TA16

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: February 23, 2007
Refer To: ENV-RCRA: 07-033

Ms. Pam Allen
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

SUBJECT: TRANSMITTAL OF REQUESTED ELECTRONIC FILE OF THE LOS ALAMOS NATIONAL LABORATORY (LANL) TECHNICAL AREA (TA) 16 BURN TRAY CLOSURE PLAN

Dear Ms. Allen:

This letter transmits an electronic copy of the "Closure Plan for the TA-16-394 Burn Tray, Rev. 1," LA-UR-99-6216, February 2001. This document was requested by you in a phone conversation February 22, 2007. The compact disc attached contains the requested document in Adobe Acrobat (.pdf) format file only. At this time, we do not have a version available in a word processing format (ex., doc). After scanning, the text within the .pdf format file was processed through an optical character recognition program so that text can be selected and copied for pasting into a word processing format. There are no current plans to recreate the word processing files associated with this document.

Please contact Jack Ellvinger, Environmental Protection Division, at 667-0633 if you any questions.

Sincerely,

A. R. Grieggs

Anthony R. Grieggs
Group Leader
Water Quality & RCRA Group

RECEIVED
MAR 2007
NMED Hazardous Waste Bureau

ARG:LVH/lm

Enclosures: a/s

Cy: John Kieling, NMED/HWB, Santa Fe, NM, w/enc.
Richard V. Bynum, PADOPS, w/o enc., MS A102
Richard S. Watkins, ADESHQ, w/o enc., MS K491
Jack Ellvinger, ENV-RCRA, w/o enc., MS K490
ENV-RCRA, File, w/enc., MS K490
IRM-RMMSO, w/enc., MS A150

LA-UR-99-6216
February 2001

Closure Plan for the TA-16-394 Burn Tray, Rev. 1

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

LA-UR-99-6216
February 2001

Closure Plan for the TA-16-394 Burn Tray, Rev. 1

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the Regents of the University of California, the United States Government nor any agency thereof, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the Regents of the University of California, the United States Government, or any agency thereof.

Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness. By acceptance of this article, the publisher recognizes that the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy.

CONTENTS

1.0 INTRODUCTION 1

1.1 Purpose and Scope 1
1.2 Structure Description 1
1.3 Rationale for Closure and Corrective Action 6

2.0 GENERAL CLOSURE INFORMATION [20 NMAC 4.1, SUBPART VI, §265, SUBPART G] 6

2.1 Closure Performance Standard [20 NMAC 4.1, SUBPART VI, §265.111] 6
2.2 Partial and Final Closure [20 NMAC 4.1, Subpart VI, §265.112(d)] 7
2.3 Closure Schedule [20 NMAC 4.1, Subpart VI, §265.112(d)(2) and §265.113] 7
2.4 Amendment of the Closure Plan [20 NMAC 4.1, Subpart VI, §265.112(c)] 7
2.5 Closure Cost Estimate, Financial Assurance, and Liability Requirements [20 NMAC 4.1, Subpart VI, §265.140(c)] 8
2.6 Closure Certification [20 NMAC 4.1, Subpart VI, §265.115] 8
2.7 Security 8
2.8 Closure Report 8
2.9 Survey Plat and Post-closure Requirements [20 NMAC 4.1, Subpart VI, §265.116, §§265.117 through 265.120] 9

3.0 CLOSURE OF THE TA-16-394 BURN TRAY [20 NMAC 4.1, SUBPART 4.1, §265.112(B)] 9

3.1 Description of Waste and Estimate of Maximum Inventory of Hazardous Waste 9
3.2 Closure Procedures 10
3.2.2 Phase II Activities 11

4.0 REFERENCES 16

List of Figures

Figure 1.2-1. Location of TA-16 2
Figure 1.2-2. Site map of TA-16 showing the location of the TA-16 Burn Ground and TA-16-394 3
Figure 1.2-3. Schematic of the TA-16-394 burn tray 4
Figure 1.2-4. Location of TA-16-394 burn tray with respect to other corrective action sites and hazardous waste treatment structures at the TA-16 Burn Ground (inset shows sampling locations for the TA-16-394 burn tray) 5

List of Tables

Table 3.2-1. Constituents and Their Associated MSSLs 11

1.0 INTRODUCTION

1.1 Purpose and Scope

This closure plan describes the activities necessary to close the TA-16-394 burn tray, hereinafter referred to as *the burn tray,* a hazardous waste treatment structure regulated by the New Mexico Adminiatrative Code, Title 20, Chapter 4, Part 1, revised January 1, 1997 (20 NMAC 4.1), Subpart VI. The burn tray is located at Los Alamos National Laboratory (LANL), which is owned by the Department of Energy (DOE) and managed by the University of California (UC). Burn tray treatment operations have been re-located to the TA-16-388 burn structure, which has been approved for use by the New Mexico Environment Department (NMED) (NMED 1999, 63422). Because it is no longer needed for treatment of hazardous waste, LANL intends to close the burn tray. Submission of this closure plan serves as notification to the NMED of LANL's intent to close the burn tray pursuant to 20 NMAC 4.1, Subpart VI, §265.112(d).

The activities described in this closure plan are intended to meet the closure requirements of 20 NMAC 4.1, Subpart VI, §265, Subparts G and P, revised January 1, 1997 (1-1-97). The procedures described, and the information provided herein, supplement and modify the general closure procedures described in Section 9.0 (Closure Plan) of LANL's "RCRA Part B Permit Application for Technical Area 16, Building 88, Container Storage Area; Flash Pads 387 and 388, Open Burn Units; Burn Pads 388 and 399, Open Burn Units; Burn Trays 388 and 394, Open Burn Units; Filter Vessels 401 and 406, Open Burn Units" (LANL 1996, 63560.1.1), hereinafter referred to as *the Part B Permit Application for TA-16.* Closure of the burn tray will minimize the need for further maintenance, preclude future release of hazardous waste or hazardous constituents to environmental media, and protect human health and the environment.

1.2 Structure Description

The burn tray is an open burning structure located at Technical Area 16 (TA-16), within an area referred to as *theTA-16 Burn Ground.* Figure 1.2-1 shows the location of TA-16 at LANL; Figure 1.2-2 shows the location of this burn ground at TA-16. The open burn structure consists of two elevated welded steel trays (8-in. high) located within a secondary containment structure. The secondary containment structure is constructed of concrete and contains gravel and sand. Firebricks line the sides of the structure (see Figure 1.2-3). The structure was originally a filter bed that received HE-contaminated wash water from the basket wash facility: TA-16-390. Filtered wash water collected within perforated piping along the bottom of the concrete structure and gravity-drained through a pipe to an adjacent outfall area southeast of the bed. The basket wash facility and the filter bed operated from 1951 to 1966. The filter bed is identified as potential release site (PRS) 16-010(j) in the SWMU report for TA-16 (LANL 1990, 07512.1) and is listed in Table A of the Hazardous and Solid Waste Amendments (HSWA) Module of LANL's Hazardous Waste Facility Permit.

In October 1990, the inactive filter bed was converted to the burn tray, a hazardous waste treatment structure, and included in the "Los Alamos National Laboratory General Part A Permit Application" (LANL 1998, 63498). It has operated pursuant to 20 NMAC 4.1, Subpart VI and to New Mexico air quality regulation 20 NMAC 2.60. In 1997, LANL received a five-year open burn permit from NMED's Air Quality Bureau (AQB) (see AQB-97-214).

The burn tray was used to burn HE-contaminated oils, solvents, and water mixed with oils and solvents, as described in Section 3.1. Once these materials were poured into the tray, several hundred pounds of wood were then stacked under and around the tray and ignited remotely. Residues from burning were appropriately characterized and managed as either RCRA hazardous waste or "New Mexico Special Waste." Additional information regarding operation of the burn tray, including operations and waste management practices, can be found in the Part B Permit Application for TA-16 (LANL 1996, 63560.1).

