Summary of Technical Impracticability Waivers at National Priorities List Sites

REPORT WITH GENERAL TECHNICAL IMPRACTICABILITY SITE INFORMATION SHEETS

1.0 INTRODUCTION

The purpose of this report is to provide a summary of Technical Impracticability (TI) waivers that have been issued by U.S. Environmental Protection Agency (EPA) Regions, and to distribute brief summaries of the completed TI waiver decisions, including a summary of the site conditions and the Regions' rationale for adopting a TI waiver. TI waivers are one of the means of waiving applicable or relevant and appropriate requirements (ARARs), consistent with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 (b) and by the National Contingency Plan (NCP) (see Section 300.430(f)(1)(ii)(C)(3)). Through analysis of site data and demonstration of the technical impracticability of achieving those ARARs (for example, maximum contaminant levels [MCLs] or other federal or state standards), a waiver may be appropriate. The compiled information in this report may be useful in evaluating whether a TI waiver may be part of a current site's remedial strategy. There have been significant scientific advances and technological innovations and improvements that may be relevant in evaluating the appropriateness of new TI waivers. For example, over time, innovative technologies such as in-situ thermal treatment and in-situ flushing have been found to effectively treat dense non-aqueous phase liquids (DNAPLs). Progress has also been made in locating the aqueous phase plume (dissolved) and in delineating the entry locations where DNAPL was released and likely is present in the subsurface.

The EPA has issued guidance on TI waivers, titled "Guidelines for Evaluating the Technical Impracticability of Ground Water Restoration," OSWER Directive 9234.2-25, September 1993. Although Headquarters is typically consulted, the TI decision is generally made by the EPA Regional Administrator. For additional information on consultation procedures for Superfund response decisions, see Appendix C of "*A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*," OSWER Directive 9200.1-23.P, July 1999. Additional information regarding the 1993 TI Guidance, especially regarding communications, points of contact, and the TI decision review process (including regional TI review teams) can be found in "*Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Ground-Water Restoration at Superfund Sites*," OSWER Directive 9200.4-14, January 19, 1995.

This report compiles historical information on 91 TI waivers that have been approved for either groundwater or surface water at 85 National Priorities List (NPL) Sites (also called Superfund sites) between 1988 and 2011. Sources of this TI information include Records of Decision (ROD); ROD Amendments; five-year reviews; explanations of significant differences (ESD); site summaries; TI evaluations as stand-alone reports or as part of a feasibility study (FS) or focused FS; petitions and requests for TI waivers; TI demonstration reports; and TI determinations. Information included in this report was verified by contacting regional personnel.

A summary sheet for each TI waiver is included in Appendix A to this report. These summary sheets are intended to synthesize the site information contained in a technical evaluation report or decision document. They are not intended to be used as a substitute for the complete evaluation report or decision document. For additional information on each TI determination, consult the evaluation report or decision document referenced in each summary sheet.

This report provides only a summary of the numbers and types of TI waivers that have been granted in the past by regions. It does not provide an evaluation of the basis of those decisions or recommendations as to how those decisions would be made if the TI waiver were being considered at the present time.

2.0 OVERVIEW OF TI WAIVERS ISSUED

Between 1988 and 2011, the EPA issued between one and eleven TI waivers each year (except 2008 and 2010 when no waivers were issued). A total of 91 TI waivers were issued at 85 sites. Figure 1 shows the number of TI waivers issued in each year. Of the 85 sites with TI waivers, eight are federal facilities. Nine of ten EPA regions have issued waivers; Region 4 is the only region that does not currently have any final TI waivers. Figure 2 shows the number of TI waivers issued by each region.

Figure 1: EPA TI Waivers by Fiscal Year (FY 1988 – 2011)

