014 C	2.0 C	8.6 C		
Avermectin B1	PEST	B2			15 N	1.5 N	0.54 N	26 N	270 N		
Azobenzene					0.61 C	0.058 C	0.029 C	4.0 C	17 C		
Barium and compounds			430	2000	2600 N	0.52 N	95 N	5300 N	SAT	SAT	32 E
Baygon	PEST				150 N	15 N	5.4 N	260 N	2700N		
Bayleton	PEST				1100 N	110 N	41 N	2000 N	20000N		
Baythroid	PEST				910 N	91 N	34 N	1600 N	17000 N		
Benefin	PEST				11000 N	1100 N	410 N	20000 N	SAT		
Benomyl	PEST				1800 N	180 N	68 N	3300 N	34000 N		
Bentazon	PEST			5	91 N	9.1 N	3.4 N	160 N	1700 N	0.5 E	0.02 E
Benzaldehyde					610 N I	370 N	140 N	6500 N	68000 N		
Benzene	VOC				0.4 C	0.22 C	0.11 C	1.4 C	3.2 C		

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								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Benzenethiol	SVOC	A			0.37 N I	0.037 N	0.014 N	0.78 N I	20 N I	1.3 C	1.1E-06 C
Benzidine	SVOC				0.0003 C	0.00003 C	0.00001 C	0.002 C	0.008 C	320 S	280 E
Benzoic acid					150000 N	15000 N	5400 N	SAT	SAT		
Benzotrichloride	SVOC	B2			0.0052 C	0.00048 C	0.00024 C	0.034 C	0.150 C	0.012 C	0.000073 C
Benzyl alcohol					11000 N	1100 N	410 N	20000 N	SAT		
Benzyl chloride		B2			0.066 C	0.037 C	0.019 C	1.4 C	3.9 C	0.5 C	0.00036 C
Beryllium and compounds		B2	0.5-2	4	0.02 C	0.00075 C	0.00073 C	0.14 C	1.10 C	690 E	180 E
Bidrin	PEST				3.7 N	0.37 N	0.14 N	6.5 N	68 N		
Biphenthrin (Talstar)					550 N	55 N	20 N	980 N	10000 N		
1,1-Biphenyl					1800 N	180 N	68 N	3300 N	34000 N	9000 S	110 N
Bis(2-chloroethyl)ether	SVOC	B2			0.0098 C	0.0054 C	0.0029 C	0.07 C	0.17 C	0.3 E	0.0003 E
Bis(2-chloroisopropyl)ether					0.27 C	0.18 C	0.045 C	3.9 C	12 C		
Bis(chloromethyl)ether		A			0.00005 C	0.00003 C	0.00001 C	0.0001 C	0.0003 C	0.00004 C	1.0E-07 C
Bis(2-chloro-1-methylethyl)ether					0.96 C	0.089 C	0.045 C	6.3 C	27 C		
Bis(2-ethylhexyl)phthalate (DEHP)	SVOC				4.8 C	0.45 C	0.23 C	32 C	140 C	210 E	11 E
Bisphenol A			2-100		1800 N	180 N	68 N	3300 N	34000 N		
Boron (and borates)					3300 N	21 N	120 N	5900 N	61000 N		
Boron trifluoride					7.3 N I	0.73 N					

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								Residential	*Industrial*	*Air* / *Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg* / *mg/kg*
Bromodichloromethane	VOC	D			0.18 C	0.1 C	0.051 C	1.4 C	3.4 C	1800E / 0.3 E
Bromoethene (vinyl bromide)	VOC	B2			0.1 C	0.057 C	0.4 C	0.45 C	1.0 C	46 E / 0.5 E
Bromoform (tribromomethane)					2.4 C I	1.6 C		56 C	240 C	
Bromomethane	VOC				8.7 N I	5.2 N	1.9 N	15 N	57 N	2 E / 0.1 E
4-Bromophenyl phenyl ether	SVOC				2100 N I	210 N	78 N	4500 N I	120000 N I	
Bromophos					180 N	18 N	6.8 N	330 N	3400 N	
Bromoxynil	PEST				180 N	73 N	27 N	1300 N	14000 N	
Bromoxynil octanoate	PEST				730 N	73 N	27 N	1300 N	14000 N	0.0013 C / 0.000072 c
1,3-Butadiene		B2			0.011 C	0.0064 C		0.009 C	0.02 N	
1-Butanol	VOC				3700 N	370 N	140 N	6500 N	68000 N	9700 E / 8 E
Butyl benzyl phthalate					7300 N	730 N	270 N	13000 N	SAT	530 E / 68 E
Butylate					1800 N	180 N	68 N	3300 N	34000 N	
sec-Butylbenzene	VOC				61 N I	37 N	14 N	780 N I	20000 N I	80 S / 0.27 M
tert-Butylbenzene	VOC				61 N I	37 N	14 N	780 N I	20000 N I	0.27 M
Butylphthalyl butylglycolate					37000 N	3700 N	1400 N	65000 N	SAT	
Cacodylic acid	PEST		0.01-1.0	5	110 N	11 N	4.1 N	200 N	2000 N	920 E / 6 E
Cadmium and compounds					18 N	0.00099 C	0.68 N	38 N	850 N	
Caprolactam					18000 N	1800 N	680 N	33000 N	SAT	

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								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Captafol	PEST				7.8 C	0.73 C	0.37 C	52 N	220 C		
Captan	PEST				19 C	1.8 C	0.9 C	130 C	550 C		
Carbaryl	PEST				3700 N	370 N	140 N	6500 N	68000 N	0.34 S	23 N
Carbofuran	SVOC			40	180 N	18 N	6.8 N	330 N	3400 N		
Carbon disulfide					21 N	730 N	140 N	16 N	52 N	11 E	14 E
Carbon tetrachloride				5	0.2 C	0.12 C	0.024 C	0.47 C	1.1 C	0.2 E	0.03 E
Carbosulfan	PEST				370 N	37 N	14 N	650 N	6800 N		
Carbozin	PEST				3700 N	370 N	140 N	6500 N	68000 N		
Chloral					73 N	7.3 N	2.7 N	130 N	1400 N		
Chloramben	PEST				550 N	55 N	20 N	980 N	10000 N		
Chloranil					0.17 C	0.016 C	0.0078 C	1.1 C	4.7 C		
Chlordane	PEST			2	0.05 C	0.0049 C	0.0024 C	0.34 C	1.5 C	10 E	2 E
Chlorimuron-ethyl					730 N	73 N	27 N	1300 N	14000 N		
Chlorine	PEST				3700 N	370 N	140 N	7700 N	SAT		
Chlorine dioxide					2.1 NI	0.21 N					
Chloroacetaldehyde					250 NI	25 N	9.3 N	540 NI	14000 NI		
Chloroacetic acid					73 N	7.3 N	2.7 N	130 N	1400 N		
2-Chloroacetophenone					0.05 N	0.031 N		0.07 N	0.27 N		

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								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4-Chloroaniline Chlorobenzene Chlorobenzilate	SVOC VOC PEST				150 N 39 N 0.25 C	15 N 21 N 0.023 C	5.4 N 27 N 0.012 C	260 N 160 N 1.6 C	2700 N 570 N 7.1 C	1200 S 94 E	0.3 E 0.6 E
p-Chlorobenzoic acid 4-Chlorobenzotrifluoride 2-Chloro-1,3-butadiene					7300 N 730 N 14 N	730 N 73 N 7.3 N	270 N 27 N 27 N	13000 N 1300 N 6.3 N	SAT 14000 N 21 N	86 N	7.5 N
1-Chlorobutane Chlorodibromomethane 1-Chloro-1,1-difluoroethane	VOC VOC				2400 N 0.13 C I 87000 N	1500 N 0.075 C 52000 N	540 N 0.038 C	810 S 7.6 C I	810 S 68 C I	1900 E	0.2 E
Chlorodifluoromethane Chloroethane 2-Chloroethyl vinyl ether	VOC VOC VOC				87000 N 8600 N 150 N I	52000 N 10000 N 91 N	540 N 84 N	350 S 31000 N I 2000 N I	350 S SAT 51000 N I	2600 S	33 N
Chloroform Chloromethane 4-Chloro-2,2-methylaniline hydrochloride	VOC VOC	B2			0.16 C 1.5 C 0.15 C	0.078 C 0.99 C 0.014 C	0.51 C 0.24 C 0.0069 C	0.53 C 2.0 C 0.77 C	1.1 C 4.3 C 3.3 C	0.2 E 0.063 C	0.3 E 0.0066 C
4-Chloro-2-methylaniline beta-Chloronaphthalene o-Chloronitrobenzene	SVOC				0.12 C 2900 N 0.42 C I	0.011 C 290 N 0.25 C	0.0054 C 110 N 0.13 C	0.97 C 5200 N 18 C	4.1 C 55000 N 76 C	2.8 S	140 N