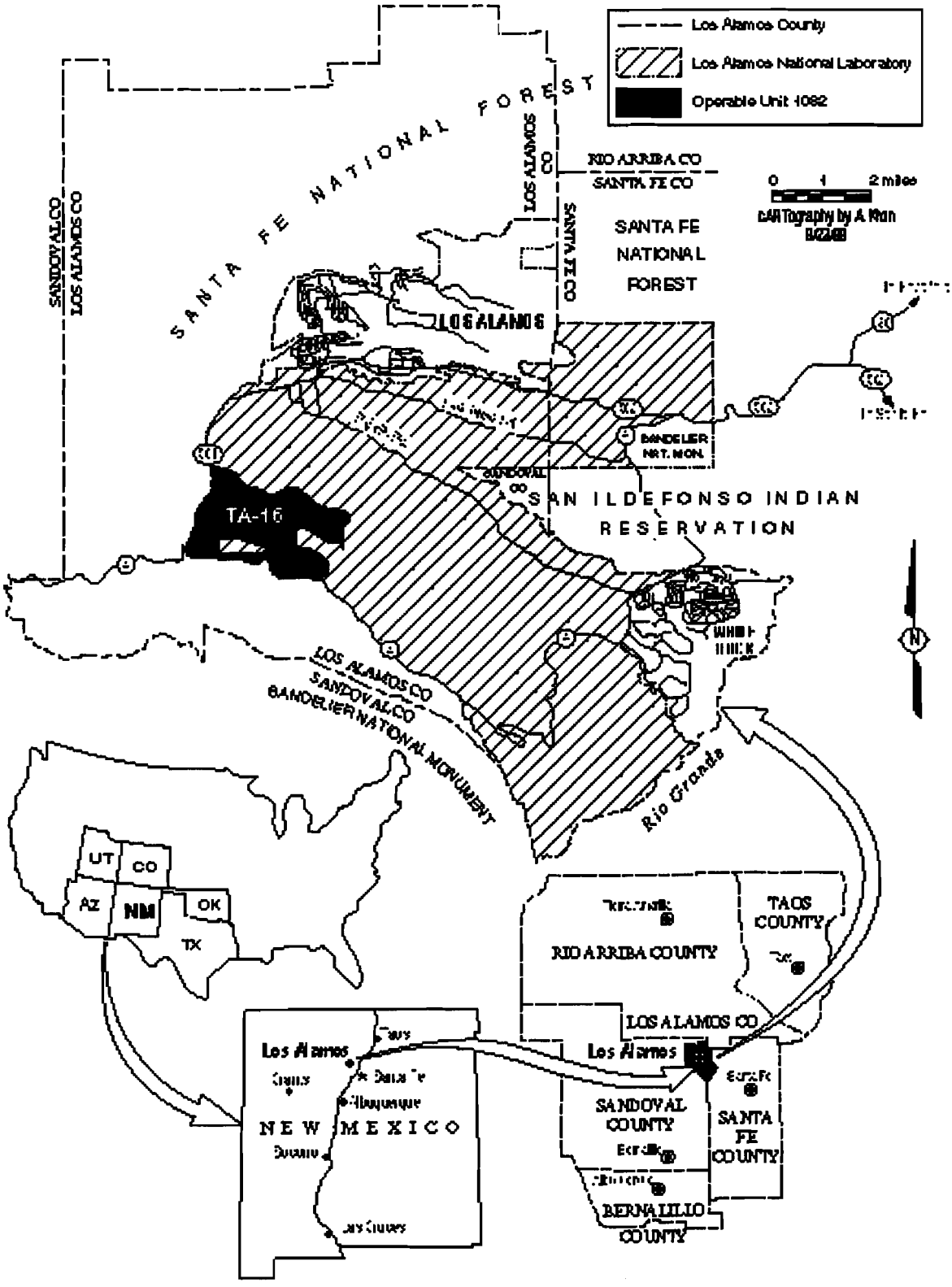

Figure 1.2-1. Location of TA-16

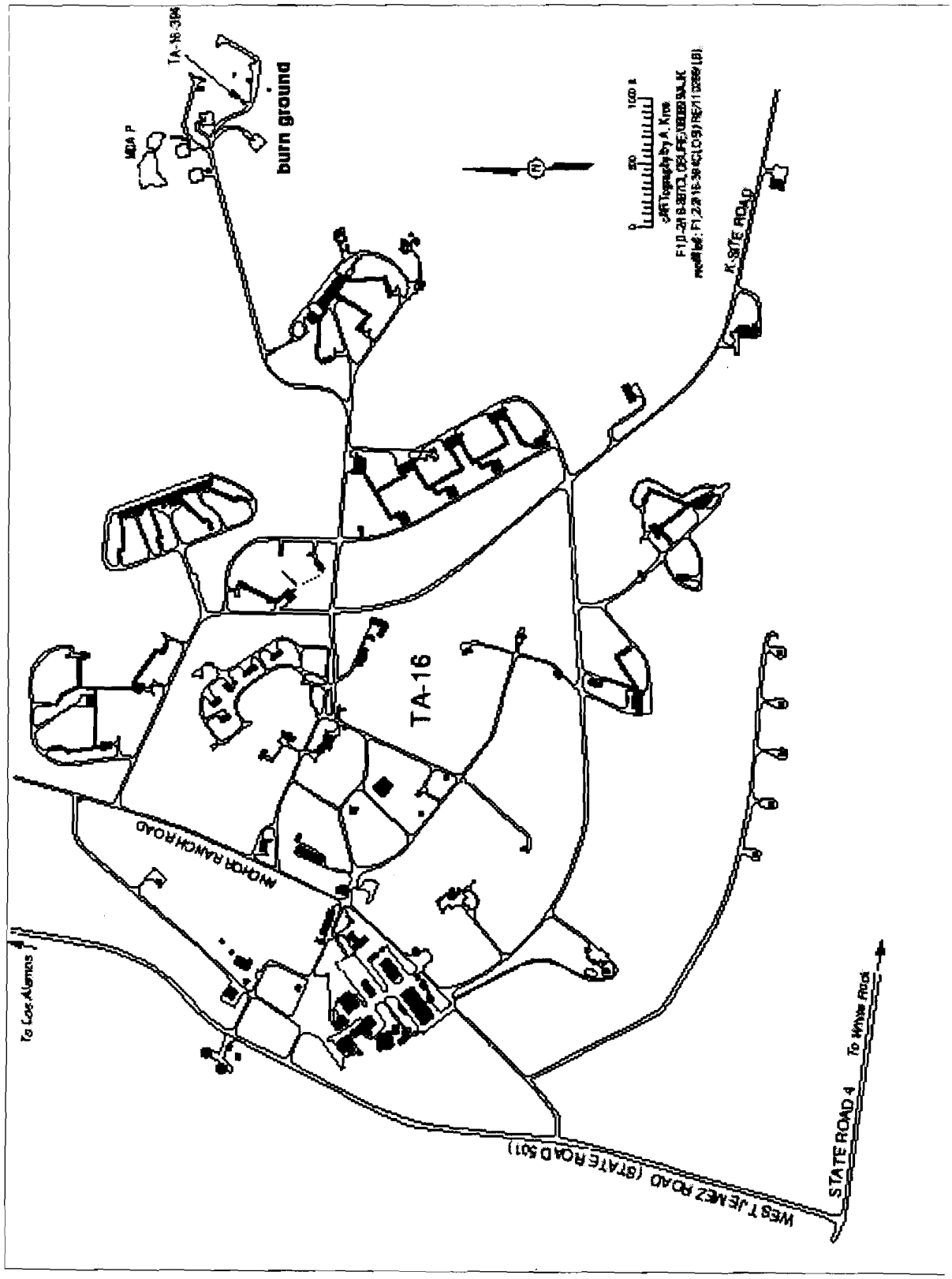

Figure 1.2-2. Site map of TA-16 showing the location of the TA-16 Burn Ground and TA-16-394

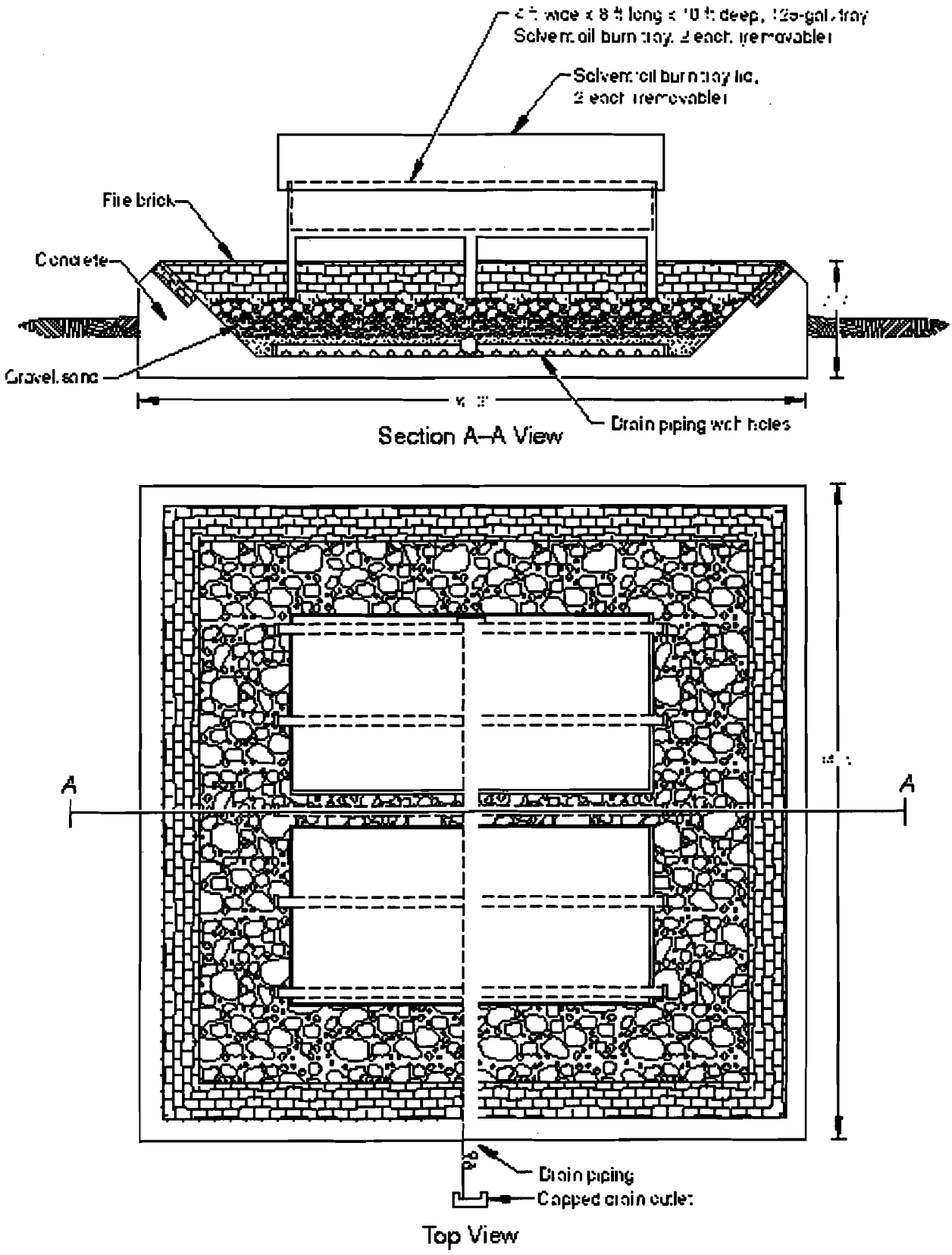

Figure 1.2-3. Schematic of the TA-16-394 burn tray

In addition to the filter bed [PRS 16-010(j)], nine HSWA corrective action sites as well as three hazardous waste treatment structures are located in the immediate vicinity of the burn tray (see Figure 1.2-4). Eight of the nine HSWA corrective action sites are associated with the basket wash facility and are identified as PRSs 16-010(e, f, h, i, k, l, m, and n); these PRSs are listed in Table A of the HSWA Module of LANL's Hazardous Waste Facility Permit. One corrective action site not associated with the basket wash facility is burn pad PRS 16-010(d). This PRS is listed in Table A of the HSWA Module of LANL's Hazardous Waste Facility Permit and is also identified as hazardous waste treatment structure TA-16-399. The other hazardous waste treatment structures located in the immediate vicinity of the burn tray are filter vessels TA-16-401 and TA-16-406, which were constructed at the same locations as filter beds PRSs 16-010(e and f), respectively. These two filter beds were constructed and operated similar to filter bed PRS 16-010(j). Once the two filter beds were removed, filter vessels TA-16-401 and TA-16-406 were constructed at the same locations at PRSs 16-010(e and f), respectively. Detailed descriptions of all of the PRSs discussed above are found in Chapters 5 and 6 of the RFI Work Plan for Operable Unit 1082 (LANL 1993, 20948.1). The "Los Alamos National Laboratory General Part A Permit Application" (LANL 1998, 63498) and the Part B Permit Application for TA-16 (LANL 1996, 63560.1) contain detailed descriptions of the hazardous waste treatment structures located in the immediate vicinity of the burn tray.

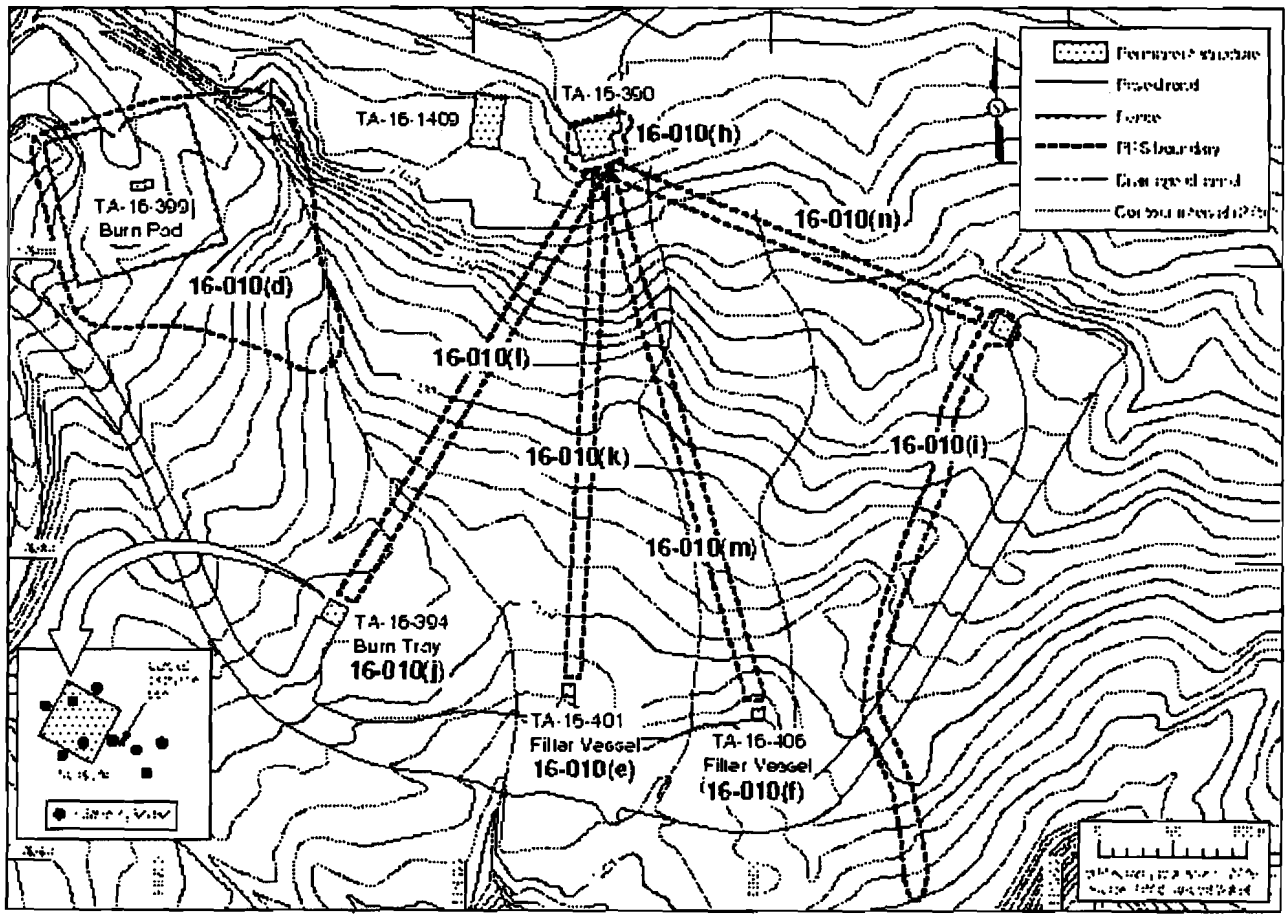

Figure 1.2-4. Location of TA-16-394 burn tray with respect to other corrective action sites and hazardous waste treatment structures at the TA-16 Burn Ground (inset shows sampling locations for the TA-16-394 burn tray)

The PRSs associated with the basket wash facility have been consolidated into one site, consolidated PRS 16-010(c)-99 (LANL 1999, 63175.1 and 63175.2). These individual PRS have been consolidated into one because they are located in the same geographic proximity, related by a single process/system, and have similar types of contamination exhibiting similar transport mechanisms and pathways. Additionally, the potential contamination present at each of the individual sites may also be present within the area encompassing all of these sites. The consolidated PRS will be investigated, characterized, assessed (including human health and ecological assessments), and potentially remediated as part of future corrective action activities at the TA-16 Burn Ground.