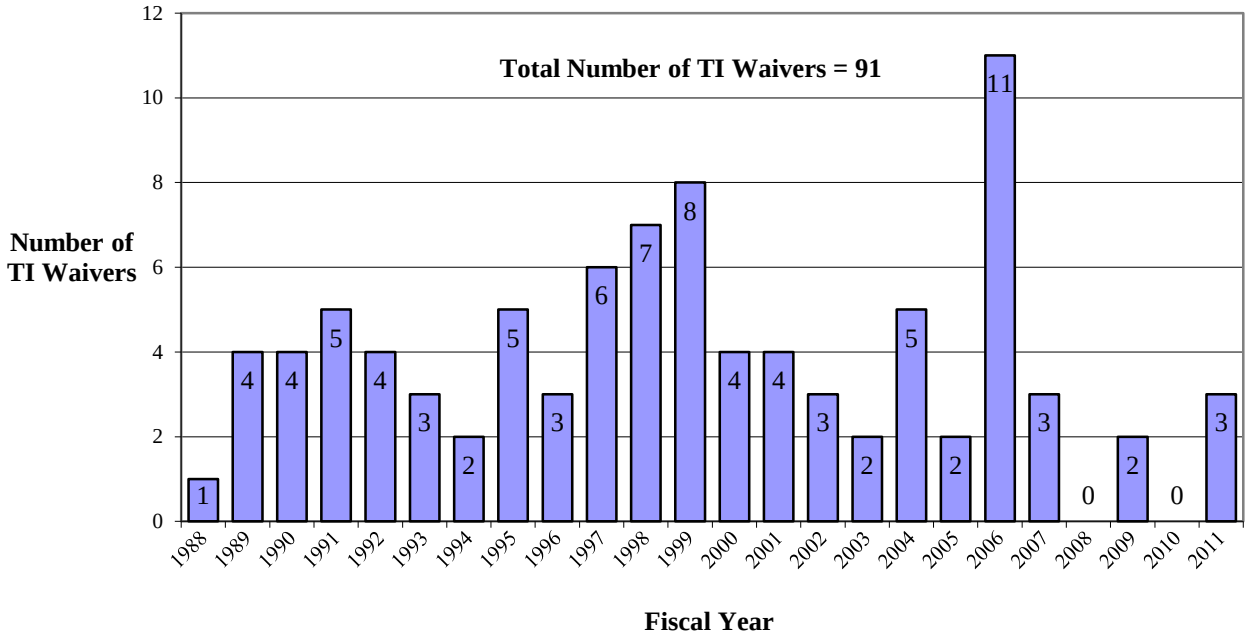
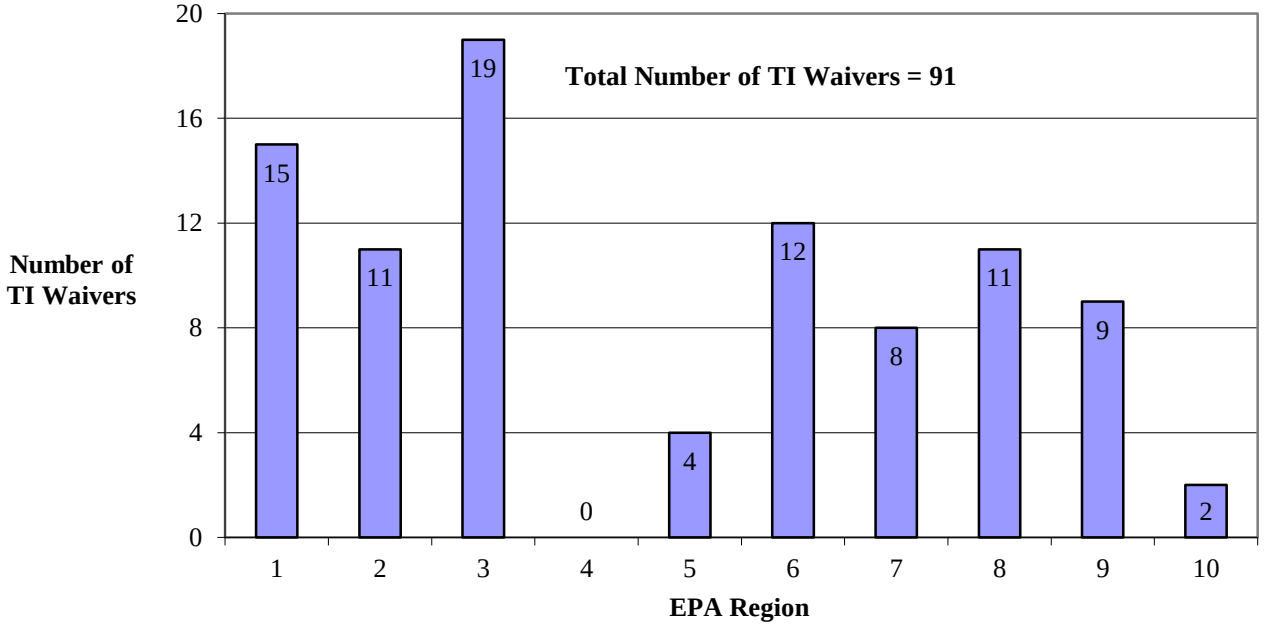


Figure 2: TI Waivers per Region (FY 1988 – 2011)



Of the 91 waivers, 81 have applied to groundwater only, six have applied to surface water only, and four have applied to both media. Most often, the ARAR waived was the maximum contaminant level (MCL) (55 waivers) or state drinking water standard (27 waivers) for at least one contaminant. Other ARARs waived included other federal or state drinking water standards and surface water quality standards.