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								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
p-Chloronitrobenzene	SVOC				0.59 C I	0.35 C	0.18 C	25 C	110 C	53000 E	2 E
2-Chlorophenol					180 N	18 N	6.8 N	330 N	3400 N	22 N	0.64 N
2-Chloropropane					170 N	100 N		350 N	1300 N		
Chlorothalonil	PEST				6.1 C	0.57 C	0.29 C	41 C	170 C	1200 N	5.6 N
o-Chlorotoluene					120 N	73 N	27 N	340 N	1600 S		
Chlorpropham	PEST				7300 N	730 N	270 N	13000 N	SAT		
Chlorpyrifos	PEST				110 N	11 N	4.1 N	200 N	2000 N		
Chlorpyrifos-methyl	PEST				370 N	37 N	14 N	650 N	6800 N		
Chlorsulfuron	PEST				1800 N	180 N	68 N	3300 N	34000 N		
Chlorthiophos					29 N	2.9 N	1.1 N	52 N	550 N		
Total Chromium (1/6 ratio Cr VI/Cr III)			38	100	37000 N I	0.0021 N	1400 N	210 N	1600 N	140 E	19 E
Chromium VI and compounds		A			180 N	0.00015 C	6.8 C	31 C	230 C		
Coal tar	PEST				2200 N I	0.0028 C	81 N	4700 N I	SAT		
Cobalt			8			220 N					
Coke Oven Emissions		A				0.0029 C					
Copper and compounds			20		1400 N	150 N	54 N	2800 N	63000 N		
Crotonaldehyde		C			0.006 C	0.033 C	0.017 C	0.1 C	0.3 C	81 N	65 N
Cumene					19 N	9.4 N	54 N	49 N	160 N		

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				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Cyanides: Barium cyanide Calcium cyanide					3700 N 1500 N	370 N 150 N	140 N 54 N	7700 N 3100 N	SAT 68000 N		
Copper cyanide Cyanazine Cyanogen	PEST				180 N 0.08 C 1500 N	18 N 0.0075 C 150 N	6.8 N 0.0038 C 54 N	380 N 130 C 2600 N	8500 N 2.3 C 27000 N		
Cyanogen bromide Cyanogen chloride Free cyanide					3300 N 1800 N 730 N	330 N 180 N 73 N	120 N 68 N 27 N	5900 N 3300 N 1300 N	SAT 34000 N 14000 N		
Hydrogen cyanide Potassium cyanide Potassium silver cyanide					6.2 N 1800 N 7300 N	3.1N 180 N 730 N	27 N 68 N 270 N	1600 N I 3300 N 13000 N	41000 N I 34000 N SAT		
Silver cyanide Sodium cyanide Thiocyanate					3700 N 1500 N 730 N I	370 N 150 N 73 N	140 N 54 N 27 N	6500 N 2600 N 1600 N I	SAT 27000 N 41000 N I		
Zinc cyanide Cyclohexanone Cyclohexylamine					1800 N 180000 N 7300 N	180 N 18000 N 730 N	68 N 6800 N 270 N	3300 N SAT 13000 N	34000 N SAT SAT		

EPA Region 6
Human Health
Media-Specific Screening Levels

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
					Tap Water (Residential Scenario: Ingestion, & Inhalation.)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Cyhalothrin/Karate	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Cypermethrin	PEST				370 N	37 N	14 N	650 N	6800 N		
Cyromazine					270 N	27 N	10 N	490 N	5100 N		
Dacthal	PEST			200	370 N I	37 N	14 N	33000 N	SAT		
Dalapon	HERB				1100 N	110 N	41 N	2000 N	20000 N		
Dinitol					18 N	91 N	34 N	33 N	340 N		
DDD	PEST	B2			0.28 C	0.026 C	0.013 C	1.9 C	7.9 C	37 S	0.7 E
DDE	PEST	B2			0.2 C	0.018 C	0.0093 C	1.3 C	5.6 C	10 S	0.5 E
DDT	PEST	B2			0.2 C	0.018 C	0.0093 C	1.3 C	5.6 C	80 E	1 E
Decabromodiphenyl ether	PEST				61 N I	37 N	14 N	650 N	6800 N		
Demeton	PEST				1.5 N	0.15 N	0.054 N	2.6 N	27 N		
Diallate					0.17 C I	0.1 C	0.052 C	7.3 C	31 C		
Diazinon	PEST				33 N	3.3 N	1.2 N	59 N	610 N	5400 S	2.8 N
Dibenzofuran	SVOC				150 N	15 N	5.4 N	260 N	2700 N	120 S	120 S
1,4-Dibromobenzene					61 N I	37 N	14 N	650 N	6800 N		
1,2-Dibromo-3-chloropropane	VOC	B2			0.048 C	0.21 N	0.0023 C	0.32 C	1.4 C	1.9 N	0.00061 M
1,2-Dibromoethane	VOC				0.00076 C	0.0081 C	0.00004 C	0.005 C	0.02 C	0.0058 C	0.00018 M
Dibutyl phthalate					3700 N	370 N	140 N	6500 N	68000 N	100 E	120 E

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Industrial	Soil Screening Level Transfers from Soil to: Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,3-Dichloropropene Dichlorvos Dicofol	PEST PEST PEST	B2 B2			0.081 C 0.23 C 0.15 C	0.048 C 0.022 C 0.014 C	0.018 C 0.011 C 0.0072 C	0.51 C 1.5 C 1.0 C	1.2 C 6.6 C 4.3 C	0.1 E 3.5 C	0.001 E 0.00072 C
Dicyclopentadiene Dieldrin Diesel emissions	PEST	B2			0.42 N 0.0042 C 52 N I	0.21 N 0.00039 C 5.2 N	41 N 0.0002 C	2300 N I 0.03 C	61000 N I 0.12 C	2 E	0.001 E
Diethyl phthalate Diethylene glycol, monobutyl ether Diethylene glycol, monoethyl ether	SVOC				29000 N 210 N 73000 N	2900 N 21 N 7300 N	1100 N 2700 N	52000 N 370 N SAT	SAT 3900 N SAT	520 E	110 E
Diethylformamide Di(2-ethylhexyl)adipate Diethylstilbestrol				400	400 N 56 N 0.00001 C	40 N 5.2 C 1.3E-06 C	15 N 2.6 C 7.0E-07 C	720 N 370 C 9.5E-05 C	7500 N 1600 C 4.1E-04 C		
Difenzoquat (Avenge) Diflubenzuron 1,1-Difluoroethane	PEST PEST				2900 N 730 N 69000 N	290 N 73 N 42000 N	110 N 27 N	5200 N 1300 N	55000 N 14000 N		
Diisopropyl methylphosphonate (DIMP) Dimethipin Dimethoate	PEST PEST				2900 N 730 N 7.3 N	290 N 73 N 0.73 N	110 N 27 N 0.27 N	5200 N 1300 N 13 N	55000 N 14000 N 140 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
3,3'-Dimethoxybenzidine Dimethylamine 2,4-Dimethylaniline hydrochloride	SVOC PEST				4.8 C 0.04 N 0.12 C	0.45 C 0.021 N 0.011 C	0.23 C 0.0054 C	32 C 0.062 N 0.8 C	140 C 0.23 N 3.3 C		
2,4-Dimethylaniline N-N-Dimethylaniline 3,3'-Dimethylbenzidine	SVOC				0.09 C 73 N 0.0073 C	0.0083 C 7.3 N 0.00068 C	0.0042 C 2.7 N 0.00034 C	0.6 C 130 N 0.05 C	2.5 C 1400 N 0.21 C	29 C	0.00039 C
N,N-Dimethylformamide 1,1-Dimethylhydrazine 1,2-Dimethylhydrazine					3700 N 0.026 C 0.0018 C	31 N 0.0018 C 0.00017 C	140 N 0.0012 C 0.00009 C	6500 N 0.17 C 0.01 C	68000 N 0.73 C 0.05 C		
2,4-Dimethylphenol 2,6-Dimethylphenol 3,4-Dimethylphenol	SVOC				730 N 22 N 37 N	73 N 2.2 N 3.7 N	27 N 0.81 N 1.4 N	1300 N 39 N 65 N	14000 N 410 N 680 N	5400 S	3 E
Dimethyl phthalate Dimethyl terephthalate 1,2-Dinitrobenzene	SVOC SVOC				370000 N 3700 N 15 N	37000 N 370 N 1.5 N	14000 N 140 N 0.54 N	SAT 6500 N 26 N	SAT 68000 N 270 N	1600 E	1200 E
1,3-Dinitrobenzene 1,4-Dinitrobenzene 4,6-Dinitro-o-cyclohexyl phenol	SVOC SVOC				3.7 N 15 N 73 N	0.37 N 1.5 N 7.3 N	0.14 N 0.54 N 2.7 N	6.5 N 26 N 130 N	68 N 270 N 1400 N		

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Media-Specific Screening Levels

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SAT = risk-based value above expected saturation point
max = maximum concentration
PEST = Pesticide Herb = Herbicide
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
"Blank" = Missing data for generation of value.