1.3 Rationale for Closure and Corrective Action

The burn tray closure approach has two phases. Phase I involves the removal of all structures associated with the burn tray (steel trays, sand and gravel, firebrick, piping, and concrete containment structure). Phase II involves taking samples and analyzing them to (1) determine whether the material (soil/tuff) surrounding and underlying the former burn tray and at the outfall area requires cleanup, and (2) verify that the closure performance standards have been met.

Analytical results from samples collected adjacent to, and beneath, the (removed) burn tray structure and from the outfall discharge area will be used to determine whether soil/tuff removal is necessary. If soil/tuff removal is necessary, excavation will be limited to those areas immediately surrounding the removed burn tray structure and outfall pipe that are most likely to have been affected by burn tray operations. Excavation of adjacent soil/tuff (if necessary) will extend no further than 5 ft around the footprint (laterally and vertically) of the removed burn tray structure and associated outfall pipe. Any contamination remaining after these excavation activities will be addressed as part of future corrective action activities (investigation, characterization, assessments, and/or remediation) for consolidated PRS 16-010(c)-99. Future corrective action activities will determine (1) ifany residual contamination associated with consolidated PRS 16-010(c)-99 [which includes filter bed PRS 16-010(j)] remains in the environment, and (2) if any such residual contamination poses an unacceptable risk to human health and the environment.

General closure information related to the burn tray is provided in Section 2.0 of this plan. Phase I and Phase II activities, as well as decontamination activities specific to the burn tray, are presented in Section 3.0 of this plan.

2.0 GENERAL CLOSURE INFORMATION [20 NMAC 4.1, SUBPART VI, §265, SUBPART G]

This section was prepared in accordance with the requirements of 20 NMAC 4.1, Subpart VI, §265, Subparts G and P, as applicable. Until closure is complete and has been certified in accordance with 20 NMAC 4.1, Subpart VI, §265.115 [1-1-97], a copy of the approved closure plan and any approved revisions will be on file at LANL's Hazardous and Solid Waste Group (Environment, Safety, and Health Division, Group 19, or ESH-19) and at the DOE Los Alamos Area Office (LAAO).

2.1 Closure Performance Standard [20 NMAC 4.1, SUBPART VI, §265.111]

The burn tray will be closed to meet the following performance standards:

- to minimize the need for further maintenance;
- to control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, contaminated

runoff, or hazardous waste decomposition products to the ground or surface waters or atmosphere; and

- to comply with 20 NMAC 4.1, Subpart VI, §265.381 [1-1-97], for thermal treatment structures during the closure of the burn tray.

These standards will be met by performing the closure activities (as outlined in Section 3.0) of removing the burn tray structure and the potentially contaminated surrounding and underlying material. Treatment of the burn tray, concrete structure, and brick material will be conducted prior to disposal and/or recycling. Confirmation sampling will be performed to ensure that the closure performance standards have been achieved. All equipment and structures associated with closure operations will be decontaminated, recycled, or disposed of as part of closure activities. Closure will be considered complete when the closure performance standards have been met, closure certification has been submitted to the Secretary of the NMED, (see Section 2.6) and NMED has approved the closure.

2.2 Partial and Final Closure [20 NMAC 4.1, Subpart VI, §265.112(d)]

This closure plan has been written with implementation of partial closure (referred to as *closure* within this plan) in mind, rather than the closure of the entire LANL facility. For these purposes, closure will consist of closing the burn tray while leaving other RCRA-regulated waste-management structures at the TA-16 Burn Ground and at LANL in service. Final closure will occur when LANL's remaining RCRA-regulated hazardous waste–management structures and units have been closed.

2.3 Closure Schedule [20 NMAC 4.1, Subpart VI, §265.112(d)(2) and §265.113]

Once NMED approves the closure plan, closure activities will begin, according to the requirements of 20 NMAC 4.1, Subpart VI, §265.112(d)(2) [1-1-97]. Activities will follow the estimated schedule presented in Attachment A. All hazardous wastes will be removed from the structure within 90 days of closure plan approval, and closure activities and reporting requirements will then be completed within 180 days of closure plan approval, as required by 20 NMAC 4.1, Subpart VI, §265.113(a) and (b) [1-1-97]. In the event that closure is prevented from proceeding according to schedule, LANL will notify the Secretary of the NMED in accordance with the extension request requirements of 20 NMAC 4.1, Subpart VI, §265.113(b) [1-1-97]. In addition, the demonstrations in 20 NMAC 4.1, Subpart VI, §265.113(a)(1) and (b)(1) [1-1-97] will be made in accordance with 20 NMAC 4.1, Subpart VI, §265.113(c) [1-1-97].

2.4 Amendment of the Closure Plan [20 NMAC 4.1, Subpart VI, §265.112(c)]

In accordance with 20 NMAC 4.1, Subpart VI, §265.112(c) [1-1-97], LANL will submit a written request to NMED for authorizing a change in the approved closure plan whenever

- there are changes in operating plans or facility design that affect the closure plan,
- there is a change in the expected year of closure, or
- unexpected events occur during closure that require modification of the approved closure plan.

LANL will submit the written request, along with a copy of the amended closure plan, to the Secretary of the NMED for approval. Submittal of the request will occur at least 60 days prior to the proposed change in structure design or operation, and no later than 60 days after an occurrence of an unexpected event that affects the closure plan. If the unexpected event occurs during the closure, the request will be submitted

within 30 days of the occurrence. If the Secretary of the NMED requests a modification of the closure plan, a plan modification (in accordance with the request) will be submitted within 60 days of notification or within 30 days of notification if a change in facility condition occurs during the closure process.

2.5 Closure Cost Estimate, Financial Assurance, and Liability Requirements [20 NMAC 4.1, Subpart VI, §265.140(c)]

In accordance with 20 NMAC 4.1, Subpart VI, §265.140(c), LANL, as a federal facility operated by a state entity, is exempt from the requirements of 20 NMAC 4.1, Subpart VI, §265.140(c), Subpart H [1-1-97], which is to provide a cost estimate, financial assurance mechanisms, and liability insurance for closure actions.

2.6 Closure Certification [20 NMAC 4.1, Subpart VI, §265.115]

Within 60 days after completing closure activities for the burn tray, LANL will submit to the Secretary of the NMED (via certified mail) a certification that the structure has been closed in accordance with the specifications of the approved closure plan. The certification will be attested to by an independent registered professional engineer and will be signed by the appropriate DOE and UC officials, in accordance with 20 NMAC 4.1, Subpart VI, §265.115 [1-1-97]. Documentation that supports the independent registered professional engineer's certification will be furnished to the Secretary of the NMED, along with the original closure certification. Both DOE-LAAO and ESH-19 will maintain copies of the certification and supporting documentation.

2.7 Security

According to the 1995 update to the LANL Site Development Plan (LANL 1995, 57224.1) the future land use for TA-16 will be continued HE operations and testing. Because of the ongoing nature of these activities at TA-16, including waste-management operations, the site will remain under the care of DOE or another authorized federal agency. Consequently, fences and site security will be maintained for as long as necessary to prohibit public access and to meet DOE requirements for protection of the public.

2.8 Closure Report

Upon completion of closure activities for the burn tray, a closure report will be prepared and submitted to the Secretary of the NMED. The report will document the closure and contain the following items:

- the certification described in Section 2.6,
- any variance from the approved closure activities and the reason for the variance,
- a summary of all sampling and analytical results, showing
  - the sample identification,
  - the sample location,
  - the datum reported,
  - the detection limit for each datum,
  - a measure of analytical precision (e.g., uncertainty, range, variance),

  - identification of analytical procedure, and
  - identification of analytical laboratory
- a quality assurance (QA)/quality control(QC) statement on analytical data validation
- an assessment of the data (as outlined within Section 3)
- the storage or disposal location of the regulated hazardous waste that resulted from closure activities
- a certification of the report's accuracy

2.9 Survey Plat and Post-closure Requirements [20 NMAC 4.1, Subpart VI, §265.116, §§265.117 through 265.120]

As part of closure activities at the burn tray, LANL intends to remove, treat, and dispose of (or recycle) the TA-16-394 burn tray, the concrete structure, the brick material, and any environmental media within 5 ft around and/or beneath the structure that exceeds the screening levels outlined in Section 3.2.2. Additionally, LANL intends to decontaminate all the equipment used during closure activities; any equipment that remains contaminated after the decontamination will be properly disposed of. No temporary structures will be constructed/used at the site. Additionally, any remaining residual contamination will be addressed as part of future TA-16 Burn Ground corrective action activities, which include investigation, characterization, assessments, and potential remediation. Therefore, the requirements for a survey plat, post-closure certification, and post-closure notices are not applicable to the closure of this burn tray.

3.0 CLOSURE OF THE TA-16-394 BURN TRAY [20 NMAC 4.1, SUBPART 4.1, §265.112(b)]

3.1 Description of Waste and Estimate of Maximum Inventory of Hazardous Waste

At LANL, HE wastes and HE-contaminated wastes are generated primarily at TA-9 and TA-16 from HE research and development (R&D), HE production, and decontamination and decommissioning (D&D) activities. These waste streams include homogeneous and heterogeneous wastes. They are described in detail in the "Waste Analysis Plan for Thermal Treatment by Open Burning at Technical Area 16", Section 3b.0, of the RCRA Part B Permit Application for TA-16 (LANL 1996, 63560.1). The following waste streams have been treated at the burn tray:

- HE-contaminated water with solvent waste consisting primarily of water and solvent from laboratory analysis and/or solvents from HE processing.
- Spent solvent waste consisting of spent solvents used to dissolve HE and polymers and spent solvents from laboratory analysis.
- HE-contaminated used oil originating from hydraulic presses and lubrication systems associated with HE machining operations.
- Liquid acids, bases, and/or inorganic salt wastes consisting of materials used as titrates, solvents, cleaning fluids, and/or materials from hydrolysis research.

HE-contaminated liquid wastes generated at LANL are managed either at the TA-16 HE Waste Treatment Facility (HEWTF) or at the TA-16-394 Burn Tray. Generators of HE-contaminated liquid wastes complete waste profile forms (WPFs) to document all information regarding waste generation and characterization. Information on the WPFs is evaluated against the waste acceptance criteria (WAC) of the HEWTF to determine whether the HE-contaminated liquid waste is managed at the HEWTF or the TA-16-394 Burn Tray. HE-contaminated liquid wastes that meet the WAC are treated at the HEWTP; all other HE-contaminated liquid wastes are treated at the TA-16-394 Burn Tray. WPFs documenting the HE-contaminated liquid wastes treated at the HEWTF or the TA-16-394 Burn Tray are on file and available for NMED-HRMB review, upon request.

The total volume of RCRA-regulated hazardous waste treated at the burn tray at any time was 250 gal., which is the process design capacity specified in the "Los Alamos National Laboratory General Part A Permit Application" (LANL 1998, 63498).