TI waivers have been applied to only a shallow aquifer, to only the deep aquifer, to all aquifers at the site, or to multiple but not all aquifers. At one site, a TI waiver was applied to underground mine workings.

3.0 JUSTIFICATION FOR TI WAIVERS ISSUED

Based on the available information, a total of 23 different factors were cited as rationale for the 91 TI waivers. Some common factors that have been used in the past as justification for TI waivers are discussed below. In most cases, more than one factor was cited as the basis for a TI waiver.

Geology and hydrogeology – Complex geology was cited as a contributing factor in the rationale for 54 of the 85 groundwater TI waivers and included fractured bedrock, karst terrain, and heterogeneous soils with low permeability. Other factors were present or cited to justify the TI waiver for the 54 that cited complex geology. For additional information about hydrogeologic characteristics, refer to Figure 1 of the 1993 TI Guidance.

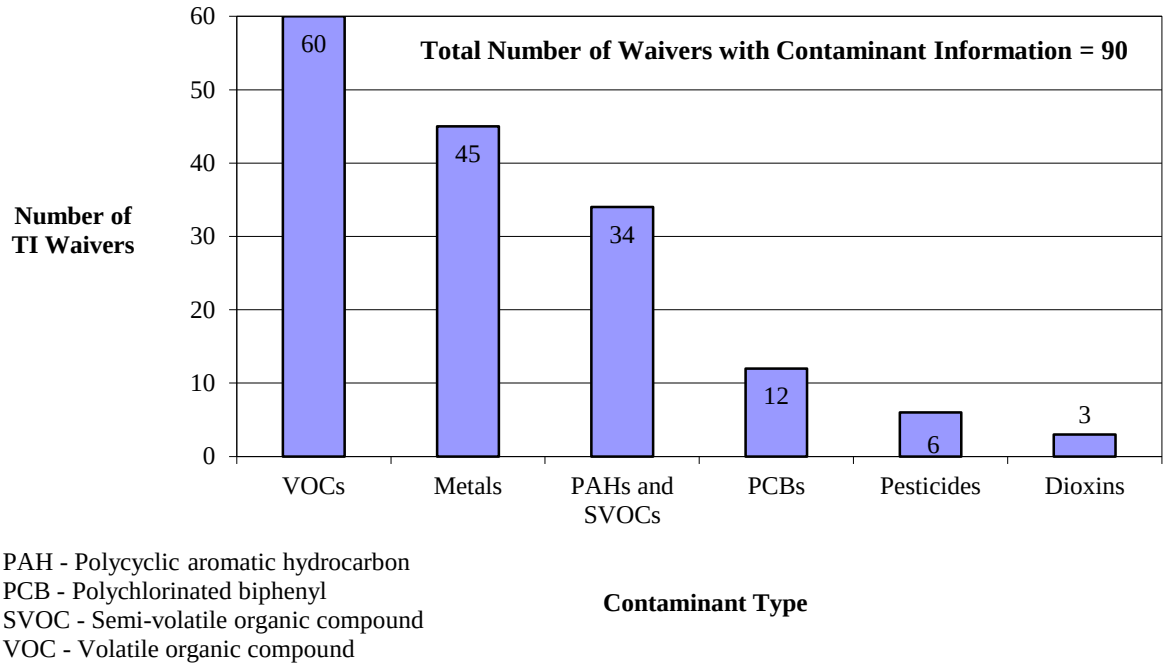
Non-aqueous phase liquid (NAPL) and other contaminants – NAPLs, because of their physical properties, may occur as "free phase" or "residual" contamination entrapped in difficult to remediate locations and because of their low solubilities, may serve as long-term continuous contaminant sources. The presence of NAPL was cited as a contributing factor in the rationale for 47 TI waivers. DNAPL was included in 43 waivers, light non-aqueous phase liquid (LNAPL) in nine TI waivers, and the type of NAPL was not specified in three waivers. Eight waivers cited both LNAPL and DNAPL.