Basis: C= carcinogenic effects N = non-carcinogenic effects
E = EPA draft Soil Screening Level S = soil saturation concentration
M' = EPA MCL I = Ingestion route only

Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
				Drinking Water	*Tap Water*	*Ambient Air*	*Fish*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
2,4-Dinitrophenol	SVOC	B2			73 N	7.3 N	2.7 N	130 N	1400 N	360 N	0.1 E
Dinitrotoluene mixture	SVOC				0.099 C	0.0092 C	0.0046 C	0.65 C	2.8 C		
2,4-Dinitrotoluene	SVOC				73 N	7.3 N	2.7 N	130 N	1400 N	120 S	0.2 E
2,6-Dinitrotoluene	SVOC			7	37 N	3.7 N	1.4 N	65 N	680 N	370 S	0.1 E
Dinoseb	HERB				37 N	3.7 N	1.4 N	65 N	680 N		
di-n-Octyl phthalate	SVOC				730 N	73 N	27 N	1300 N	14000 N	SAT	SAT
1,4-Dioxane	VOC	B2			1.0 C	0.57 C	0.29 C	14 C	37 C		
Diphenamid	PEST				1100 N	110 N	41 N	2000 N	20000 N		
Diphenylamine	SVOC				910 N	91 N	34 N	1600 N	17000 N		
1,2-Diphenylhydrazine	SVOC	B2		20	0.084 C	0.0081 C	0.0039 C	0.6 C	2.4 C		
Diquat	PEST				80 N	8 N	3 N	140 N	1500 N		
Direct black 38					0.0078 C	0.00073 C	0.00037 C	0.05 C	0.2 C		
Direct blue 6					0.0083 C	0.00077 C	0.00039 C	0.06 C	0.2 C		
Direct brown 95	PEST				0.0072 C	0.00067 C	0.00034 C	0.05 C	0.2 C		
Disulfoton					1.5 N	0.15 N	0.054 N	2.6 N	27 N		
1,4-Dithiane	PEST				370 N	37 N	14 N	650 N	6800 N		
Diuron	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Dodine					150 N	15 N	5.4 N	260 N	2700 N		

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Media-Specific Screening Levels

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)		Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
				Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Endosulfan	PEST			100	1.8 N	22 N	8.1 N	3.3 N	34 N	1 S	3 E
Endothall	PEST			2	730 N	73 N	2711	1300 N	14000 N	16 S	0.4 E
Endrin	PEST				11 N	1.1 N	0.41 N	21 N	200 N		
Epichlorohydrin	VOC	B2			2.0 N	1 C	0.32 C	8.6 C	31 C		
1,2-Epoxybutane					210 N	21 N		370 N	3900 N		
Ethephon (2-chloroethyl phosphonic acid)	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Ethion	PEST				18 N	1.8 N	0.68 N	33 N	340 N		
2-Ethoxyethanol acetate					11000 N	1100 N	410 N	20000 N	SAT		
2-Ethoxyethanol					15000 N	210 N	540 N	26000 N	SAT		
Ethyl acrylate	VOC				0.23 C	0.13 C	0.066 C	0.5 C	1.0 C		
EPTC (S-Ethyl dipropylthiocarbamate)					910 N	91 N	34 N	1600 N	17000 N		
Ethyl acetate					33000 N	3300 N	1200 N	59000 N	SAT		
Ethylbenzene	VOC			70	1300 N	1000 N	140 N	2900 S	3100 S	260 E	5 E
Ethylene cyanohydrin					11000 N	1100 N	410 N	20000 N	SAT		
Ethylene diamine					730 N	73 N	27 N	1300 N	14000 N		
Ethylene glycol	VOC				73000 N	7300 N	2700 N	130000 N	SAT		
Ethylene glycol, monobutyl ether					210 N	21 N		370 C	3900 C		
Ethylene oxide					0.024 C	0.018 C	0.0031 C	0.12 C	0.3 C		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-6}* *C= 10^{-5}* *Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*
					Tap Water (Residential Scenario: Ingestion, & Inhalation)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Ethylene thiourea (ETU) Ethyl ether Ethyl methacrylate	VOC				0.11 C 1200 N 550 N	0.053 C 730 N 330 N	0.027 C 270 N 120 N	0.7 C 3800 S 340 S	3.2 C 3800 S 340 S		
Ethyl p-nitrophenyl phenylphosphorothioate Ethylnitrosourea Ethylphthalyl ethyl glycolate					0.37 N 0.00048 C I 110000 N	0.037 N 0.00005 C 11000 N	0.014 N 0.00002 C 4100 N	0.7 N 0.005 C I SAT	6.8 N 0.041 C I SAT		
Express Fenamiphos Fluometuron	PEST PEST PEST				290 N 9.1 N 470 N	29 N 0.91 N 47 N	11 N 0.34 N 18 N	520 N 16 N 850 N	5500 N 170 N 8900 N		
Fluoride Fluoridone Flurprimidol	PEST PEST			4000	2200 N 2900 N 730 N	220 N 290 N 73 N	81 N 110 N 27 N	3900 N 5200 N 1300 N	41000 N 55000 N 14000 N		
Flutolanil Fluvalinate Folpet	PEST PEST PEST	B2			2200 N 370 N 19 C	220 N 37 N 1.8 C	81 N 14 N 0.9 C	3900 N 650 N 130 C	41000 N 6800 N 550 C		
Fomesafen Fonofos Formaldehyde	PEST PEST	C			3.5 C 73 N 5500 N	0.33 C 7.3 N 0.14 C	0.17 C 2.7 N 270 N	23 C 130 N 9800 N	100 C 1400 N SAT		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Formic Acid Fosetyl- Al Furan	PEST				73000 N 110000 N 37 N	7300 N 11000 N 3.7 N	2700 N 4100 N 1.4 N	SAT SAT 65 N	SAT SAT 680 N		
Furazolidone Furfural Furium	PEST				0.018 C 110 N 0.0013 C	0.0016 C 52 N 0.00013 C	0.00083 C 4.1 N 0.00006 C	0.12 C 200 N 0.009 C	0.5 C 2000 N 0.04 C		
Furmecyclox Glufosinate-ammonium Glycidaldehyde		B2			2.2 C 15 N 15 N	0.21 C 1.5 N 1 N	0.11 C 0.54 N 0.54 N	15 C 26 N 26 N	64 C 270 N 270 N		
Glyphosate Haloxyfop-methyl Harmony	PEST PEST			700	3700 N 1.8 N 470 N	370 N 0.18 N 47 N	140 N 0.068 N 18 N	6500 N 3.3 N 850 N	68000 N 34 N 8900 N		
HCH (alpha) HCH (beta) HCH (gamma) Lindane	PEST PEST PEST	B2 C		0.2	0.011 C 0.37 C 0.05 C	0.00099 C 0.035 C 0.0048 C	0.0005 C 0.018 C 0.0024 C	0.07 C 3 C 0.34 C	0.3 C 11 C 1.5 C	0.9 E 16 E 4.2 C	0.0004 E 0.002 E 0.006 E
HCH-technical Heptachlor Heptachlor epoxide	PEST PEST PEST	B2 B2 B2		0.1 0.2	0.037 C 0.2 C 0.007 C	0.0035 C 0.0014 C 0.00069 C	0.0018 C 0.0007 C 0.00035 C	0.3 C 0.1 C 0.05 C	1.1 C 0.4 C 0.2 C	0.3 E 1 E	0.06 E 0.03 E

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-4} C= 10^{-5} Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
					Tap Water (Residential Scenario: Ingestion, & Inhalation,)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Hexabromobenzene Hexachlorobenzene Hexachlorobutadiene	PEST VOC	B2 C		1	12 N I 0.04 C 8.6 C	7.3 N 0.0039 C 0.81 C	2.7 N 0.002 C 0.4 C	130 N 0.3 C 57 C	1400 N 1.2 C 240 C	1 E 1 E	0.8 E 0.1 E
Hexachlorocyclopentadiene Hexachlorodibenzo-p-dioxin mixture Hexachloroethane	PEST VOC	B2 C		50	260 N 0.00001 C 48 C	0.073 N 1.4E-06 C 4.5 C	9.5 N 5.0E-07 C 2.3 C	450 N 7.2E-05 C 320 C	4700 N 3.1E-04 C 1400 C	2 E 49 E	10 E 0.2 E
Hexachlorophene Hexahydro-1,3,5-trinitro-1,3,5-triazine 1,6-Hexamethylene diisocyanate	SVOC	C			11 N 6.1 C 0.1 N	1.1 N 0.57 C 0.01 N	0.41 N 0.29 C	20 N 40 C	200 N 170 C		
n-Hexanex Hexazinone Hydrazine, hydrazine sulfate	PEST	B2			350 N I 1200 N 0.022 C	210 N 120 N 0.00037 C	81 N 45 N 0.0011 C	4700 N I 2200 N 0.2 C	SAT 22000 N 0.6 C	32 N	13 N
Hydrogen chloride Hydrogen sulfide Hydroquinone					210 N I 1.8 N 1500 N	21 N 1 N 150 N	4.1 N 54 N	6100 N I 2600 N	230 N I 27000 N		
Imazalil Imazaquin Iprodione	PEST PEST PEST				470 N 9100 N 1500 N	47 N 910 N 150 N	18 N 340 N 54 N	850 N 16000 N 2600 N	8900 N SAT 27000 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-4}* *C= 10^{-5}* *Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Iron	VOC	C			11000 N I	1100 N	410 N	23000 N I	SAT		
Isobutanol	PEST				1800 N I	1100 N	410 N	20000 N	SAT	3400 E	0.2 E
Isophorone					710 C	66 C	33 C	4700 C	20000 C		
Isopropalin	PEST				550 N	55 N	20 N	980 N	10000 N		
Isopropyl methyl phosphonic acid					3700 N	370 N	140 N	6500 N	68000 N		
Isoxaben					1800 N	180 N	68 N	3300 N	34000 N		
Lead			10-18		(Uptake	Biokinetic	Model)	400 N	2000 N		
Kepone	PEST				0.0037 C	0.00035 C	0.00018 C	0.03 C	0.1 C		
Lactofen	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Linuron	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Lithium					730 N	73 N	27 N	1500 N	34000 N		
Londax	PEST				7300 N	730 N	270 N	13000 N	SAT		
Malathion	PEST				730 N	73 N	27 N	1300 N	14000 N		
Maleic anhydride	SVOC				3700 N	370 N	140 N	6500 N	68000 N		
Maleic hydrazide	PEST				18000 N	1800 N	680 N	33000 N	SAT		
Malononitrile	VOC				0.73 N	0.073 N	0.027 N	1.3 N	14 N		
Mancozeb	PEST				1100 N	110 N	41 N	2000 N	20000 N		
Maneb	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Manganese and compounds			389-850		180 N	0.052 N	6.8 N	380 N	8300 N		