3.2 Closure Procedures

3.2.1 Phase I Activities

Phase I closure activities involve the removal, treatment, and/or disposition of all structures/media that comprise the burn tray. These structures include the two welded steel burn trays, sand and gravel, firebrick, piping, and concrete secondary containment (see Figure 1.2-3). Prior to removal, all structures/media will be field-screened using a Ludlum 139 (or equivalent) to detect alpha radiation and an ESP-1 (or equivalent) to detect beta/gamma radiation. This field-screening will be used for health and safety and waste management purposes to confirm that no unexpected radiological contamination is associated with the structures/media. These structures/media will be removed and segregated using a combination of hand and mechanized methods. After removal and segregation, management of the structures/media will include treatment by open burning at TA-16 and/or characterization by analytical samples prior to recycling or disposal. Management of each structure/media is presented below:

(a) Welded Steel Trays

The welded steel burn trays will be taken to the TA-16-388 burn structure and treated by open burning. This will treat/remove any remaining HE and organic residues on the trays. After treatment, the welded steel trays will be recycled by a local vendor.

(b) Sand and Gravel

Sand and gravel will be removed from the structure, placed in DOT-approved containers (situated in a <90-day accumulation area), and sampled for waste-characterization purposes prior to disposal. In order to avoid any difficulty associated with laboratory analysis of gravel, one sample of sand will be collected in accordance with LANL Environmental Restoration Project Standard Operating Procedure 6.09, "Spade and Scoop Method for Collection of Soil Samples" (LANL-ER-SOP-6.09). The sand grab sample will be analyzed for waste characterization purposes. The results of the sand grab sample will be conservatively representative of the sand and gravel waste stream and will be used to characterize and profile the sand and gravel for disposal. The grab sample will be submitted for fixed-laboratory analyses using Environmental Protection Agency Solid Waste 846 (EPA SW-846) methods (or equivalent EPA SW-846 methods) as outlined below:

- volatile organic compounds (VOCs) using EPA SW-846 Method 8260

- semivolatile organic compounds (SVOCs) using EPA SW-846 Method 8270
- total petroleum hydrocarbon (TPH) using EPA SW-846 Method 8015
- toxicity characteristic leaching procedure (TCLP) metals using EPA SW-846 Method 1311 and Method 6010

One aliquot of the grab sample will be field-analyzed for HE (using the HE spot test kit) to determine if the grab sample should be submitted for fixed-laboratory analysis of HE. If the HE spot test kit produces a positive HE result, the grab sample will be also be submitted for fixed-laboratory analysis of HE using EPA SW-846 Method 8330. Additional analyses may be required prior to disposal in order to address the waste acceptance criteria (WAC) requirements of the disposal facility. Sand and gravel will be disposed of at a RCRA Subtitle C or D facility as appropriate, based on the waste characterization analytical results.

(c) Firebrick

The firebrick will be taken to the TA-16-388 burn structure and treated by open burning. This will treat/remove any remaining HE and organic residues, if present. Because the potential metals composition (in particular, chromium composition) of the firebrick is unknown, the firebrick will then be sampled for waste-characterization purposes, prior to disposal. One grab sample will be collected in accordance with LANL-ER-SOP-6.28, "Chip Sampling of Porous Surfaces," and submitted for the same fixed-laboratory analytical suite as the waste characterization sample for sand and gravel, as described above. Additional analyses may be required prior to disposal in order to address the WAC requirements of the disposal facility. The firebrick will be disposed of at a RCRA Subtitle C or D facility as appropriate, based on the analytical results.

(d) Piping

The piping will be packaged in DOT-approved containers and transported for disposal at a RCRA Subtitle C or D facility as appropriate, based on the waste characterization analytical results of the sand and gravel.

(e) Concrete Secondary Containment

The concrete secondary containment structure will be demolished into manageable pieces during removal, then taken to the TA-16-388 burn structure to be treated by open burning. Open burning will treat/remove any HE and organic residues, if present. After treatment, the concrete will be recycled or disposed of at a RCRA Subtitle D landfill facility, as appropriate.

3.2.2 Phase II Activities

Phase II involves sampling and analysis to (1) determine if the material (soil/tuff) surrounding the former burn tray and associated outfall pipe and drainage area requires cleanup, and (2) verify that the closure performance standards have been met.

(a) Screening Levels

To determine if excavation of the material (soil/tuff) surrounding the removed burn tray structure and/or in the outfall area is necessary, the analytical results from sampling activities will be compared to EPA Region 6 Medium-Specific Screening Levels (MSSLs). The proposed MSSLs are those that were developed using inhalation, ingestion, and dermal exposure routes under industrial land use conditions. For reference

purposes, the EPA Region 6 MSSLs, associated background document, and update memo are found in Attachment B.

Based on operational history and the information reported in the Part B Permit Application for TA-16 (LANL 1996, 63560.1), any potential remaining contamination resulting from operation of the burn tray may include HE, solvents/organics, metals, and/or used oil (TPH). The primary individual constituents that are related to potential contamination and specific to these closure activities, as well as their associated MSSLs, are presented in Table 3.2-1.

Table 3.2-1
Constituents and Their Associated MSSLs

Contamination	Constituent	MSSL (mg/kg)
Solvents/organics		
	Acetone	5800
	Acetonitrile	2000
	Chloroform	0.52
	1,2-Dichloroethane	0.75
	Methyl ethyl ketone	26,000
	Pyridine	620
	Toluene	520
HE		
	2,4-Dinitrotoluene	1200
	2,6-Dinitrotoluene	620
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	16
	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	31,000
	2,4,6-Trinitrotoluene (TNT)	58
Metals		
	Antimony	820
	Arsenic	360
	Barium	10,000
	Cadmium	1000
	Chromium	450
	Lead	2000
	Mercury	610
	Selenium	10,000
	Silver	10,000

All the primary solvent/organic constituents, as well as barium, chromium, and mercury, are reported in the Part B Permit Application for TA-16 (LANL 1996, 63560.1) as specific to the possible waste streams treated at the burn tray. The primary HE constituents include degradation products and the primary metals (other than those already included from the Part B Permit Application for TA-16 (LANL 1996, 63560.1) consist of the remaining RCRA metals.

No single MSSL is established for TPH as results represent a complex mixture of compounds, some of which are RCRA-regulated constituents. Proposed closure activities involve assessing the presence and concentrations of any of the RCRA-regulated constituents that comprise TPH by analyzing for SVOCs and VOCs. Any detected RCRA-regulated constituents will be evaluated through comparison with the EPA Region 6 MSSLs, which are found in Attachment B. Once demonstrated that these constituents are below EPA Region 6 MSSLs, the remainder of the cleanup will be conducted to meet the TPH criteria in section IV of the New Mexico Department of Energy, Minerals, and Natural Resources Oil Conservation Division (OCD) *Guidelines for Remediation of Leaks, Spills, and Releases* (NMDEMNR 1993, 68518).

LANL believes that it is likely that wastes generated during closure activities that are contaminated with TPH will also contain other potential contaminants (i.e., solvents and/or metals). These wastes will be characterized and disposed appropriately, as outlined in previous sections. If, although unlikely, any materials contaminated with TPH (and no other contaminants) are generated during closure activities, they will be appropriately characterized and disposed as solid waste, in accordance with the New Mexico Solid Waste Management Regulation (20 NMAC 9.1).

(b) Sampling and Removal

Prior to collecting samples from materials surrounding the removed burn tray structure, a radiological field survey of the newly exposed area will be conducted using a Ludlum 139 (or equivalent) to detect alpha radiation and an ESP-1 (or equivalent) to detect beta/gamma radiation. This field-screening will be used for health and safety and waste management purposes to confirm that no unexpected radiological contamination is associated with materials surrounding the removed burn tray structure. Subsequent to the radiological survey, samples will be collected from locations immediately adjacent to, and beneath, the removed burn tray structure and at the discharge area from the outfall pipe (see Figure 1.2-4). Samples will be collected from four locations around the perimeter of the removed burn tray structure (perimeter samples), three locations at the outfall area (outfall samples), and two locations from beneath the removed burn tray structure (footprint samples). All samples will be field-screened using a Ludlum 139 and an ESP-1 (or equivalents) to detect alpha and beta/gamma radiation, respectively, to again confirm that no unexpected radiological contamination is present. Specific sample locations will be selected using best professional judgment, visual evidence, and/or results of the field screening used during removal of the secondary concrete structure. All samples will be collected in accordance with LANL-ER-SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples," or LANL-ER-SOP-6.10, "Hand Auger and Thin-Wall Tube Sampler" (as appropriate).

Analytical results from perimeter and outfall area samples will determine if hazardous constituents were released to surface, and near-surface, soils from burn tray operations (via splashing or drainage); analytical results from footprint samples will determine if hazardous constituents were released to the soil/tuff beneath the concrete structure (compromised integrity). The analytical results from all samples will be compared to screening levels to determine if soil/tuff excavation is required to complete the closure activities.

<u>Sampling Locations in Perimeter and Outfall Area</u>

Grab samples will be collected from the seven perimeter and outfall area locations at the following intervals: the 0- to 1-ft depth, the 1- to 1.5-ft depth, and the 3- to 4-ft depth. The 0- to 1-ft interval samples will be analyzed for target analyte list (TAL) metals, TPH, and HE; the 1- to 1.5-ft interval samples will be analyzed for VOCs; and the 3- to 4-ft interval samples will be analyzed for all four suites (TAL metals, TPH, HE, and VOCs). These samples will be submitted for fixed-laboratory analyses using EPA SW-846 methods (or equivalent EPA SW-846 methods) as outlined below:

- TAL metals using EPA SW-846 Method 6010

- TPH using EPA SW-846 Method 8015
- HE using EPA SW-846 Method 8330
- VOCs using EPA SW-846 Method 8260

Two samples (one from a perimeter location and one from an outfall location) will be taken from the initial interval(s) (0–1 ft and 1–1.5 ft) and submitted for fixed-laboratory analyses of TCLP metals and organics (using EPA SW-846 methods 1311, 6010, and 8260). The analytical results from these samples will ensure that no characteristic hazardous waste was released to the environment that surrounds the removed burn tray structure or in the outfall area. Although not expected, any identified characteristic hazardous waste will require removal in order to complete these closure activities.

Analytical results from the initial interval(s) (0–1 ft and 1–1.5 ft) will be compared with screening levels to determine if the removal of soil/tuff surrounding the removed burn tray or in the outfall discharge area will be required to complete the closure activities. The scope of soil/tuff removal activities will be evaluated based on the following criteria:

- Soil/tuff surrounding the removed burn tray or in the outfall discharge area will not be removed if analytical results from the initial interval(s) (0–1 ft and 1–1.5 ft) confirm that all primary constituents (or TPH) are below their associated screening levels.
- If analytical results from the initial interval(s) (0–1 ft and 1–1.5 ft) at a single location indicate that any primary constituents (or TPH) exceed screening levels, soil/tuff will be removed from the area associated with that sample location. For perimeter locations with analytical results from the initial interval(s) (0–1 ft and 1–1.5 ft) that exceed screening levels, soil/tuff removal will occur along the associated side of the removed burn tray structure and will extend 5 ft laterally from the edge of the removed the burn tray structure. For outfall locations with analytical results from the initial interval(s) (0–1 and 1–1.5 ft) that exceed screening levels, soil/tuff removal will extend approximately 5 ft in each (lateral) direction. The vertical extent of excavation at these perimeter and outfall area locations will depend upon the analytical results of the samples collected from the 3–4 ft interval:
    - If analytical results from the 3–4 ft interval indicate that primary constituents (or TPH) do not exceed screening levels, soil/tuff will be removed to a depth of 3 ft from the ground surface.
    - If analytical results from the 3-4 ft interval indicated that any primary constituents (or TPH) exceed screening levels, soil/tuff will be removed to a depth of 5 ft from the original ground surface from the area associated with that sample location. After removal to 5 ft, additional samples (two per removed structure side and two in the outfall area) will be collected and submitted for fixed laboratory analysis (using the procedures and methods described above) for those analyte suites containing the constituents exceeding screening levels. Specific sample locations will be selected based on best professional judgment, visual evidence, and/or the results of any field screening methods used during excavation activities. These additional samples will be collected from the 5-6 and 9-10 ft intervals from the original ground surface, which are now the 0-1 and 4-5 ft intervals, respectively, from the new excavation surface. Analytical results from these additional samples will be used to support future corrective action activities for consolidated PRS 16-010(c)-99.