In addition, 16 TI waivers cited certain other complexities (e.g., low solubility, tendency to sorb to organic soils, and relative immobility in the subsurface) presented by contaminants such as metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs), as contributing to the rationale for the TI waiver.

There are 44 waivers where NAPL is not an issue, and most of those sites have metals contamination. There are two sites with a TI waiver, where even though NAPL was present, the TI waiver applied to only metals contamination. Of the ten TI waivers for surface water, eight of them apply to metals contamination.

The most common types of contaminants waived in a TI waiver are shown in Figure 3. Volatile organic compounds (VOCs) (60 waivers), metals (45), and semi-volatile organic compounds (SVOCs) and PAHs (34) are the most common contaminant groups addressed by a TI waiver.

Figure 3: Types of Contaminants Addressed by TI Waivers



PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyl
SVOC - Semi-volatile organic compound
VOC - Volatile organic compound

Site-specific conditions – Other factors that have been considered when evaluating the ability to achieve ARARs include: (1) a large source that could not be removed (12 TI waivers); (2) the presence of upstream sources (six TI waivers); and (3) too much volume to treat prior to surface water discharge as a result of storm events or mine drainage (three TI waivers).

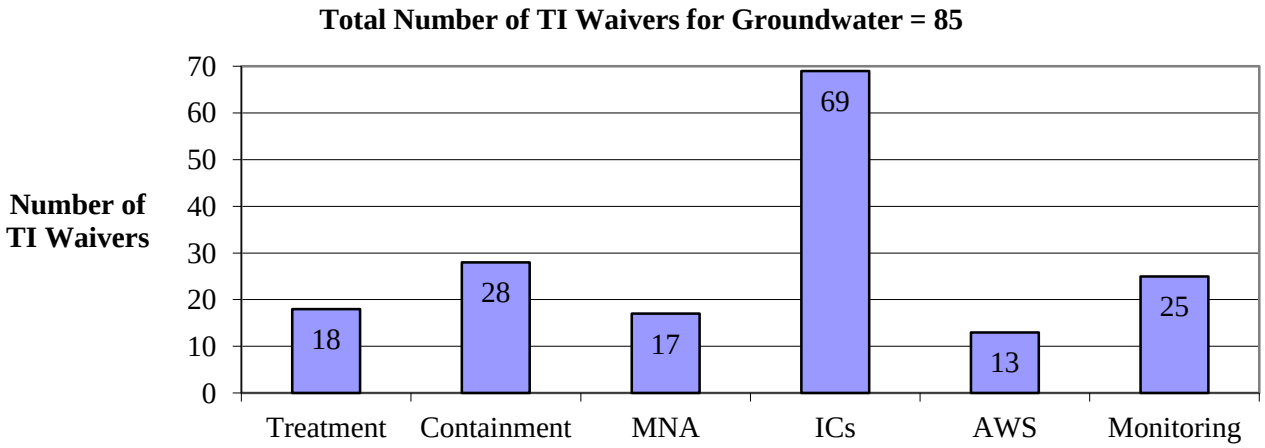
Timeframe – With regard to considering the timeframe associated with achieving ARARs, of the 91 waivers, 56 had information about the timeframe. Most of those waivers (more than 90 percent) included timeframes of greater than 100 years.

4.0 ATTAINING PROTECTIVENESS

Groundwater remedial alternatives – The groundwater remedy components implemented to ensure protectiveness at sites with TI waivers for groundwater ARARs are shown in Figure 4. Note that sites typically have more than one groundwater remedy; therefore the number of remedies exceeds the number of TI waivers for groundwater. Remedial components identified in waivers include treatment, containment, monitored natural attenuation (MNA), institutional controls (ICs), alternate water supplies (AWS) or well-head treatment, and monitoring.

Source control measures – With regard to remediation of contamination sources as a part of aquifer restoration efforts, removal is the most common source action, selected at 31 sites (36 percent). Source containment and treatment were selected at 17 and 10 sites, respectively.