EPA Region 6
Human Health
Media-Specific Screening Levels

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-4}* *C= 10^{-5}* *Blank= 10^{-6}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Mephosfolan	PEST				3.3 N I	0.33 N	0.12 N	5.9 N	180 N I		
Mepiquat chloride	PEST				1100 N I	110 N	41 N	2000 N	61000 N I		
Mercuric chloride					11 N I	1.1 N	0.41 N	23 N I	610 N I		
Mercury (inorganic)			0.10	2	11 N	0.31 N	0.41 N	23 N	510 N	7 E	3 E
Mercury (methyl)					3.7 N I	0.37 N	0.14 N	20 N	200 N I		
Merphos	PEST				1.1 N	0.11 N	0.041 N	2.0 N	21 N		
Merphos oxide	PEST				1.1 N	0.11 N	0.041 N	2.0 N	20 N		
Metalaxyl	PEST				2200 N	220 N	81 N	3900 N	41000 N		
Methacrylonitrile	VOC				1.0 N	0.73 N	0.14 N	1.3 N	5.1 N		
Methamidophos	PEST				1.8 N	0.18 N	0.068 N	3.3 N	34 N		
Methanol	VOC				18000 N	1800 N	680 N	33000 N	SAT		
Methidathion	PEST				37 N	3.7 N	1.4 N	65 N	680 N		
Methomyl	PEST				910 N	91 N	34 N	1600 N	17000 N		
Methoxychlor	PEST			40	180 N	18 N	6.8 N	330 N	3400 N	41 S	62 E
2-Methoxyethanol acetate					73 N	7.3 N	2.7 N	130 N	1400 N		
2-Methoxyethanol					37 N	21 N	1.4 N	65 N	680 N		
2-Methoxy-5-nitroaniline					1.5 C	0.14 C	0.069 C	9.7 C	41 C		
Methyl acetate					6100 N	3700 N	1400 N	20000 N	84000 N		

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-4} C= 10^{-5} Blank= 10^{-6}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Industrial	Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Methyl acrylate 2-Methylaniline hydrochloride 2-Methylaniline					1100 N I 0.37 C 0.28 C	110 N 0.035 C 0.026 C	41 N 0.018 C 0.013 C	150 N 2.5 C 1.9 C	520 N 11 C 7.9 C		
Methyl chlorocarbonate 4-(2-Methyl-4-chlorophenoxy) butyric acid 2-Methyl-4-chlorophenoxyacetic acid	HERB HERB				37000 N 370 N 18 N	3700 N 37 N 1.8 N	1400 N 14 N 0.68 N	65000 N 650 N 33 N	SAT 6800 N 340 N		
2-(2-Methyl-1,4-chlorophenoxy)propionic acid Methylcyclohexane Methylene bromide	HERB				37 N 31000 N 61 N I	3.7 N 3100 N 37 N	1.4 N 14 N	65 N 56000 N 650 N	680 N SAT 6800 N	60 S	1500 N
Methylene chloride 4,4'-Methylene bis(2-chloroaniline) 4,4'-Methylenebisbenzeneamine	VOC				4.3 C 0.52 C 0.27 C	3.8 C 0.048 C 0.025 C	0.42 C 0.024 C 0.013 C	11 C 3.4 C 1.8 C	25 C 15 C 7.6 C	7 E	0.01 E
4,4'-Methylene bis(N,N'-dimethyl)aniline 4,4'-Methylenediphenyl isocyanate Methyl ethyl ketone		B2			1.5 C 0.035 N I 1900 N	0.14 C 0.021 N 1000 N	0.069 C 810 N	9.7 C 0.37 N 8700 N	41 C 3.9 N 34000 N		
Methyl hydrazine Methyl isobutyl ketone Methyl methacrylate	VOC				0.061 C 2900 N 2900 N	0.0057 C 84 N 290 N	0.0029 C 110 N 110 N	0.4 C 5200 N 5200 N	1.7 C 55000 N 55000 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level:* *A/B= 10^{-6}* *C= 10^{-5}* *Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
2-Methyl-5-nitroaniline	SVOC				2 C	0.19 C	0.096 C	13 C	58 C	28 S	0.041 N
Methyl parathion	SVOC				9.1 N	0.91 N	0.34 N	16 N	170 N	12000 S	6 E
2-Methylphenol (o-cresol)					1800 N	180 N	68 N	3300 N	34000 N		
3-Methylphenol (m-cresol)	SVOC				1800 N	180 N	68 N	3300 N	34000 N		
4-Methylphenol (p-cresol)	SVOC				180 N	18 N	6.8 N	330 N	3400 N	100 N	1 N
Methyl styrene (mixture)					60 N	42 N	8.1 N	220 N	1200 N		
Methyl styrene (alpha)					430 N	260 N	95 N	1800 N	8100 N	8.8 S	7.5 N
Methyl tertbutyl ether (MTBE)	VOC				180 N	3100 N	6.8 N	330 N	3400 N		
Metolaclor (Dual)	PEST				5500 N	550 N	200 N	9800 N	SAT		
Metribuzin	PEST				910 N	91 N	34 N	1600 N	17000 N		
Mirex	PEST				0.037 C	0.0035 C	0.0018 C	0.25 C	1.1 C		
Molinate	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
Molybdenum					180 N	18 N	6.8 N	380 N	8500 N		
Monochloramine					3700 N	370 N	140 N	6500 N	68000 N		
Naled	PEST				73 N	7.3 N	2.7 N	130 N	1400 N		
2-Naphthylamine	SVOC				0.00052 C I	0.00005 C	0.00002 C	0.005 C I	0.04 C I		
Napropamide	PEST				3700 N	370 N	140 N	6500 N	68000 N		
Nickel refinery dust		A				0.0075 C					

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation.)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Nickel and compounds Nickel subsulfide Nitrapyrin	PEST	A	16	100	730 N 55 N	73 N 0.0037 C 5.5 N	27 N 2 N	1500 N 98 N	34000 N 39000 C 1000 N	6900 E	21 E
Nitrate Nitric Oxide Nitrite				10000 1000	58000 N 3700 N 3700 N	5800 N 370 N 370 N	2200 N 140 N 140 N	SAT 6500 N 6500 N	SAT SAT SAT		
2-Nitroaniline 3-Nitroaniline 4-Nitroaniline	SVOC SVOC SVOC				2.2 N 110 N I 110 N I	0.21 N 11 N 11 N	0.081 N 4.1 N 4.1 N	3.9 N 230 N I 230 N I	41 N 6100 N I 6100 N I		
Nitrobenzene Nitrofurantoin Nitrofurazone	VOC				3.4 N I 2600 N 0.045 C	2.1 N 260 N 0.00067 C	0.68 N 95 N 0.0021 C	33 N 4600 N 0.3 C	340 N 48000 N 1.3 C	110 E	0.09 E
Nitrogen dioxide Nitroguanidine 4-Nitrophenol					37000 N I 3700 N 2300 N I	3700 N 370 N 230 N	1400 N 140 N 84 N	SAT 6500 N 4800 N I	SAT 68000 N SAT		
2-Nitropropane N-Nitrosodi-n-butylamine N-Nitrosodiethanolamine	VOC VOC	B2 B2			35 C 0.012 C 0.024 C	0.00067 C 0.0011 C 0.0022 C	0.00058 C 0.0011 C	0.08 C 0.2 C	0.4 C 0.7 C		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc./Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Len's* *Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
N-Nitrosodiethylamine	SVOC	B2			0.00045 C	0.00004 C	0.00002 C	0.003 C	0.01 C		
N-Nitrosodimethylamine	SVOC	B2			0.0013 C	0.00013 C	0.00006 C	0.009 C	0.04 C		
N-Nitrosodiphenylamine	SVOC	B2			14 C	1.3 C	0.64 C	91 C	390 C	29 C	0.2 E
N-Nitroso di-n-propylamine	SVOC				0.0096 C	0.00089 C	0.00045 C	0.06 C	0.3 C		
N-Nitroso-N-methylethylamine		B2			0.0031 C	0.00028 C	0.00014 C	0.02 C	0.09 C	0.014 C	0.00002 E
N-Nitrosopyrrolidine		B2			0.032 C	0.0029 C	0.0015 C	0.2 C	0.9 C		
m-Nitrotoluene					61 N I	37 N	14 N	650 N	6800 N	460 S	0.42 N
o-Nitrotoluene					61 N I	37 N	14 N	780 N I	20000 N I	460 S	0.42 N
p-Nitrotoluene					61 N I	37 N	14 N	650 N	6800 N	460 S	0.42 N
Norflurazon	PEST				1500 N I	150 N	54 N	31000 N I			
NuStar	PEST				26 N	2.6 N	0.95 N	46 N	480 N		
Octabromodiphenyl ether					110 N	11 N	4.1 N	200 N	2000 N		
Octahydro-1357-tetranitro-1357-tetrazocine					1800 N	180 N	68 N	3300 N	34000 N		
Octamethylpyrophosphoramide	SVOC				73 N	7.3 N	2.7 N	130 N	1400 N		
Oryzalin	PEST				1800 N	180 N	68 N	3300 N	34000 N		
Oxadiazon	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Oxamyl	PEST			200	910 N	91 N	34 N	1600 N	17000 N		
Oxyfluorfen	PEST				110 N	11 N	4.1 N	200 N	2000 N		