Sampling Locations Beneath Removed Structure

Grab samples will be collected from the 0-1 ft depth interval and the 3-4 ft depth interval from the two locations beneath the removed burn tray structure. All of these samples will be submitted for fixed laboratory analyses of TAL metals, TPH, HE, and VOCs using the EPA SW-846 methods (or equivalent EPA SW-846 methods) listed above for the perimeter and outfall area samples. One sample from the initial interval (0-1 interval) will also be submitted for fixed laboratory analyses of TCLP metals and organics (using the EPA SW-846 methods outline above for the perimeter and outfall sample). The analytical results from these samples will ensure that no characteristic hazardous waste was released to the environment beneath the removed burn tray structure. Although not expected, any identified characteristic hazardous waste will require removal to complete these closure activities.

Analytical results from the initial interval (0-1 ft interval) will be compared to screening levels to determine whether removal of soil/tuff beneath the removed burn tray structure is required to complete the closure activities. The scope of soil/tuff removal activities (if necessary) will evaluated based on the following criteria:

- Soil/tuff beneath the removed burn tray structure will not be removed if analytical results from the initial interval (0-1 ft interval) confirm that all primary constituents (or TPH) are below their associated screening levels.
- If analytical results from the initial interval (0-1 ft interval) from either location indicate that any primary constituents (or TPH) exceed screening levels, soil/tuff will be removed from the area beneath the removed burn tray structure. Soil/tuff removal will occur across the entire area underlying the removed burn tray structure. The vertical extent of excavation beneath the removed burn tray structure depends on the analytical results of the samples collected from the 3-4 ft interval:
    - If analytical results from the 3-4 ft interval indicate that primary constituents (or TPH) *do not* exceed screening levels, soil/tuff will be removed to a depth of 3 ft below the removed burn tray structure (approximately 4.5 ft from the ground surface).
    - If analytical results from the 3–4 ft interval indicate that any primary constituents (or TPH) *do* exceed screening levels, soil/tuff will be removed to a depth of 5 ft below the removed burn tray structure (approximately 6.5 ft from the ground surface). After this removal to 5 ft, two additional samples will be collected and submitted for fixed-laboratory analysis (using the procedures and methods described above) of those analyte suites containing the constituents exceeding screening levels. Specific sampling locations will be selected based on best professional judgment, visual evidence, and/or the results of any field-screening methods used during excavation activities. These additional samples will be collected at 5- to 6-ft and 9- to 10-ft depths from the original surface beneath the removed burn tray structure; these are now 0- to 1-ft and 4- to 5-ft depths, respectively, from the new excavation surface. Analytical results from these additional samples will be used to support future corrective action activities for consolidated PRS 16-010(c)-99.

(c) Soil/Tuff Disposition

If soil/tuff removal is required, the removed material will be placed (upon generation) in DOT-approved containers and sampled for waste-characterization purposes prior to disposal. Containers will be situated in appropriate storage areas if removed soil/tuff is known or suspected of being a hazardous or New Mexico special solid waste. Waste-characterization grab samples (1 per 20 yd^3 of excavated soil/tuff) will be

collected in accordance with LANL-ER-SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples," and submitted for the same fixed-laboratory analytical suites as the sand-and-gravel grab sample discussed in Section 3.2.1. Prior to disposal, additional analyses may be required to address the WAC requirements of the disposal facility. The soil/tuff will be stored or disposed of at a RCRA Subtitle C or D facility, as appropriate, based on the waste-characterization analytical results.

(d) Site Restoration

After the burn tray structure removal and soil/tuff excavation (if necessary) activities are complete, the affected area will be backfilled to the original grade with clean material (soil, crushed tuff, etc.). Clean material will be placed in such a way as to prevent erosion. Appropriate best management practices (BMPs) will also be employed at the site to prevent and/or control stormwater run-on and runoff.

(e) Decontamination Activities

The equipment used during closure operations will be taken to TA-16, Building 400 (or other appropriate LANL facility), for decontamination. The decontamination water generated from washing the equipment will be sampled for waste characterization which will then determine disposition. One sample will be collected in accordance with LANL-ER-SOP-6.15, "Coliwasa Sampler for Liquids and Slurries," and submitted for fixed-laboratory analyses by EPA SW-846 methods (or equivalent EPA SW-846 methods) as outlined below:

- TAL metals using EPA SW-846 Methods 6010
- VOCs using EPA SW-846 Method 8260
- SVOCs using EPA SW-846 Method 8270
- HE using EPA SW-846 Method 8330

Decontamination water will be transported to the TA-16 HE wastewater treatment facility (HEWTF) or other appropriate LANL or off-site facility. Additional analyses may be required prior to disposal in order to address the WAC requirements of the disposal facility.

4.0 REFERENCES

Los Alamos National Laboratory (LANL), November 1990. "Solid Waste Management Units Report," Volume II of IV (TA-10 through TA-25), Los Alamos National Laboratory document LA-UR-90-3400, Los Alamos, New Mexico. (LANL 1990, 07512.1)

Los Alamos National Laboratory (LANL), July 1, 1993. "RFI Workplan for Operable Unit 1082," Los Alamos National Laboratory document LA-UR-93-1196, Los Alamos, New Mexico. (LANL 1993, 20948.1)

Los Alamos National Laboratory (LANL), 1995. "Site Development Plan, Annual Update 1995," Los Alamos National Laboratory publication LALP-95-113, Los Alamos, New Mexico. (LANL 1995, 57224.1)

Los Alamos National Laboratory (LANL), April 1996. "RCRA Part B Permit Application for Technical Area 16, Building 88, Container Storage Area; Flash Pads 387 and 388, Open Burn Units; Burn Pads 388 and 399, Open Burn Units; Burn Trays 388 and 394, Open Burn Units; Filter Vessels 401 and 406, Open Burn Units," original date June 1995, revised April 1996, Los Alamos National Laboratory's Hazardous and Solid Waste Group (ESH-19), Los Alamos, New Mexico. (LANL 1996, 63560.1)

Los Alamos National Laboratory (LANL) Hazardous and Solid Waste Group (ESH-19), April 1998. "Los Alamos National Laboratory General Part A Permit Application," Revision 0.0, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1998, 63498.1)

Los Alamos National Laboratory (LANL), April 1999. "Los Alamos National Laboratory's Environmental Restoration Project's Final Table (Revision 1) Listing Agreed Upon Annual Unit Audit Numbers," Los Alamos National Laboratory letter (EM/ER:99-103) to B. Garcia (NMED HRMB) from J. Canepa (ER Project Program Manager) and T. Taylor (DOE ER Program Manager), Los Alamos, New Mexico. (LANL 1999, 63175.1 and 63175.2)

New Mexico Environment Department (NMED), May 12, 1999. "Approval of Change Under Interim Status; Technical Area (TA) 16-388, EPA I.D. No. NM 089 001 0515," NMED HRMB letter to D. Gurule (Area Manager, DOE-LAAO) and J. Browne (Director, Los Alamos National Laboratory) from G. Lewis (Director, Water and Waste Management Division), Santa Fe, New Mexico. (NMED HRMB 1999, 63422)

New Mexico Department of Energy, Minerals, and Natural Resources, August 13, 1993. "Guidelines for Remediation of Leaks, Spills, and Releases," Oil Conservation Division (OCD), Santa Fe, New Mexico. (NMDEMNR 1993, 68518)

Attachment A

Estimated Schedule for Closure Activities at the TA-16-394 Burn Tray

CLOSURE SCHEDULE

An estimated total of 180 days will be required to accomplish closure procedures and reporting requirements. The year of closure for the burn tray structure is 2000. Closure will proceed according to the schedule below:

Activity	Maximum Time Allowed
Notify NMED by Submitting Closure Plan	–45 Days
Procure Equipment and Subcontractors	–45 Days
Conduct Readiness Review	–5 Days
Begin Operations	Day 0
Remove Structures/Media and Treat and/or Sample	Day 10
Analyze Samples for Waste Characterization	Day 20
Sample Media Surrounding and Beneath Former Structure	Day 25
Analyze Samples for Removal Determination	Day 35
Excavate Surrounding Media and Sample (if necessary)	Day 60
Decontaminate Equipment	Day 65
Restore Site	Day 70
Analyze Samples for Waste Characterization and for Future Corrective Action Activities	Day 75
Submit Closure Certification	Day 130
Submit Closure Report to NMED	Day 180

NOTE: The schedule above indicates the maximum number of calendar days, relative to Day 0, within which each activity will be completed. Some activities may be conducted simultaneously.

Attachment B

EPA Region 6 Medium-Specific Screening Levels (MSSLs), Background Document, and Update Memo

EPA Region 6

Human Health

Medium-Specific Screening Levels

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

June 1999

BACKGROUND ON REGION 6 SCREENING VALUES

General

Screening levels are chemical concentrations that correspond to fixed levels of risk (i.e., either a one-in-one million [10^{-6}] cancer risk or a non-carcinogenic hazard quotient of one, whichever occurs at a lower concentration) in soil, air, and water. In most cases, where a substance causes both cancer and non-cancer or systemic effects, the 10^{-6} cancer risk will result in a more stringent criterion and consequently this value is presented in the table. Screening level concentrations based on cancer risk are indicated by "C." Screening level concentrations based on non-carcinogenic health threats are indicated by "N."

In general, screening level concentrations in the table are risk-based but for soil there are two important exceptions: (1) for several volatile chemicals, screening levels are based on the soil saturation equation ("sat") and (2) for relatively less toxic inorganic and semi-volatile contaminants, a non-risk based "ceiling limit" concentration is given as 10^{+5} mg/kg ("max").

The screening value table also presents information on soil for both residential and industrial exposure scenarios and including and excluding the dermal exposure pathway. The exposure pathways used in developing the screening values are indicated in ***boldface italics*** on the exposure table below.

TYPICAL EXPOSURE PATHWAYS BY MEDIUM FOR RESIDENTIAL AND INDUSTRIAL LAND USES

EXPOSURE PATHWAYS, ASSUMING:		
MEDIUM	RESIDENTIAL LAND USE	INDUSTRIAL LAND USE
Ground Water	***Ingestion from drinking***	Ingestion from drinking
	Inhalation of volatile chemicals	Inhalation of volatile chemicals
	Dermal absorption from bathing	Dermal absorption
Surface Water	***Ingestion from drinking***	Ingestion from drinking
	Inhalation of volatile chemicals	Inhalation of volatile chemicals
	Dermal absorption from bathing	Dermal absorption

EXPOSURE PATHWAYS, ASSUMING:		
MEDIUM	RESIDENTIAL LAND USE	INDUSTRIAL LAND USE
	Ingestion during swimming	
	Ingestion of contaminated fish	
Soil	***Ingestion***	***Ingestion***
	Inhalation of particulates	***Inhalation of particulates***
	Inhalation of volatile chemicals	***Inhalation of volatile chemicals***
	Exposure to indoor air from soil gas	Exposure to indoor air from soil gas
	Exposure to ground water contaminated by soil leachate	Exposure to ground water contaminated by soil leachate
	Ingestion via plant, meat, or dairy products	Inhalation of particulates from trucks and heavy equipment
	Dermal absorption	***Dermal absorption***

Toxicity Values

EPA toxicity values, known as non-carcinogenic reference doses (RfD) and carcinogenic slope factors (SF) were obtained from IRIS, HEAST, and EPA's National Center for Environmental Assessment, NCEA. The IRIS and NCEA values were updated as of May 1, 1999. The HEAST values were not reviewed since HEAST has not been updated since the last screening value table. The priority among sources of toxicological constants used are as follows: (1) IRIS (indicated by "i"), (2) HEAST ("h"), (3) NCEA ("n"), and (4) withdrawn from IRIS or HEAST and under review ("x").