Figure 4: Groundwater Remedy Components Coupled with TI Waiver to Ensure Protectiveness



5.0 SUMMARY

In summary, TI waivers have been issued at sites in every region except Region 4. The most common type of TI waiver has been for groundwater restoration to ARARs (75 percent). The most common contaminant groups addressed by TI waivers have been VOCs (67 percent), metals (50 percent), and SVOCs/PAHs (38 percent). The most common reasons that have been used to justify TI waivers for groundwater ARARs are complex geology (64 percent) and the presence of NAPL (55 percent). Where TI waivers have been issued for surface water, the most common reasons that have been used to justify the TI waivers are the presence of upstream sources (60 percent) and the presence of very large sources that cannot be removed (50 percent). Nearly all TI waivers included more than one reason for the waiver.

The Superfund program remains committed to restoring groundwater to beneficial reuse consistent with CERCLA and the NCP, and bringing human exposures under control. TI waiver determinations are a recognized part of the EPA's remedial strategy, and they may be appropriate depending on site-specific conditions, as discussed in the 1993 TI Guidance.

In light of the continuing scientific advances in groundwater remediation technologies which continue to evolve, regions should not be limited by previously-approved TI waivers described in this technical report as justification for what may be appropriate when evaluating and documenting current or future TI waivers.

Sites with Technical Impracticability Waivers (Listed by Region)

REGION 1
Charles-George Reclamation Trust Landfill, MA (A-1)
Pinette's Salvage Yard, ME (A-2)
Sullivan's Ledge, MA (A-3)
Old Springfield Landfill, VT (A-4)
Pease Air Force Base, Site 32/36, NH (A-5)
Tansitor Electronics, Inc., VT (A-6)
South Municipal Water Supply Well, NH (A-7)
Hocomonco Pond, MA (A-8)
Loring Air Force Base, Entomology Shop (ES) and Jet Engine Build-up Shop (JEBS), ME (A-9)
Loring Air Force Base, Quarry site, ME (A-10)
McKin Superfund Site, ME (A-11)
O'Connor Superfund Site, ME (A-12)
Durham Meadows, CT (A-13)
West Site/Hows Corner, ME (A-14)
Elizabeth Mine Superfund Site, VT (A-15)

REGION 2
Caldwell Trucking Co., NJ (A-16)
GE Moreau, NY (A-17)
Niagara Mohawk Power Corp. (Saratoga Springs Plant), NY (A-18)
Love Canal, NY (A-19)
Dupont/Necco Park, NY (A-20)
Federal Creosote, NJ (A-21)
Hudson River PCBs, NY (A-22)
Roebling Steel Company, NJ (A-23)
Atlantic Resources, NJ (A-24)
Horseshoe Road, NJ (A-25)
Chemical Insecticide, NJ (A-26)

REGION 3
Dorney Road Landfill, PA (A-27)
Heleva Landfill, PA (A-28)
Middletown Air Field, PA (A-29)
Whitmoyer Laboratories, PA (A-30)
Lindane Dump, PA (A-31)
Westinghouse Elevator Co, PA (A-32)
E.I. Dupont Nemours (Newport Landfill), DE (A-33)
Hunterstown Road, PA (A-34)
Aladdin Plating, PA (A-35)
Butler Mine Tunnel, PA (A-36)
Brodhead Creek, PA (A-37)
Revere Chemical Co, PA (A-38)
Aberdeen Proving Ground, Edgewood Area (OU2), MD (A-39)
Aberdeen Proving Ground, Edgewood Area (OU8), MD (A-40)
Rodale Manufacturing Co., Inc., PA (A-41)
Naval Air Development Center, PA (A-42)
Keystone Sanitation Landfill, PA (A-43)
Westinghouse Electric (Sharon Plant), PA (A-44)
UGI Columbia Gas Plant, PA (A-45)

REGION 5
Continental Steel Corp, IN (A-46)
Conrail Rail Yard (Elkhart), IN (A-47)
Lemon Lane Landfill, IN (A-48)
Neal's Landfill, IN (A-49)

REGION 6
Hardage/Criner, OK (A-50)
Crystal Chemical Co., TX (A-51)
Highway 71/72 Refinery, LA (A-52)
Popile Inc. Superfund Site, AR (A-53)
Garland Creosoting, TX (A-54)
Petro-Chemical Systems Inc. (Turtle Bayou), TX (A-55)
Hart Creosoting, TX (A-56)
Midland Products, AR (A-57)
Jasper Creosoting, TX (A-58)
Vertac, AR (A-59)
City of Perryton Well #2, TX (A-60)
North Cavalcade, TX (A-61)