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					Risk-Based Screening Levels					*Soil Screening Level Transfers from Soil to:*	
Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc./Range (mg/kg)*	*Drinking Water (MCL's)*	*Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Paclobutrazol	PEST				470 N	47 N	18 N	850 N	8900 N		
Paraquat	PEST				160 N	16 N	6.1 N	290 N	3100 N	110 S	3.9 N
Parathion	PEST				220 N	22 N	8.1 N	390 N	4100 N		
Pebulate	PEST				1800 N	180 N	68 N	3300 N	34000 N		
Pendimethalin	PEST				1500 N	150 N	54 N	2600 N	27000 N		
Pentabromo-6-chloro cyclohexane					2.9 C	0.27 C	0.14 C	19 C	83 C		
Pentabromodiphenyl ether					73 N	7.3 N	2.7 N	130 N	1400 N		
Pentachlorobenzene					4.9 N I	2.9 N	1.1 N	52 N	550 N	570 N	48 N
Pentachloronitrobenzene	SVOC				0.041 C I	0.024 C	0.012 C	1.7 C	7.3 C		
Pentachlorophenol	PEST			1	0.56 C	0.052 C	0.026 C	2.5 C	7.9 C	7.9 C	0.2 E
Permethrin	PEST				1800 N	180 N	68 N	3300 N	34000 N		
Phenmedipham	PEST				9100 N	910 N	340 N	16000 N	SAT		
Phenol	SVOC				22000 N	2200 N	810 N	39000 N	SAT	21000 S	49 E
m-Phenylenediamine	SVOC				220 N	22 N	8.1 N	390 N	4100 N		
p-Phenylenediamine	SVOC				6900 N	690 N	260 N	12000 N	SAT		
Phenylmercuric acetate					2.9 N	0.29 N	0.11 N	5.2 N	55 N		
2-Phenylphenol					35 C	3.2 C	1.6 C	230 C	980 C		
Phorate	PEST				7.3 N	0.73 N	0.27 N	13 N	140 N		

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Industrial	Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Phosmet Phosphine Phosphoric acid	PEST				730 N 11 N 100 N I	73 N 0.31 N 10 N	27 N 0.41 N	1300 N 20 N	14000 N 200 N		
Phosphorus (white) p-Phthalic acid Phthalic anhydride	SVOC				0.73 N I 37000 N I 73000 N I	0.073 N 3700 N 130 N	0.027 N 1400 N 2700 N	1.6 N I SAT SAT	41 N I SAT SAT		
Picloram Pirimiphos-methyl Polybrominated biphenyls	PEST PEST				2600 N 370 N 0.0076 C	260 N 37 N 0.0007 C	95 N 14 N 0.00035 C	4600 N 650 N 0.05 C	48000 N 6800 N 0.2 C		
Polychlorinated biphenyls (PCBs) Aroclor 1016 Aroclor 1254	SVOC	B2		0.5	0.009 C 2.6 N 0.73 N	0.00081 C 0.26 N 0.073 N	0.00041 C 0.095 N 0.027 N	0.07 C 4.9 N 1.4 N	0.3 C 65 N 19 N		
Polychlorinated terphenyls (PCTs) Polynuclear aromatic hydrocarbons Acenaphthene	SVOC				0.015 C I 370 N	0.0014 C 220 N	0.0007 C 81 N	0.14 C I 360 S	1.3 C I 360 S	SAT 120 S	200 E
Anthracene Benz[a]anthracene Benzo[b]fluoranthene	SVOC SVOC SVOC	B2			1800 N 0.092 C 0.092 C	1100 N 0.01 C 0.01 C	410 N 0.0043 C 0.0043 C	19 S 0.6 C 0.6 C	19 S 2.6 C 2.6 C	6.1 S 27 S 23 S	4300 E 0.7 E 4 E

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
					Tap Water (Residential Scenario: Ingestion, & Inhalation)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*			
								Residential	*Industrial*	*Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Benzo[k]fluoranthene	SVOC	B2		0.2	0.92 C	0.1 C	0.043 C	6.1 C	26 C		4 E
Benzo[a]pyrene	SVOC	B2			0.0092 C	0.001 C	0.00043 C	0.06 C	0.3 C	11 S	4 E
Carbazole	SVOC				3.4 C I	0.31 C	0.16 C	32 C I	290 C I	11 S	0.5 E
Chrysene	SVOC				9.2 C	1 C	0.43 C	24 S	24 S	3.6 S	1 E
Dibenz[a,h]anthracene	SVOC				0.0092 C	0.001 C	0.00043 C	0.06 C	0.3 C	7.2 S	11 E
Fluoranthene	SVOC				1500 N	150 N	54 N	2600 N	27000 N	68 S	980 E
Fluorene	SVOC				240 N	150 N	54 N	300 S	300 S	89 S	160 E
Indeno[1,2,3-cd]pyrene	SVOC	B2			0.092 C	0.01 C	0.0043 C	0.6 C	2.6 C	280 S	35 E
Naphthalene	SVOC				240 N	150 N	54 N	800 S	800 S	180 S	30 E
Pyrene	SVOC				1100 N	110 N	41 N	2000 N	20000 N	56 S	1400 E
Prochloraz	PEST	C			4.5 C I	0.42 C	0.21 C	30 C	130 C		
Profluralin					220 N	22 N	8.1 N	390 N	4100 N		
Prometon	PEST				550 N	55 N	20 N	980 N	10000 N		
Prometryn	PEST				150 N	15 N	5.4 N	260 N	2700 N		
Pronamide	PEST				2700 N	270 N	100 N	4900 N	51000 N		
Propachlor	PEST				470 N	47 N	18 N	850 N	8900 N		
Propanil	PEST				180 N	18 N	6.8 N	330 N	3400 N		
Propargite	PEST				730 N	73 N	27 N	1300 N	14000 N		

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Industrial	Soil Screening Level Transfers from Soil to: Air	Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Propargyl alcohol	VOC				73 N	7.3 N	2.7 N	130 N	1400 N		
Propazine	PEST				730 N	73 N	27 N	1300 N	14000 N		
Propham	PEST				730 N	73 N	27 N	1300 N	14000 N		
Propiconazole	PEST				470 N	47 N	18 N	850 N	8900 N		
Propylene glycol					730000 N	73000 N	27000 N	SAT	SAT		
Propylene glycol, monoethyl ether					26000 N	2600 N	950 N	46000 N	SAT		
Propylene glycol, monomethyl ether		B2			26000 N	2100 N	950 N	46000 N	SAT		
Propylene oxide					0.22 C	0.49 C	0.013 C	2.7 C I	24 C I		
Pursuit	PEST				9100 N	910 N	340 N	16000 N	SAT		
Pydrin	PEST				910 N	91 N	34 N	1600 N	17000 N		
Pyridine	VOC				37 N	3.7 N	1.4 N	65 N	680 N		
Quinalphos	PEST				18 N	1.8 N	0.68 N	33 N	340 N		
Quinoline	PEST				0.0056 C	0.00052 C	0.00026 C	0.04 C	0.2 C		
Resmethrin	PEST				1100 N	110 N	41 N	2000 N	20000 N		
Ronnel					1800 N	180 N	68 N	3300 N	34000 N		
RDX (Cyclonite)		C			6.1 C	0.6 C		40 C	170 C		
Rotenone	PEST				150 N	15 N	5.4 N	260 N	2700 N		
Savey	PEST				910 N	91 N	34 N	1600 N	17000 N		
Selenious Acid					180 N	18 N	6.8 N	330 N	3400 N		

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc./Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Selenium Selenourea Sethoxydim	PEST		0.2	50	180 N 180 N 3300 N	18 N 18 N 330 N	6.8 N 6.8 N 120 N	380 N 330 N 5900 N	8500 N 3400 N 61000 N		3 E
Silver and compounds Simazine Sodium azide	PEST		0.01-5	4	180 N 0.6 C 150 N	18 N 0.052 C 15 N	6.8 N 0.026 C 5.4 N	380 N 3.7 C 260 N	8500 N 16 C 2700 N		
Sodium diethyldithiocarbamate Sodium fluoroacetate Sodium metavanadate	PEST				0.25 C 0.73 N 37 N	0.023 C 0.073 N 3.7 N	0.012 C 0.027 N 1.4 N	1.6 C 1.3 N 65 N	7.1 C 14 N 680 N		
Strontium, stable Strychnine Styrene	PEST VOC			100	22000 N 11 N 1600 N	2200 N 1.1 N 1000 N	810 N 0.41 N 270 N	46000 N 20 N 2200 S	SAT 200 N 2200 S	1400 E	2 E
Systhane 2,3,7,8-TCDD (dioxin) Tebuthiuron	PEST PEST			3E-08	910 N 4.5E-07 C 2600 N	91 N 5.4E-08 C 260 N	34 N 95 N	1600 N 3.8E-06 C 4600 N	17000 N 2.4E-05 C 48000 N		
Temephos Terbacil Terbufos	PEST PEST PEST				730 N 470 N 0.91 N	73 N 47 N 0.091 N	27 N 18 N 0.034 N	1300 N 850 N 1.6 N	14000 N 8900 N 17 N		