Route-to-route extrapolations ("r") were frequently used when there were no toxicity values available for a given route of exposure. Oral cancer slope factors ("SFo") and reference doses ("RfDo") were used for both oral and inhaled exposures for organic compounds lacking inhalation values. Inhalation slope factors ("SFi") and inhalation reference doses ("RfDi") were used for both inhaled and oral exposures for organic compounds lacking oral values unless the toxicity data indicated otherwise. An additional route extrapolation is the use of oral toxicity values for evaluating dermal exposures. **Although route-to-route methods are a useful**

screening procedure, the appropriateness of these default assumptions for specific contaminants should be verified by a toxicologist.

Inorganic Background

Naturally-occurring inorganic background levels may be considered in the screening of environmental data. Background values are important in making risk-based decisions. Elevated naturally-occurring background, relative to risk-based screening levels, and/or widespread contaminant concentrations can complicate the determination of a cleanup level or the extent of the corrective action effort. The issues are complex and present a challenge for regulators nationwide. Typical values of inorganic concentrations found in soils within Region 6 are described in the table below. The values have been compiled from technical sources and from Region 6 approved background study reports.

Contaminant	Background Concentration/ Range mg/kg	Contaminant	Background Concentration/ Range mg/kg
Aluminum	45000	Lead	10-18
Arsenic	1.1-16.7	Manganese	389-850
Barium	430	Mercury	0.1
Beryllium	0.5-2	Nickel	16
Boron	2-100	Selenium	0.2
Cadmium	0.01-1.0	Silver	0.01-5
Chromium	38	Tin	122
Cobalt	8	Vanadium	66
Copper	20	Zinc	22-50

Dermal

Since these screening levels are intended as an initial risk-based screen of environmental media, the screening level concentrations reflect the inclusion and exclusion of the dermal exposure route. Site soil concentrations should be screened against both the "with dermal" and "without

dermal" numbers. A chemical-specific decision whether this exposure route is relevant should be made in subsequent risk assessment efforts.

APPLICATION OF THE SCREENING LEVELS TABLE

The decision to use the screening levels at a site will be driven by the potential benefits of having generic risk-based concentrations in the absence of site-specific risk assessments.

Potential Benefits:

- Screening sites to determine further evaluation
- Prioritizing multiple sites within a facility
- Focusing future risk assessment efforts

Developing a Conceptual Site Model

The primary condition for use of the screening levels is that exposure pathways of concern and conditions at the site match those taken into account by the screening levels. Thus, it is always necessary to develop a conceptual site model (CSM) to identify likely contaminant source areas, exposure pathways, and potential receptors. This information can be used to determine the applicability of screening levels at the site and the need for additional information.

The final CSM diagram represents linkages among contaminant sources, release mechanisms, exposure pathways and routes and receptors based on historical information. It summarizes the understanding of the contamination problem.

As a final check, the CSM should answer the following questions:

- Are there potential ecological concerns?
- Is there potential for land use other than those covered by the screening levels (i.e., residential and industrial)?
- Are there other likely human exposure pathways that were not considered in development of the screening levels (e.g. raising beef, dairy, or other livestock)?
- Are there unusual site conditions (e.g. large areas of contamination, high fugitive dust

levels, potential for indoor air contamination)?

Potential Problems

As with any risk-based tool, the potential exists for misapplication. In most cases the root cause will be a lack of understanding of the intended use of the screening levels table. In order to prevent misuse of screening levels, the following should be avoided:

- Applying screening levels to a site without adequately developing a conceptual site model that identifies relevant exposure pathways and exposure scenarios,
- Not considering background concentrations when choosing screening levels,
- Use of screening levels as cleanup levels without the consideration of other relevant criteria
- Use of screening levels as cleanup levels without verifying numbers with a toxicologist/risk assessor,
- Use of outdated screening levels tables that have been superseded by more recent publications,
- Not considering the effects from the presence of multiple chemicals.

TECHNICAL SUPPORT DOCUMENTATION

The Region 6 screening levels consider human exposure hazards to chemicals from contact with contaminated soils, air, and water. The emphasis of the screening levels equations and technical discussion are aimed at developing initial goals for soils, since this is an area where few standards exist. For air and water, additional reference concentrations or standards are available for many chemicals (e.g. non-zero MCLGs, AWQC, and NAAQS) and consequently the discussion of these media are brief.

Inhalation of Volatile Chemicals and Fugitive Dusts

Agency toxicity criteria indicate that risks from exposure to some chemicals via inhalation far outweigh the risk via ingestion; therefore soil screening levels have been designed to address this pathway as well. The models used to calculate screening levels for inhalation of volatile chemicals / particulates are updates of risk assessment methods presented in RAGS Part B (USEPA 1991a) and are consistent with the *Soil Screening Guidance: User's Guide and*

Technical Background Document (USEPA 1996a,b).

To address the soil-to-air pathways the screening level calculations incorporate volatilization factors (VF_s) for volatile contaminants and particulate emission factors (PEF) for nonvolatile contaminants. These factors relate soil contaminant concentrations to air contaminant concentrations that may be inhaled on-site. The VF_s and PEF equations can be broken into two separate models: an emission model to estimate emissions of the contaminant from the soil and a dispersion model to simulate the dispersion of the contaminant in the atmosphere.

It should be noted that the box model in RAGS Part B has been replaced with a dispersion term (Q/C) derived from a modeling exercise using meteorological data from 29 locations across the United States because the box model may not be applicable to a broad range of site types and meteorology and does not utilize state-of-the-art techniques developed for regulatory dispersion modeling. The dispersion model for both volatile chemicals and particulates is the AREA-ST, an updated version of the Office of Air Quality Planning and Standards, Industrial Source Complex Model, ISC2. However, different Q/C terms are used in the VF and PEF equations. Los Angeles was selected as the 90th percentile data set for volatile chemicals and Minneapolis was selected as the 90th percentile data set for fugitive dusts (USEPA 1996 a,b). A default source size of 0.5 acres was chosen for the screening level calculations. This is consistent with the default exposure area over which Region 6 typically averages contaminant concentrations in soils. If unusual site conditions exist such that the area source is substantially larger than the default source size assumed here, an alternative Q/C could be applied (see USEPA 1996a,b).

Volatilization Factor for Soils

Volatile chemicals, defined as those chemicals having a Henry's Law constant greater than 10^{-5} (atm-m^3/mol) and a molecular weight less than 200 g/mole, were screened for inhalation exposures using a volatilization factor for soils (VF_s).
The emission terms used in the VF_s are chemical-specific and were calculated from physical-chemical information obtained from a number of sources including *Superfund Exposure Assessment Manual* (SEAM, EPA 1988), *Subsurface Contamination Reference Guide* (EPA 1990a), *Fate and Exposure Data* (Howard 1991), and *Superfund Chemical Data Matrix* (USEPA 1994c). In those cases where Diffusivity Coefficients (Di) were not provided in existing literature, Di's were calculated using Fuller's Method described in SEAM. A surrogate term was required for some chemicals that lacked physico-chemical information. In these cases, a proxy chemical of similar structure was used that may over- or under-estimate the screening level for soils.

The soil saturation concentration "sat" corresponds to the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil pore air have been reached. Above this concentration, the soil contaminant may be present in free phase, i.e., nonaqueous phase liquids (NAPLs) for contaminants that are liquid at ambient soil temperatures and pure solid phases for compounds that are solid at ambient

soil temperatures.

Equation 10 below is used to calculate "sat" for each volatile contaminant. As an update to RAGS HHEM, Part B (USEPA 1991a), this equation takes into account the amount of contaminant that is in the vapor phase in soil in addition to the amount dissolved in the soil's pore water and sorbed to soil particles. A basic principle of the volatilization model is not applicable when free-phase contaminants are present. How these cases are handled depends on whether the contaminant is liquid or solid at ambient temperatures. Liquid contaminant that have a volatilization factor (VF)-based PRG that exceeds the "sat" concentration are set equal to "sat" whereas for solids (e.g., PAHs), soil screening decisions are based on appropriate other pathways of concern at the site (e.g., ingestion and dermal contact).

Volatilization Factor for Tap Water

For tap water, an upper bound volatilization constant (VF_w) is used that is based on all uses of household water (e.g showering, laundering, and dish washing). Certain assumptions were made. For example, it is assumed that the volume of water used in a residence for a family of four is 720 L/day, the volume of the dwelling is 150,000 L and the air exchange rate is 0.25 air changes/hour (Andelman in RAGS Part B). Furthermore, it is assumed that the average transfer efficiency weighted by water use is 50 percent (i.e. half of the concentration of each chemical in water will be transferred into air by all water uses). Note: the range of transfer efficiencies extends from 30% for toilets to 90% for dishwashers. Volatilization was only included in the tap water equations for compounds with an "1" in the "VOC" column.

Particulate Emission Factor for Soils

Inhalation of chemicals adsorbed to respirable particles (PM_{10}) were assessed using a default PEF equal to 1.316×10^9 m^3/kg that relates the contaminant concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from contaminated soils. The generic PEF was derived using default values in Equation 11, which corresponds to a receptor point concentration of approximately 0.76 ug/m^3. The relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time (e.g. years). This represents an annual average emission rate based on wind erosion that should be compared with chronic health criteria; it is not appropriate for evaluating the potential for more acute exposures.

With the exception of specific heavy metals, the PEF does not appear to significantly affect most soil screening levels. Equation 11 forms the basis for deriving a generic PEF for the inhalation pathway. For more details regarding specific parameters used in the PEF model, the reader is referred to *Soil Screening Guidance: Technical Background Document* (USEPA 1996a).

Note: the generic PEF evaluates windborne emissions and does not consider dust

emissions from traffic or other forms of mechanical disturbance that could lead to greater emissions than assumed here.

Dermal Default Values

Much uncertainty surrounds the determination of hazards associated with skin contact with soils. One important data gap is the lack of EPA verified toxicity values for the dermal route. For screening purposes it is assumed that dermal toxicity values can be route-to-route extrapolated from oral values but this may not always be an appropriate assumption and should be checked.

The Supplemental Dermal Guidance to RAGS is not yet available, but several aspects of the guidance have been presented at various conferences. The dermal assumptions used in developing the screening values are based upon the latest information available as of May 6, 1999. Chemical-specific dermal absorption values for contaminants in soil and dust are presented for arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, PAH's, pentachlorophenol, PCBs, and dioxin. Otherwise, default skin absorption fractions are assumed to be 0.10, for organic chemicals. A default absorption for inorganics is no longer recommended.

Default values for dermal contact with soil include surface area and soil adherence. Exposed surface areas are 5700 and 2900 for adults and children, respectively. Recommended adherence factors are age-specific adherence factors of 0.07 and 0.2 mg/cm^2 for adults and children, respectively. An adult soil adherence factor of 0.2 is also used in the industrial exposure scenario.

SSLs for the Migration to Groundwater Pathway

Development of Soil Screening Levels

In May 1996 the EPA Office of Solid Waste and Emergency Response published the Soil Screening Guidance: Technical Background Document (Document 9355.4-17A, PB96-963502, EPA/540/R-95/128, available through NTIS at 703-487-4650). This document provides (1) a framework in which soil screening levels are to be used, (2) a detailed methodology for calculating soil screening levels, and (3) generic soil screening levels for selected chemicals.

The methodology for calculating SSLs for the migration to groundwater was developed to identify chemical concentrations in soil that have the potential to contaminate groundwater. Migration of contaminants from soil to groundwater can be envisioned as a two-stage process: (1) release of contaminant in soil leachate and (2) transport of the contaminant through the underlying soil and aquifer to a receptor well. The SSL methodology considers both of these fate and transport mechanisms.

SSLs are back calculated from acceptable ground water concentrations (i.e. nonzero MCLGs, MCLs, or risk-based screening levels). Residential exposure scenarios are assumed based on a

fixed upper bound risk of 10^{-6} or a fixed hazard quotient of 1. First, the acceptable groundwater concentration is multiplied by a dilution factor to obtain a target leachate concentration. For example, if the dilution factor is 10 and the acceptable ground water concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation (presented in the *Soil Screening Guidance* document) is then used to calculate the total soil concentration (i.e. SSL) corresponding to this soil leachate concentration.

The SSL methodology was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Because of this constraint, the methodology is based on conservative, simplifying assumptions about the release and transport of contaminants in the subsurface. These SSLs provide reasonable maximum estimates of transfers of contaminants from soil to other media. One column contains soil concentrations protective of groundwater quality; the other contains soil concentrations protective of air quality.

Users of the screening levels table are strongly encouraged to consult the official guidance document for details concerning the soil screening calculations. Currently, the Region 6 spreadsheet does not generate values based upon the soil screening calculations. The numbers for the "DAF" column are pasted from the August 1998 Region 6 Medium-Specific Screening Level document. Based upon the feedback from the spreadsheet users and the regional resources, future revisions to the spreadsheet can incorporate the information necessary to calculate appropriate soil values for protection of groundwater.

Exposure Factors

Default exposure factors were obtained primarily from RAGS Supplemental Guidance Standard Default *Exposure Factors* (OSWER Directive, 9285.6-03) dated March 25, 1991 and more recent information from U.S. EPA's Office of Solid Waste and Emergency Response, and U.S. EPA's Office of Research and Development.

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors ("adj"). Use of age-adjusted factors are especially important for soil ingestion exposures, which are higher during childhood and decrease with age. However, for purposes of combining exposures across pathways, additional age-adjusted factors are used for inhalation and dermal exposures. These factors approximate the integrated exposure from birth until age 30 combining contact rates, body weights, and exposure durations for two age groups - small children and adults. Age-adjusted factors were obtained from RAGS PART B or developed by analogy.

For soils only, non-carcinogenic contaminants are evaluated in children separately from adults. No age-adjustment factor is used in this case. The focus on children is considered protective of the higher daily intake rates of soil by children and their lower body weight. For maintaining consistency when evaluating soils, dermal and inhalation exposures are also based on childhood

contact rates.

(1) ingestion([mg ! yr]/[kg ! d]:

$$IFS_{adj} = \frac{ED_c \ x \ IRS_c}{BW_c} + \frac{(ED_r - ED_c) \ x \ IRS_a}{BW_a}$$

(2) skin contact([mg ! yr]/[kg ! d]:

$$SFS_{adj} = \frac{ED_c \ x \ AF \ x \ SA_c}{BW_c} + \frac{(ED_r - ED_c) \ x \ AF \ x \ SA_a}{BW_a}$$

(3) inhalation ([m^3 ! yr]/[kg ! d]):

$$InhF_{adj} = \frac{ED_c \ x \ IRA_c}{BW_c} + \frac{(ED_r - ED_c) \ x \ IRA_a}{BW_a}$$

Screening Level Equations

The equations used to calculate the screening levels for carcinogenic and non-carcinogenic contaminants are presented in Equations 1 through 8. The screening level equations update RAGS Part B equations. The methodology back calculates a soil, air, or water concentration level from a target risk (for carcinogens) or hazard quotient (for non-carcinogens). For completeness, the soil equations combine risks from ingestion, skin contact, and inhalation simultaneously. The "without dermal" screening values use these equations minus the dermal component of the denominator.

To calculate screening levels for volatile chemicals in soil, a chemical-specific volatilization factor is calculated per Equation 9. Because of its reliance on Henry's law, the VF_s model is applicable only when the contaminant concentration in soil is at or below saturation (i.e. there is no free-phase contaminant present). Soil saturation ("sat") corresponds to the contaminant concentration in soil at which the adsorptive limits of the soil particles and the solubility limits of the available soil moisture have been reached. Above this point, pure liquid-phase or solid-phase

contaminant is expected in the soil. If the screening level calculated using VF_s was greater than the calculated sat, the screening level was set equal to the saturation value for liquid contamination, in accordance with *Soil Screening Guidance* (USEPA 1996 a,b). The updated equation for deriving soil saturation is presented in Equation 10.

STANDARD DEFAULT FACTORS

Symbol	Definition (units)	Default	Reference
CSFo	Cancer slope factor oral (mg/kg-d)-1	–	IRIS, HEAST, or NCEA
CSFi	Cancer slope factor inhaled (mg/kg-d)-1	–	IRIS, HEAST, or NCEA
RfDo	Reference dose oral (mg/kg-d)	–	IRIS, HEAST, or NCEA
RfDi	Reference dose inhaled (mg/kg-d) –	IRIS, HEAST, or NCEA	
TR	Target cancer risk	10^{-6}	–
THQ	Target hazard quotient	1	–
BWa	Body weight, adult (kg)	70	RAGS (Part a), EPA 1989 (EPA/540/1-89/002)
BWc	Body weight, child (kg)	15	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
ATc	Averaging time - carcinogens (days)	25550	RAGS(Part a), EPA 1989 (EPA/540/1-89/002)
ATn	Averaging time - noncarcinogens (days)	ED*365	
SAa	Exposed surface area, adult (cm^2/day)	5700	
SAc	Exposed surface area, child (cm^2/day)	2900	
AFa	Adherence factor, adult (mg/cm^2)	0.07	See text
Afw	Adherence factor, adult-work (mg/cm^2)	0.2	See text
AFc	Adherence factor, child (mg/cm^2)	0.2	See text
ABS	Skin absorption (unitless):		
	– organics	0.1	Dermal Assessment, See text
	–Inorganics	none	Dermal Assessment, See text
IRAa	Inhalation rate - adult (m^3/day)	20	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
IRAc	Inhalation rate - child (m^3/day)	10	RAGS (Part A), EPA 1989 (EPA/540/1-89/002)
IRWa	Drinking water ingestion - adult (L/day	2	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
IRWc	Drinking water ingestion - child (L/day)	1	
IRSa	Soil ingestion - adult (mg/day)	100	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
IRSc	Soil ingestion - child (mg/day),	200	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
IRSo	Soil ingestion - occupational (mg/day)	50	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
EFr	Exposure frequency - residential (d/y)	350	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
EFo	Exposure frequency - occupational (d/y)	250	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
EDr	Exposure duration - residential (years)	30*	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
EDc	Exposure duration - child (years)	6	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
EDo	Exposure duration - occupational (years)	25	Exposure Factors , EPA 1991 (OSWER No. 9285.6-03)
	Age-adjusted factors for carcinogens:		
IFSadj	Ingestion factor, soils ([mg ! yr]/[kg ! d])	114	RAGS(Part B) , EPA 1991 (OSWER No. 9285.7-01B)
SFSadj	Skin contact factor, soils ([mg ! yr]/[kg ! d])	340	By analogy to RAGS (Part B)
InhFadj	Inhalation factor ([m^3 ! yr]/[kg ! d])	11	By analogy to RAGS (Part B)
IFWadj	Ingestion factor, water ([l ! yr]/[kg ! d])	1.1	By analogy to RAGS (Part B)
VFw	Volatilization factor for water (L/m^3)	0.5	RAGS(Part B) , EPA 1991 (OSWER No. 9285.7-01B)
PEF	Particulate emission factor (m^3/kg)	See below	Soil Screening Guidance (EPA 1996a,b)
VFs	Volatilization factor for soil (m^3/kg)	See below	Soil Screening Guidance (EPA 1996a,b)
sat	Soil saturation concentration (mg/kg)	See below	Soil Screening Guidance (EPA 1996a,b)

Footnote:
*Exposure duration for lifetime residents is assumed to be 30 years total. For carcinogens, exposures are combined for children (6 years) and adults (24 years).

SCREENING LEVEL EQUATIONS

Soil Equations: For soils, equations were based on three exposure routes (ingestion, skin contact, and

inhalation).

Equation 1: Combined Exposures to Carcinogenic Contaminants in Residential Soil

$$C(mg/kg) = \frac{TR \times AT_c}{EF_r\left[\left(\frac{IFS_{adj} \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{SFS_{adj} \times ABS \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{Inh_{adj} \times CSF_i}{VF_s *}\right)\right]}$$

Equation 2: Combined Exposures to Noncarcinogenic Contaminants in Residential Soil

$$C(mg/kg) = \frac{THQ \times BW_c \times AT_n}{EF_r \times ED_c\left[\left(\frac{1}{RfD_o}\right) \times \left(\frac{IRS_c}{10^6 mg/kg}\right) + \left(\frac{1 \times SA_c \times AF \times ABS}{RfD_o \times 10^6 mg/kg}\right) + \left(\frac{1}{RfD_i} \times \frac{IRA_c}{VF_s *}\right)\right]}$$

Equation 3: Combined Exposures to Carcinogenic Contaminants in Industrial Soil

$$C(mg/kg) = \frac{TR \times BW_a \times AT_c}{EF_o \times ED_o\left[\left(\frac{IRS_o}{10^6 mg/kg}\right) + \left(\frac{SA_a \times AF \times ABS \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{IRA_a \times CSF_i}{VF_s *}\right)\right]}$$

Equation 4: Combined Exposures to Noncarcinogenic Contaminants in Industrial Soil

$$C(mg/kg) = \frac{THQ \times BW_a \times AT_n}{EF_o \times ED_o\left[\left(\frac{1}{RfD_o}\right) \times \left(\frac{IRS_o}{10^6 mg/kg}\right) + \left(\frac{1 \times SA_a \times AF \times ABS}{RfD_o \times 10^6 mg/kg}\right) + \left(\frac{1}{RfD_i} \times \frac{IRA_a}{VF_s *}\right)\right]}$$

Footnote:

* Use VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol) or PEF for non-volatile chemicals.

Tap Water Equations:

Equation 5: Ingestion and Inhalation Exposures to Carcinogenic Contaminants in Water

$$C(ug/L) = \frac{TR \ x \ AT_c \ x \ 1000ug/mg}{EF_r \ [(IFW_{adj} \ x \ CSF_o) + (VF_w \ x \ InhF_{adj} \ x \ CSF_i)]}$$

Equation 6: Ingestion and Inhalation Exposures to Noncarcinogenic Contaminants in Water

$$C(ug/L) = \frac{THQ \ x \ BW_a \ x \ AT_n \ x \ 1000ug/mg}{EF_r \ x \ ED_r \ [(\frac{IRW_a}{RfD_o}) + (\frac{VF_w \ x \ IRA_a}{RfD_i})]}$$

<u>Air Equations</u>:

Equation 7: Inhalation Exposures to Carcinogenic Contaminants in Air

$$C(ug/m^3) = \frac{TR \ x \ AT_c \ x \ 1000ug/mg}{EF_r \ x \ InhF_{adj} \ x \ CSF_i}$$

Equation 8: Inhalation Exposures to Noncarcinogenic Contaminants in Air

$$C(ug/m^3) = \frac{THQ \ x \ RfD_i \ x \ BW_a \ x \ AT_n \ x \ 1000ug/mg}{EF_r \ x \ ED_r \ x \ IRA_a}$$

SOIL-TO-AIR VOLATILIZATION FACTOR (VF_s)

Equation 9: Derivation of the Volatilization Factor

$$VF_s(m^3/kg) = (Q/C) \ x \ \frac{(3.14 \ x \ D_A \ x \ T)^{1/2}}{(2 \ x \ \rho_b \ x \ D_A)} \ x \ 10^{-4}(m^2/cm^2)$$

where:

$$D_A = \frac{[(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w)/n^2]}{\rho_B K_d + \Theta_w + \Theta_a H'}$$

Parameter	Definition (units)	Default
VF_s	Volatilization factor (m^3/kg)	--
D_A	Apparent diffusivity (cm^2/s)	--
Q/C	Inverse of the mean conc. at the center of a 0.5-acre square source (g/m^2-s per kg/m^3)	68.81
T	Exposure interval (s)	9.5×10^8
ρ_b	Dry soil bulk density (g/cm^3)	1.5
Θ_a	Air filled soil porosity (L_{air}/L_{soil})	0.28 or n-Θ_w
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 - (ρ_b/ρ_s)
Θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15
ρ_s	Soil particle density (g/cm^3)	2.65
Di	Diffusivity in air (cm^2/s)	Chemical-specific
H	Henry's Law constant (atm-m^3/mol)	Chemical-specific
H'	Dimensionless Henry's Law constant	Calculated from H by multiplying by 41 (USEPA 1991a)
D_w	Diffusivity in water (cm^2/s)	Chemical-specific
K_d	Soil-water partition coefficient (cm^3/g) = $K_{oc}f_{oc}$	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient (cm^3/g)	Chemical-specific
f_{oc}	Fraction organic carbon in soil (g/g)	0.006 (0.6%)