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					Risk-Based Screening Levels					Soil Screening Level Transfers from Soil to:	
Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Tap Water (Residential Scenario: Ingestion, & Inhalation)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes)		Air	Ground Water
								Residential	Industrial		
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Terbutryn 1,2,4,5-Tetrachlorobenzene 1,1,1,2-Tetrachloroethane	PEST SVOC VOC	C			37 N 11 N 4.3 C	3.7 N 11 N 2.4 C	1.4 N 0.41 N 1.2 C	65 N 20 N 48 C	680 N 200 N 120 C	91 N	0.69 N
1,1,2,2-Tetrachloroethane Tetrachloroethylene (PCE) 2,3,4,6-Tetrachlorophenol	VOC VOC SVOC	C		5	0.55 C 1.1 C 1100 N	0.31 C 3.1 C 110 N	0.16 C 0.061 C 41 N	9 C 7 C 2000 N	24 C 25 C 20000 N	0.4 E 11 E	0.001 E 0.04 E
p,a,a,a-Tetrachlorotoluene Tetrachlorovinphos Tetraethyldithiopyrophosphate	PEST PEST				0.00053 C I 2.8 C 18 N	0.00031 C 0.26 C 1.8 N	0.00016 C 0.13 C 0.68 N	0.02 C 19 C 33 N	0.1 C 79 C 340 N		
Tetraethyl lead 1,1,1,2-Tetrafluoroethane Thallic oxide					0.0037 N 140000 N I 2.6 N	0.00037 N 84000 N 0.26 N	0.00014 N 0.095 N	0.006 NI 5.4 N	0.07 N 120 N	0.00068 N	0.000034 N
Thallium Thallium acetate Thallium carbonate				20	3.3 N 2.9 N	0.33 N 0.29 N	0.12 N 0.11 N	6.9 N 6.1 N	150 N 140 N		0.4 E
Thallium chloride Thallium nitrate Thallium selenite					2.9 N 3.3 N 3.3 N	0.29 N 0.33 N 0.33 N	0.11 N 0.12 N 0.12 N	6.1 N 6.9 N 6.9 N	140 N 150 N 150 N		

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels* *Tap Water (Residential Scenario: Ingestion, & Inhalation,)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)* *Residential*	*Industrial*	*Soil Screening Level Transfers from Soil to:* *Air*	*Ground Water*
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
Thallium sulfate	PEST				2.9 N	0.29 N	0.11 N	6.1 N	140 N		
Thiobencarb					370 N	37 N	14 N	650 N	6800 N		
2-(Thiocyanomethylthio)-benzothiazole					1100 N	110 N	41 N	2000 N	20000 N		
Thiofanox	PEST				11 N	1.1 N	0.41 N	20 N	200 N		
Thiophanate-methyl	PEST				2900 N	290 N	110 N	5200 N	55000 N		
Thiram					180 N	18 N	6.8 N	330 N	3400 N		
Tin and compounds	VOC		122	1000	22000 N	2200 N	810 N	46000 N	SAT	520 E	5 E
Toluene					720 N	420 N	270 N	1900 N	2700 S		
Toluene-2,4-diamine					0.021 C	0.002 C	0.00099 C	0.1 C	0.6 C		
Toluene-2,5-diamine					22000 N	2200 N	810 N	39000 N	SAT		
Toluene-2,6-diamine					7300 N	730 N	270 N	13000 N	SAT		
p-Toluidine					0.35 C	0.033 C	0.017 C	2.3 C	10 C		
Toxaphene	PEST	B2		3	0.061 C	0.0056 C	0.0029 C	0.4 C	1.7 C	5 E	0.04 E
Tralomethrin	PEST				270 N	27 N	10 N	490 N	5100 N		
Triallate	PEST				470 N	47 N	18 N	850 N	8900 N		
Trisulfuron	PEST				370 N	37 N	14 N	650 N	6800 N		
1,2,4-Tribromobenzene					30 N I	18 N	6.8 N	330 N	3400 N		
Tributyltin oxide (TBTO)	PEST				1.1 N	0.11 N	0.041 N	2 N	20 N		

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Contaminant	*Chemical Group Name*	*Cancer Class Risk Level: M= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Drinking Water (MCL's)*	*Risk-Based Screening Levels*					*Soil Screening Level Transfers from Soil to:*	
					Tap Water (Residential Scenario: Ingestion, & Inhalation.)	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
2,4,6-Trichloroaniline hydrochloride					2.3 C	0.22 C	0.11 C	15 C	66 C		
2,4,6-Trichloroaniline					2.0 C	0.18 C	0.093 C	13 C	56 C		
1,2,4-Trichlorobenzene	VOC			70	190 N	210 N	14 N	620 N	5900 N	240 E	2 E
1,1,1-Trichloroethane	VOC			200	1300 N	1000 N	120 N	3200 N	3000 S	980 E	0.9 E
1,1,2-Trichloroethane	VOC			5	0.2 C	0.11 C	0.055 C	1.4 C	3.3 C	0.8 E	0.01 E
Trichloroethylene (TCE)	VOC			5	1.6 C	1 C	0.29 C	7.1 C	17 C	3 E	0.02 E
Trichlorofluoromethane	VOC				1300 N	730 N	410 N	710 N	2400 N	790 N	13 N
2,4,5-Trichlorophenol	SVOC				3700 N	370 N	140 N	6500 N	68000 N	8200 S	120 E
2,4,6-Trichlorophenol	SVOC	B2			6.1 C	0.57 C	0.29 C	40 C	170 C	150 C	0.06 E
2,4,5-Trichlorophenoxyacetic acid	PEST				370 N	37 N	14 N	650 N	6800 N		
2-(2,4,5-Trichlorophenoxy)propionic acid	PEST				290 N	29 N	11 N	520 N	5500 N		
1,1,2-Trichloropropane					30 N	18 N	6.8 N	51 N	190 N	13 N	0.14 N
1,2,3-Trichloropropane					0.0015 C I	0.00089 C	0.00045 C	0.007 C	0.02 C	0.00003 C	6.0E-06 C
1,2,3-Trichloropropene					31 N	18 N	6.8 N	75 N	290 N		
1,1,2-Trichloro-1,2,2- trifluoroethane					59000 N	31000 N	41000 N	3600 S	3600 S	2400 S	3100 N
Tridiphane	PEST				110 N	11 N	4.1 N	200 N	2000 N		
Triethylamine					12 N	7.3 N		22 N	80 N		
Trifluralin	PEST	C			87 C	8.1 C	4.1 C	580 C	2500 C		

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Contaminant	Chemical Group Name	Cancer Class Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}	Soil Regional Background Conc/Range (mg/kg)	Drinking Water (MCL's)	Risk-Based Screening Levels Tap Water (Residential Scenario: Ingestion, & Inhalation,)	Ambient Air (Residential Scenario)	Fish (Recreational Fishing Scenario)	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Residential	Soil (Ingestion, Inhalation, and Dermal Exposure Routes) Industrial	Soil Screening Level Transfers from Soil to: Air	Soil Screening Level Transfers from Soil to: Ground Water
				µg/L	µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1,2,4-Trimethylbenzene	VOC				300 N I	180 N	68 N	3900 N I	SAT	98 S	0.26 M
1,3,5-Trimethylbenzene	VOC				300 N I	180 N	68 N	3900 N I	SAT		
Trimethyl phosphate					1.8 C	0.17 C	0.085 C	12 C	52 C		
1,3,5-Trinitrobenzene	SVOC				1.8 N	0.18 N	0.068 N	3.3 N	34 N		
Trinitrophenylmethylnitramine					370 N	37 N	14 N	650 N	6800 N		
2,4,6-Trinitrotoluene		C			22 C	2.1 C	1.1 C	480 C	640 C		
Uranium (soluble salts)					110 N	11 N	4.1 N	230 N	5100 N		
Vanadium			66		260 N	26 N	9.5 N	540 N	12000 N		
Vanadium pentoxide					330 N	33 N	12 N	690 N	15000 N		
Vanadium sulfate					730 N	73 N	27 N	1500 N	34000 N		
Vernam	PEST				37 N	3.7 N	1.4 N	65 N	680 N		
Vinclozolin	PEST				910 N	91 N	34 N	1600 N	17000 N		
Vinyl acetate	VOC				37000 N	210 N	1400 N	65000 N	SAT	370 E	84 E
Vinyl bromide					5.2 N I	3.1 N				2 N	0.018 N
Vinyl chloride	VOC			2	0.02 C	0.021 C	0.0017 C	0.005 C	0.01 C	0.002 E	0.01 E
Warfarin	PEST				11 N	1.1 N	0.41 N	20N	200 N	0.046 N	1800 N
m-Xylene	VOC				1400 N	730 N	2700 N	980 S	980 S	950 S	240 M
o-Xylene	VOC				1400 N	730 N	2700 N	980 S	980 S	730 S	150 M