SOIL SATURATION CONCENTRATION (sat)

Equation 10: Derivation of the Soil Saturation Limit

$$sat = \frac{S}{\rho_b} (K_d \rho_b + \Theta_w + H' \Theta_a)$$

Parameter	Definition (units)	Default
sat	Soil saturation concentration (mg/kg)	--
S	Solubility in water (mg/L-water)	Chemical-specific
ρ_b	Dry soil bulk density (kg/L)	1.5
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 - (ρ_b/ρ_s)
ρ_s	Soil particle density (kg/L)	2.65
K_d	Soil-water partition coefficient (L/kg)	K_{oc} x f_{oc} (chemical-specific)
k_{oc}	Soil organic carbon/water partition coefficient (L/kg)	Chemical-specific
f_{oc}	Fraction organic carbon content of soil (g/g)	0.006 or site-specific
Θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15
Θ_a	Air filled soil porosity (L_{air}/L_{soil})	0.28 or n-Θ_w
w	Average soil moisture content (kg_{water}/kg_{soil} or L_{water}/kg_{soil})	0.1
H	Henry's Law constant (atm-m^3/mol)	Chemical-specific
H'	Dimensionless Henry's Law constant	H x 41, where 41 is a units conversion factor

SOIL-TO-AIR PARTICULATE EMISSION FACTOR (PEF)

Equation 11: Derivation of the Particulate Emission Factor

$$PEF(m^3/kg) = Q/C \; x \; \frac{3600 s/h}{0.036 \; x \; (1-V) \; x \; (U_m/U_t)^3 \; x \; F(x)}$$

Parameter	Definition (units)	Default
PEF	Particulate emission factor (m^3/kg)	1.316×10^9
Q/C	Inverse of the mean concentration at the center of a 0.5-acre-square source (g/m^2-s per kg/m^3)	90.80
V	Fraction of vegetative cover (unitless)	0.5
U_m	Mean annual windspeed (m/s)	4.69
U_t	Equivalent threshold value of windspeed at 7 m (m/s)	11.32
F(x)	Function dependent on U_m/U_t derived using Cowherd (1985) (unitless)	0.194

REFERENCES

Cowherd, C., G. Muleski, P. Engelhart, and D. Gillette. 1985. *Rapid Assessment of Exposure to Particulate Emission from Surface Contamination*. EPA/600/8-85/002. Prepared for Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Washington, DC. NTIS PB85-192219 7AS.

Howard, P.H. 1990. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*. Lewis Publishers, Chelsea Michigan.

U.S. EPA. 1988. *Superfund Exposure Assessment Manual*. EPA/540/1-88/001. Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA. 1990a. *Subsurface Contamination Reference Guide*. EPA/540/2-90/011. Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA 1990b. *Exposure Factors Handbook*. EPA/600/8089/043. Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA. 1991a. *Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*. Publication 9285.7-01B. Office of Emergency and Remedial Response, Washington, DC. NTIS PB92-963333.

U.S. EPA. 1991b. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*. Publication 9285.6-03. Office of Emergency and Remedial Response, Washington, DC. NTIS PB91-921314.

U.S. EPA. 1992a *Technical Support Document for Land Application of Sewage Sludge; Volumes I and II*. Office of Water, Washington, DC. 822/R-93-001a,b.

U.S. EPA. 1992b *Dermal Exposure Assessment: Principles and Applications*. EPA/600/8-91/011B. Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA 1994a. *Estimating Exposure to Dioxin-Like Compounds*. U.S. EPA Office of Research and Development, EPA/600/6-88/005B.

U.S. EPA 1994b. *Role of Ecological Assessment in the Baseline Risk Assessment*. OSWER Directive No. 9285.7-17. Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA 1994c. *Superfund Chemical Data Matrix*. EPA/540/R-94/009. Office of Solid Waste and Emergency Response, Washington, DC. PB94-963506.

U.S. EPA. 1996a. *Soil Screening Guidance: Technical Background Document*. EPA/540/R-95/128. Office of Emergency and Remedial Response, Washington, DC. PB96-963502.

U.S. EPA. 1996b. *Soil Screening Guidance: User's Guide*. EPA/540/R-96/018. Office of Emergency and Remedial Response, Washington, DC. PB96-963505.

U.S. EPA 1996c. *Superfund Chemical Data Matrix*. EPA/540/R-96/028. Office of Solid Waste and Emergency Response, Washington, DC. PB94-963506.

U.S. EPA. 1997a. *Health Effects Assessment Summary Tables* (HEAST): Annual Update, FY 1997. National Center For Environmental Assessment (NCEA), Office of Research and Development and Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA. 1997b. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final*. EPA/540/R-97/006. Office of Solid Waste and Emergency Response, Washington, DC. PB97-963211.

U.S. EPA. 1998a. *Integrated Risk Information System* (IRIS). Duluth, MN.

U.S. EPA. 1998b. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, Interim Guidance. NCEA-W-0364. Office of Emergency and Remedial Response, Washington, D.C.

Van Wijnen, J.H., P. Clausing and B. Brunekreef. 1990. Estimated soil ingestion by children. *Environmental Research*, 51:147-162.

SUBJECT: Changes Made to the June 1999 Screening Value Table and Text

FROM: Cheryl Overstreet, 6PD-NB
Risk Assessor
New Mexico/Federal Facilities Section

TO: Users of the Region 6 Screening Value Table and Text

Several changes were made to the June 1999 update of the Region 6 Human Health Screening Value table and text. These changes are summarized below.

Format- The look of the screening value tables has changed. The tables are now in both Excel and Microsoft Word. The Word table is in landscape orientation with more information included than in the previous table. The MCLs or action levels have been added as well as columns with and without the dermal exposure pathway. When viewing the table on the computer, be sure to have your "header" button turned on. All of the column headings and table descriptors have been done as a header and may not appear on your screen. The headings, however, will print on each page making it easy to tell which screening value goes with what exposure pathway. The same information and more can also be found on the Excel spreadsheet.

Text Revisions- The text has been revised to include more information such as a table with regional background concentrations or ranges. Details concerning the changes made to the screening table are included. The equations have been redone in Wordperfect 8 which improves their readability.

Consistency- Regions 3, 6, and 9 have developed screening level tables that are available on the internet. We are trying to be more consistent with one another. Changes that were made to the Region 6 Human Health Screening Values to accomplish this include changing some chemicals' status to become designated as a volatile organic chemical or changing from volatile to non-volatile. All three regions use the same definition for volatile, but there were several "borderline" chemicals that now should be consistent. Another Region 6 change involved revising all Class C carcinogens to screen at the 10(-6) risk level.

Deletions- Several chemicals were deleted from this update. Most of these chemicals are the deletions that Region 3 made several years ago and have not had any requests to add them back to their table. The purpose of the chemical deletions are to make the review time for revisions shorter and to make the file smaller. The following chemicals were deleted:

Acephate	Chlorsulfuron	Imazaquin	Pentabromodiphenyl ether
Acetone cyanohydrin	Chlorthiophos	Iprodione	Phenmedipham
Acifluorfen	Cyclohexylamine	Isoxaben	Phorate
Ally	Cyromazine	Lactofen	Phosmet
Ally alcohol	Danitol	Linuron	Picloram
Aluminum phosphide	Decabromodiphenyl ether	Londax	Pirimiphos-methyl
Ametryn	Demeton	Maleic hydrazide	Prochloraz
m-Aminophenol	Diallate	Malononitrile	Profluralin
Amitraz	Diethylformamide	Mancozeb	Pronamide
Ammonium sulfamate	Diflubenzuron	Maneb	Propham
Antimony potassium tartrate	Dimethipin	Merphos	Pydrin
Apollo	Dimethoate	Merphos oxide	Quinalphos
Aramite	N,N-Dimethylformamide	Matalaxyl	Savey
Asulam	Dimethyl terephthalate	Methamidophos	Selenourea
Avermectin B1	Diphenamid	Methomyl	Sethoxydim
Bayleton	Direct black 38	2-Methoxyethanol	Systhane
Benefin	Direct blue 6	2-Methoxyethanol acetate	Tebuthiuron
Benomyl	Direct brown 95	2-Methoxy-5-nitroaniline	Temephos
Benzotrichloride	Dodine	2-Methylaniline hydrochloride	Terbacil
Bidrin	1,2-Epoxy-butane	Methyl chlorocarbonate	Terbufos
Biphenthrin (Talstar)	EPTC	4-4'-Methylenebis-benzeneamine	Terbutryn
Bis(2-chloro-1-methylethyl)ether	Ethephon	Metribuzin	Tetraethyldithiopyrophosphate
Bisphenol A	Ethyl acrylate	Molinate	TCMTB
4-Bromophenyl phenyl ether	Ethylene cyanohydrin	Napropamide	Thiofanox
Bromoxynil octanoate	Ethyl p-nitrophenyl phenylphos-phorothloate	Nitrapyrin	Thiophanate-methyl
Butylphthalyl butylglycolate	Ethylphthalyl ethyl glycolate	3-Nitroaniline	Thiram
Cacodylic acid	Express	4-Nitroaniline	Tralomethrin
Captafol	Fluoridone	Nitroguanidine	Triallate
Carboxin	Flurprimidol	Norflurazon	Triasulfuron
Chloramben	Flutolanil	Octabromodiphenyl ether	2,4,6-Trichloroaniline hydrochloride
Chlorimuron-ethyl	Fluvalinate	Octamethylpyrophosphoramide	Tridiphane
Chloroacetaldehyde	Folpet	Paclobutrazol	Trifluralin
2-Chloroacetophenone	Fosetyl-al	Pebulate	Vernam
4-Chloro-2-methylaniline hydrochloride	Furium	Pendimethalin	
Chlorothalonil	Furmecyclox	Pentabromo-6-chloro cyclohexane	
Chlorpropham	Glufosinate-ammonium		
	Haloxyfop-methyl		
	Harmony		
	Imazalil		

Dermal-

The soil adherence factors changed for both adult and child and an industrial adult adherence factor was added. Default adsorption factors for inorganic chemicals are no longer recommended by the dermal workgroup and this default was deleted from the screening value table. All of the assumptions used for dermal as well as other exposure pathways can be found in the text in the table entitled, Standard Default Factors.

Changes in Toxicity Values, Physical and Chemical Parameters-
While very few toxicity factors changed (acetonitrile and benzene), physical and/or chemical factors were revised for several chemicals. These changes which include changing the molecular weight, the voc status, Henry's law number, physical state, may or may not have made a difference to the actual screening value derived. The chemicals with something changed are acetonitrile, benzene, o-chloronitrobenzene, p-chloronitrobenzene, chromium III, cyanogen, 1,2-dibromo-3-chloropropane, dibromochloromethane, hydrogen sulfide, methylcyclohexane, methylene bromide, alachlor, aldicarb, aldicarb sulfone, 4-aminopyridine, atrazine, captan, cargaryl, carbofuran, chlorobenzilate, chlorpyrifos, dicamba, 2,4-D, diethylstilbestrol, 3,3'-dimethylbenzidine, 1,3-dintrobenzene, 1,4-dintrobenzene, dioxin, endothall, ETU, kepone, maleic anhydride, 2-nitroaniline, p-nitrotoluene, oxamyl, parathion, polybrominated biphenyls, 1,1,1,2-tetrachloroethane, toluene-2-4-diamine, toluene-2-6-diamine, p-toluene, and 1,3,5-trinitrobenzene.

All soil based - always use dermal because most conservative

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

Indoor screening

Risk-Based Screening Levels

actual [ ]-that are used / using level

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

(use data from site and use risk (comment calcs.

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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

EPA REGION 6- HUMAN HEALTH MEDIUM-SPECIFIC SCREENING LEVELS

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

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