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Contaminant	*Chemical Group Name*	*Cancer Class* *Risk Level: A/B= 10^{-6} C= 10^{-5} Blank= 10^{-4}*	*Soil Regional Background Conc/Range (mg/kg)*	*Risk-Based Screening Levels*						*Soil Screening Level Transfers from Soil to:*	
				Drinking Water (MCL's)	*Tap Water (Residential Scenario: Ingestion, & Inhalation.)*	*Ambient Air (Residential Scenario)*	*Fish (Recreational Fishing Scenario)*	*Soil (Ingestion, Inhalation, and Dermal Exposure Routes)*		*Air*	*Ground Water*
								Residential	*Industrial*		
				µg/L	*µg/L*	*µg/m3*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*	*mg/kg*
p-Xylene Xylene (mixed) Zinc	VOC VOC		22-50	10000	520 N I 1400 N 11000 N	310 N 7300 N 1100 N	2700 N 410 N	980 S 980 S 23000 N	980 S 980 S SAT	1000 S 320 E	220 M 74 E 42000 E
Zinc phosphide Zineb	PEST PEST				11 N 1800 N	1.1 N 180 N	0.41 N 68 N	23 N 3300 N	510 N 34000 N		

REGION 6 DEVELOPMENT OF MINIMUM QUANTIFICATION LEVELS

INTRODUCTION

The development of water quality based permit limits to protect numeric criteria for toxics has focused attention on the analytical sensitivity used when these toxic parameters are measured. Currently, there is not a consistent benchmark to determine the sensitivity of chemical analyses. Analytical results are characterized by a number of different terms, including Method Detection Level, Instrument Detection Level, Practical Quantification Level and Minimum Levels. These "detection levels" convey different information about the analysis. Several EPA-approved methods are cited for most toxic parameters, with varying levels of sensitivity. The permitting authority must then deal with three questions. The parameter by which to judge sensitivity must be clearly defined. The level of analytical sensitivity required of the discharger when effluent data accompanies a permit application must be chosen. Further, a quantitation level to monitor compliance for permit limits below analytical levels must be established.

EPA's Office of Wastewater Enforcement and Compliance (OWEC) has formed a workgroup to address the issue of detection limits. The Office of Research and Development (ORD) is working to standardize detection and quantitation levels within and across environmental media. Region 6 undertook the study described below to provide an interim approach and set of quantitation values with which defensible permits could be written.

OBJECTIVE

The available statistics and terms were examined to select an analytical parameter or benchmark to judge sensitivity of chemical measurements. The next goal was to select a minimum level of sensitivity for each of the priority pollutants listed in 40 CFR 122 (Tables II and III). Then, EPA approved methods that could be expected to achieve these minimum levels were identified.

PROCEDURE

Selection of an Analytical Benchmark for Sensitivity

Analytical data is characterized by a number of different terms. A true detection limit connotes the lowest concentration that a given instrument can record. A quantitation limit is the lowest concentration that can be measured with known accuracy. The parameters evaluated by Region 6 were the Method Detection Level (MDL) defined by EPA at 40 CFR 136 Appendix B, Instrument Detection Level (IDL) defined by EPA Method 1620, the Limit of

Attachment 1

Detection (LOD) and Limit of Quantification (LOQ) described by the American Chemical Society[2] the Practical Quantification Level (PQL), and the Minimum Level (ML) defined by EPA in 40 CFR 136 "1600" Series. LOD and MDL are statistically derived from the results of replicate analyses. LOD, IDL, and MDL are described as approximately three times the standard deviation obtained from replicate measurements, and may be described as that value determined to be statistically significant from the measurement of a reagent blank. An IDL is determined from the analysis of a chemical in a reagent water matrix, and MDL may be determined in either reagent or sample matrix. LOQ and PQL are the products of an LOD or MDL and a constant factor and attempt to define a level of analyte that may be repeatedly measured. The ML is defined as the concentration in a sample equivalent to the concentration of the lowest point on the calibration curve.

The concept of a Minimum Level, or the lowest point on the calibration curve, was judged to be a true quantitation limit. The comparison of instream waste concentrations to criteria or effluent concentrations to permit limits are both quantitative exercises best done with a measured level of a pollutant rather than an indication of its presence. Region 6 has elected to define a minimum quantification level (MQL) as the lowest concentration at which a particular substance can be quantitatively measured. The most straightforward estimator of a minimum quantitation level currently available is the lowest concentration used in the calibration of a measurement system. This method of evaluating acceptable limits of quantification has been used by EPA in other cases, namely the development of the 1624 and 1625 organic analysis methods[3], the regulation of dioxin from pulp and paper mills[4], and the development of Organic Chemical effluent guidelines[5].

Establishing MQLs for Priority Pollutants

A literature review was made of analytical methods that have been characterized by a low calibration point or minimum level. These sources of information were used to arrive at appropriate low calibration points for the available analytical methods.

Volatile and Semivolatile Organics

The first step in the development of a water quality-based permit is to obtain the best analytical scan of the toxic priority pollutants that is reasonably available to the broad spectrum of dischargers. Gas chromatograph-mass spectroscopy (GC-MS) as detailed in 40 CFR 136 Methods 624 and 625 are appropriate and cost-effective methods to screen an effluent for the entire set of volatile and semivolatile priority pollutants. There were two sources of information that could be used to set appropriate low calibration points or MQLs for these methods. The Contract

Laboratory Program (CLP) administered under CERCLA contains a list of priority pollutants and associated Contract Required Quantitation Levels (CRQL)[6]. These quantitation levels were developed under the assumption that 624 and 625 GC-MS were used to perform analyses on the target compounds. Region 6 used the CRQL as the primary basis for establishing its own MQLs for organic pollutants. The Minimum Levels found in the federal regulations describing the similar GC-MS 1624 and 1625 methods were then used as a cross reference[3].

The CRQL was used to establish the MQL for sixty-seven of the eighty-four volatile and semivolatile pollutants. For sixty-five of these compounds, the CRQL and the ML were equal. The MQLs for the remaining seventeen pollutants were taken from the ML value. Some priority pollutants are not target compounds under the CERCLA program, these being acrolein, acrylonitrile, 2-chloroethyl vinyl ether, benzidine and 1,2 diphenlyhydrazine. The MLs for three halogenated aliphatic hydrocarbons, hexachloroethane, 2-nitrophenol, benzopyrylene, indenopyrene, dibenzoanthracene, and three nitrosoamines are higher than the CRQL by a factor of 2 to 5, although in the same order of magnitude. These higher MLs were used as the basis for the regional MQL in recognition of the difficulty in recovery and identification of these pollutants.

Pesticides

Gas chromatography is the most sensitive analytical method for pesticides, it is also relatively inexpensive and readily available. CRQLs have been established for pesticides, the required quantitation level assumes analyses the gas chromatography method as detailed in 40 CFR 136 Method 608. Region 6 chose to base the MQL on the CRQL for priority pollutant pesticides, with the exception of the pesticide chlordane. The regional Environmental Services Division Laboratory in Houston, Texas provided professional guidance in setting the MQL for chlordane at 0.2 ug/l. A CRQL has been established at .05 ug/l for pure alpha and gamma chlordane isomers. The pesticide listed as a priority pollutant and encountered in wastewaters is technical grade chlordane, which does not provide as strong and distinctive chromatographic response as the pure isomers and is more reliably quantified at this higher level.

Metals

Region 6 used the Contract Required Detection Level (CRDL) described for metals in CERCLA CLP[7] as the primary basis for MQLs. The EPA-approved methods for the measurement of priority pollutant metals include graphite furnace and flame atomic absorption spectrometry (AA) and inductively coupled plasma (ICP). Each of these methods has a different level of

sensitivity. The CRDLs reflect acceptable ICP analysis of some metals and the more sensitive graphite furnace measurement of the remainder of the set of priority metals.

The CRDL served as the basis for the MQL for four metals (Arsenic, Mercury, Selenium, and Thallium) and Cyanide and represents analysis by the most sensitive available technique. CRDLs were used to establish MQLs for Antimony, Tri- and Hexavalent Chromium, and Zinc at levels of sensitivity attainable by ICP analysis but sufficient to demonstrate compliance with water quality standards. The MQL for Beryllium was based on the CRDL attainable by ICP analysis. In that Beryllium is not regulated by the states in Region 6, more sensitive measurement of this pollutant is not currently necessary for water quality decisions.

The CRDL for Nickel is sufficient to protect water quality when discharges to freshwater are being evaluated and will be used as the value of the MQL in that scenario. However, the ambient marine criteria for Nickel are two orders of magnitude lower than the freshwater standards. To adequately assess nickel discharges to marine waters, a lower MQL predicating the use of graphite furnace analysis will be necessary. Region 6 selected an MQL for Nickel of 5 ug/l for use in marine discharges, based on the optimum concentration range described in EPA Method 249.2[9].

Similarly, the MQL for Cadmium, Lead and Silver were based on the optimum lower range described in the graphite furnace methods for these pollutants[9]. Silver is governed by a low water quality criteria, the MQL was set to reflect the most sensitive analyses available. The lower end of the optimum range for Lead was slightly higher than CRDL and was used to reflect the difficulty in overcoming background contamination of this metal. The optimum concentration range for Cadmium reflected a sensitivity protective of the water quality criteria for this metal and was used to set the MQL.

The CRDL has a direct relation to the low calibration standard for atomic absorption methods. The QA/QC control requirements[8] in the CLP state that one AA calibration standard must be at the CRDL for all metals except mercury. For mercury and for ICP measurements in which the lowest calibration point may not be directly related to quantitation, a demonstration of sensitivity may be made by measurement of a "check standard" equal to the CRDL. The measured value should be within ten per cent of the known concentration.

Attachment 1

Discharger-Specific Quantification Levels

The process of setting MQLs for the pollutants described above is a general approach , describing the minimum sensitivity that would be acceptable in evaluating discharges. The MQLs for organic pollutants have been set to evaluate scans of the entire list of priority pollutants by GC-MS. The measure of individual organic pollutants at trace levels may be made with greater sensitivity in many cases by a specific gas chromatography technique. This is, however, dependent on the pollutant and the matrix. If application information indicates that a specific pollutant regulated at a trace level is being discharged, appropriate evaluation will include a comparison of the sensitivity of GC-MS and GC tests for that specific pollutant and matrix. The most sensitive method may then be required for analysis. A matrix specific Method Detection level may be determined for the pollutant as described in 40 CFR 136 Appendix B. The MDL and LOD[2] being similar descriptors and both equivalent to three standard deviations about replicate measurements, a relationship between the MDL and the LOQ is drawn as follows:

LOD = 3 s.d.
LOQ = 10 s.d.
LOQ = 10/3 LOD
LOD = MDL

Minimum Quantitation Level= 3.3 MDL

Summary

EPA has embraced Minimum Levels (defined as the lowest calibration point) as a valid scientific and regulatory concept for establishing water quality-based limits in the Dioxin Permitting Strategy. A national workgroup has been formed to address the issue of permit limits below analytical quantification levels. A goal of this workgroup is to publish Minimum Levels reflecting matrix effects for all of the EPA-approved analytical methods for wastewater. Until this exercise is completed, the states and regions must have some benchmark of required analytical sensitivity.

Region 6 have developed MQLs in an effort to obtain reliable data with which to evaluate our universe of dischargers and protect water quality standards. In stipulating these calibration points to the permittee, we establish an easily identified baseline for quantitation on which the decision to impose a limit can be made.

References

1. USEPA, 1989. Method 1620: Metals by ICP and AA Spectroscopy
2. Analytical Chemistry, 1983. 55(14):2210-2218.
3. 40 CFR 136, Methods 1624 and 1625
4. USEPA, May 21, 1990"Strategy for the Regulation of Discharges of PHDDs and PHDFs from Pulp and Paper Mills to Waters of the United States"
5. USEPA, 1987. Development Document for Effluent Guidelines and Standards for the Organic Chemicals, Plastics and Synthetic Fibers Point Source Category, volumes 1 and 2 (EPA 440/1-87/009)
6. USEPA, 1991. Contract Laboratory Program Statement of Work for Organic Analysis (OLM 01.10.2-.8)
7. USEPA, 1991. Contract Laboratory Program Statement of Work for Inorganic Analysis (ILM02.0)
8. USEPA, 1991. Contract Laboratory Program Statement of Work for Inorganic Analysis, Exhibit E, Quality Assurnace/Quality Control Requirements
9. USEPA, 1983. Methods for Chemical Analysis of Water and Wastes
Methods 249.2, 239.2, 213.2, 272.2. (EPA-600/4-79-020)

Attachment 1

MINIMUM QUANTIFICATION LEVELS (MQLs)

	REQUIRED MQL (µg/L)	EPA METHOD
METALS AND CYANIDE		
Antimony (Total)[1]	60	200.7
Arsenic (Total)[1]	10	206.2
Beryllium (Total)[1]	5	200.7
Cadmium (Total)[2]	1	213.2
Chromium (Total)[1]	10	200.7
Chromium (3+)[1]	10	200.7
Chromium (6+)[1]	10	200.7
Copper (Total)[2]	10	220.2
Lead (Total)[2]	5	239.2
Mercury (Total)[1]	.2	245.1
Molybdenum (Total)[9]	30	200.7
Nickel (Total)[1]	[Freshwater] 40	200.7
Nickel (Total)[2]	[Marine] 5	249.2
Selenium (Total)[1]	5	270.2
Silver (Total)[2]	2	272.2
Thallium (Total)[1]	10	279.2
Zinc (Total[1]	20	200.7
Cyanide (Total)[1]	10	335.2
DIOXIN		
2,3,7,8-Tetrachloro-dibenzo-p-dioxin (TCDD)[3]	.00001	1613
VOLATILE COMPOUNDS		
Acrolein[4]	50	624
Acrylonitrile[4]	50	624
Benzene[4]	10	624
Bromoform[5]	10	624
Carbon Tetrachloride[5]	10	624
Chlorobenzene[5]	10	624
Chlorodibromomethane[5]	10	624
Chloroethane[6]	50	624
2-Chloroethyl vinyl ether[4]	10	624
Chloroform[5]	10	624
Dichlorobromomethane[5]	10	624
1,1-Dichloroethane[5]	10	624
1,2-Dichloroethane[5]	10	624
1,1-Dichloroethylene[5]	10	624
1,2-Dichloropropane[5]	10	624
1,3-Dichloropropylene[5]	10	624
Ethylbenzene[5]	10	624

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Methyl Bromide [Bromomethane][6]	50	624
Methyl Chloride [Chloromethane][6]	50	624
Methylene Chloride[5]	20	624
1,1,2,2-Tetrachloroethane[5]	10	624
Tetrachloroethylene[5]	10	624
Toluene[5]	10	624
1,2-trans-Dichloroethylene[5]	10	624
1,1,1-Trichloroethane[5]	10	624
1,1,2-Trichloroethane[5]	10	624
Trichloroethylene[5]	10	624
Vinyl Chloride[5]	10	624
ACID COMPOUNDS		
2-Chlorophenol[5]	10	625
2,4-Dichlorophenol[5]	10	625
2,4-Dimethylphenol[7]	10	625
4,6-Dinitro-o-Cresol [2 methyl 4,6-dinitrophenol[8]	50	625
2,4-Dinitrophenol[5]	50	625
2-Nitrophenol[6]	20	625
4-Nitrophenol[5]	50	625
p-Chloro-m-Cresol [4 chloro-3-methylphenol][5]	10	625
Pentachlorophenol[5]	50	625
Phenol[5]	10	625
2,4,6-Trichlorophenol[5]	10	625
BASE/NEUTRAL COMPOUNDS		
Acenaphthene[5]	10	625
Acenaphthylene[5]	10	625
Anthracene[5]	10	625
Benzidine[4]	50	625
Benzo(a)anthracene[5]	10	625
Benzo(a)pyrene[5]	10	625
3,4-Benzofluoranthene[5]	10	625
Benzo(ghi)perylene[6]	20	625
Benzo(k)fluoranthene[5]	10	625
Bis(2-chloroethoxy) methane[5]	10	625
Bis(2-chloroethyl) ether[5]	10	625
Bis(2-chloroisopropyl) ether[5]	10	625
Bis(2-ethylhexyl) phthalate[5]	10	625
4-Bromophenyl phenyl ether[5]	10	625
Butyl benzyl phthalate[5]	10	625

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2-Chloronapthalene[5]	10	625
4-Chlorophenyl phenyl ether[5]	10	625
Chrysene[5]	10	625
Dibenzo (a,h) anthracene[6]	20	625
1,2-Dichlorobenzene[5]	10	625
1,3-Dichlorobenzene[5]	10	625
1,4-Dichlorobenzene[5]	10	625
3,3'-Dichlorobenzidine[6]	50	625
Diethyl Phthalate[5]	10	625
Dimethyl Phthalate[5]	10	625
Di-n-Butyl Phthalate[5]	10	625
2,4-Dinitrotoluene[5]	10	625
2,6-Dinitrotoluene[5]	10	625
Di-n-octyl Phthalate[5]	10	625
1,2-Diphenylhydrazine[4]	20	625
Fluoranthene[5]	10	625
Fluorene[5]	10	625
Hexachlorobenzene[5]	10	625
Hexachlorobutadiene[5]	10	625
Hexachlorocyclopentadiene[5]	10	625
Hexachloroethane[6]	20	625
Indeno (1,2,3-cd) pyrene[6] (2,3-o-phenylene pyrene)	20	625
Isophorone[5]	10	625
Naphthalene[5]	10	625
Nitrobenzene[5]	10	625
N-nitrosodimethylamine[6]	50	625
N-nitrosodi-n-propylamine[6]	20	625
N-nitrosodiphenylamine[6]	20	625
Phenanthrene[5]	10	625
Pyrene[5]	10	625
1,2,4-Trichlorobenzene[5]	10	625
PESTICIDES		
Aldrin[7]	.05	608
Alpha-BHC[7]	.05	608
Beta-BHC[7]	.05	608
Gamma-BHC (Lindane)[7]	.05	608
Delta-BHC[7]	.05	608
Chlordane[7]	.2	608
4,4'-DDT[7]	.1	608
4,4'-DDE (p,p-DDX)[7]	.1	608
4,4'-DDD (p,p-TDE)[7]	.1	608

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Dieldrin[7]	.1	608
Alpha-endosulfan[7]	.1	608
Beta-endosulfan[7]	.1	608
Endosulfan sulfate[7]	.1	608
Endrin[7]	.1	608
Endrin aldehyde[7]	.1	608
Heptachlor[7]	.05	608
Heptachlor epoxide[7] (BHC-hexachlorocyclohexane)	.05	608
PCB-1242[7]	1.0	608
PCB-1254	1.0	608
PCB-1221	1.0	608
PCB-1232	1.0	608
PCB-1248	1.0	608
PCB-1260	1.0	608
PCB-1016	1.0	608
Toxaphene[7]	5.0	608

1 CRDL
2 Method 213.2, 239.2, 220.2, 272.2
3 Dioxin National Strategy
4 No CRQL established
5 CRQL basis, equivalent to ML
6 ML basis, higher than CRQL
7 CRQL basis, no ML established
8 CRQL basis, higher than ML
9 Based on 3.3 times IDL published in 40 CFR Part 136, Appeddix C

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