REGION 7
Cherokee County, Baxter Springs and Treece Subsites, KS (A-62)
Cherokee County, Galena Subsite, KS (A-63)
Aluminum Company of America-Davenport, IA (A-64)
Missouri Electric Works, MO (A-65)
Waterloo Coal Gasification Plant, IA (A-66)
Oronogo-Duenweg Mining Belt, MO (A-67)
Iowa City FMGP, IA (A-68)
Riverfront, MO (A-69)

REGION 8
East Helena, MT (A-70)
Whitewood Creek, SD (A-71)
Broderick Wood Products, CO (A-72)
Silver Bow Creek/Butte Area (OU3), MT (A-73)
Anaconda Co. Smelter, MT (A-74)
Summitville Mine, CO (A-75)
Milltown Reservoir Sediments, MT (A-76)
Silver Bow Creek/Butte Area (OU8), MT (A-77)
Libby Groundwater Contamination, MT (A-78)
California Gulch, CO (A-79)
Anaconda Co. Smelter, MT (A-80)

REGION 9
Westinghouse Electric Corp (Sunnyvale Plant), CA (A-82)
Schofield Barracks, HI (A-83)
Tucson International Airport Area, AZ (A-84)
Del Norte Pesticide Storage, CA (A-85)
J.H. Baxter & Co., CA (A-86)
Del Amo, CA (A-87)
Koppers Co. Inc. (Oroville Plant), CA (A-88)
Montrose Chemical Corp., CA (A-89)
Edwards Air Force Base, CA (A-90)

REGION 10
Eielson Air Force Base (OU2), AK (A-91)
Eielson Air Force Base (OU4), AK (A-92)

For Headquarters TI consultation, please contact Matthew Charsky (charsky.matthew@epa.gov or 703-603-8777) or Dave Bartenfelder (bartenfelder.david@epa.gov or 703-603-9047) of the EPA's Office of Superfund Remediation and Technology Innovation, Assessment and Remediation Division, Science Policy Branch.

For additional information regarding the individual site summaries, please refer to the regional contacts below:

Region 1	Bill Brandon	Region 6	Greg Lyssy
Region 2	Matthew Westgate	Region 7	Bill Pedicino
Region 3	Kathy Davies	Region 8	Fran Costanzi
Region 4	Bill Osteen	Region 9	Herb Levine
Region 5	Luanne Vanderpool	Region 10	Jonathan Williams

6.0 REFERENCES

EPA. 1993. *Guidelines for Evaluating the Technical Impracticability of Ground Water Restoration*, OSWER Directive 9234.2-25, September. www.epa.gov/superfund/health/conmedia/gwdocs/techimp.htm.

EPA. 1995. *Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Ground-Water Restoration at Superfund Sites*, OSWER Directive 9200.4-14, January 19. www.epa.gov/superfund/policy/remedy/pdfs/92-00414-s.pdf.

EPA. 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, OSWER Directive 9200.1-23.P, July. www.epa.gov/superfund/policy/remedy/rods/index.htm.

APPENDIX A:

Summary of Technical Impracticability Waivers at Superfund Sites

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 1: 14 sites (15 waivers)
Site Name: Charles-George Reclamation Trust Landfill *State:* MA; *OUs:* 3 & 4 *Decision Doc. (Type & Date):* ROD, 9/29/88 *Stage:* Pre- construction *Media:* Groundwater *References:* (1) ROD, OUs 3 and 4, 9/29/88, www.epa.gov/superfund/sites/rods/fulltext/r0188029.pdf; (2) Five-year review, 2010, www.epa.gov/region1/superfund/sites/charlesgeorge/454642.pdf	***TI Decision:*** ARARs to achieve MCLs for certain contaminants (specifically benzene, arsenic, and cadmium) in the "Eastern Deep Bedrock Plume" area (groundwater deeper than 100 ft below ground surface) are waived because they are not likely to be attained.
	Rationale: Contaminated deep bedrock groundwater will only be monitored (not remediated) for the following reasons: (1) given the uncertainties regarding the spatial extent of the deep bedrock plume and the difficulties in predicting groundwater flow in bedrock, it is considered infeasible to extract the entire deep bedrock plume. Heavy pumping for remedial purposes in the eastern deep aquifer could cause further contaminant migration by drawing contamination from the shallow aquifers into the deeper one; (2) upon extension and connection of a municipal water line from an alternate water supply source to nearby areas, the deep aquifer in the affected areas will not be used for drinking water; (3) with landfill capping and overburden/shallow bedrock remediation, the landfill is not expected to contribute more contaminants to the deep plume, and MCLs and acceptable risk levels should be attained through natural attenuation at an approximate distance of 1,000 feet east of the landfill; and (4) this deep plume is not expected to discharge to nearby surface water bodies or move up into the overburden aquifer in the Flint Pond area. As such, it will not pose environmental risks to these surface waters nor human health risks to users of the Flint Pond aquifer. The Eastern Deep Bedrock Plume is inferred to discharge to the Merrimack River where groundwater monitoring will be implemented in order to track contaminants on an ongoing basis. In the event of deteriorating conditions, the need for additional actions will be examined.
	Conditions: *NAPL (suspected or observed)* – DNAPL has not been observed and, based on groundwater data, is not expected to be present at the site. Eleven chlorinated VOCs are listed as COCs for the site, 9 of which are COCs because they are found in concentrations in landfill gas vent emissions. In 1987, TCE was observed in landfill leachate (maximum of 24 ppb), and 1,1-DCA was found in leachate and in overburden groundwater (maximum of 83 ppb, and 16J ppb, respectively). The presence of DNAPL was not identified as a reason for the TI waiver. *COCs* (for the Eastern Deep Bedrock Plume) – Benzene, arsenic, and cadmium *Concentration* – Maximum concentrations for COCs in the Eastern Deep Bedrock Plume area are benzene (69 ppb), arsenic (93 ppb), and cadmium (19 ppb). Site-wide COCs are listed in Table 1 of ROD. *Geology* – Bedrock *TI Zone* – TI zone includes the deep bedrock aquifer (not the overburden or shallow bedrock aquifers); however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not estimated *Remedial Action Alternatives* – Contaminated overburden and shallow bedrock groundwater will be treated using P&T. The Eastern Deep Bedrock Plume area, however, will only be monitored.
	Current Status/Activities: P&T for overburden and shallow bedrock groundwater is currently in the LTRA phase. An alternate water supply has also been provided to nearby residents. Sampling was conducted in 2006 and 2009. The 2010 5-year review recommended that (1) additional monitoring be established to increase understanding of contaminant distributions and trends, and (2) ICs be established to prevent use of contaminated groundwater and to prevent disturbance of the landfill cap.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Pinette's Salvage Yard *State:* ME; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 5/30/89 *Stage:* Pre- construction *Media:* Groundwater *References:* (1) ROD, OU 1, 5/30/89, www.epa.gov/superfund/sites/rods/fulltext/r0189034.pdf; (2) Site summary,www.yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/0c97f4916d26dbdd8525691f0063f6e9!OpenDocument; (3) Five-year review, 2010, www.epa.gov/region1/superfund/sites/pinette/470820.pdf	***TI Decision:*** ARARs to achieve state MEG (0.5 ppb) are waived for PCBs in groundwater beneath the property.
	Rationale: PCBs are bound to aquifer soil particles and not easily removed from the subsurface. However, these PCBs can continue to dissolve and enter groundwater at concentrations above drinking water standards. The 1989 ROD did not require restoration of groundwater to drinking water quality, but rather explicitly recognized the technical impracticability, from an engineering perspective, of reducing PCBs to the Maine MEG of 0.5 ppb. The objectives of the groundwater migration management component of the ROD were (1) to reduce the potential off-site migration of PCBs by reducing concentrations of associated VOCs that facilitate transport of PCBs, and (2) to prevent ingestion of contaminated water from the site. Thus, the selected P&T remedy objectives were set to reduce other organic COCs to the following cleanup goals: benzene, 5 ppb; 1,4-dichlorobenzene, 27 ppb; chlorobenzene, 47 ppb; 1,2,4-trichlorobenzene, 680 ppb; and chloromethane, 10 ppb.
	Conditions: *NAPL (suspected or observed)* – An estimated 1,000 gallons of dielectric fluids containing PCBs were spilled directly to the land surface (from 3 obsolete electrical transformers brought to the site for salvage). *COCs* – PCBs, VOCs, SVOCs, metals *Concentration* – Maximum PCB concentrations in the shallow and bedrock groundwater were 23 and 7.4 ppb, respectively, based on unfiltered samples reported in the 1989 ROD. *Geology* – The site is underlain by two distinct aquifers separated by an intervening clay unit. The clay unit has a low permeability relative to the overlying alluvium, acts as an aquitard limiting the downward movement of recharge waters and contaminants. The clay unit also creates semi-confined conditions for the underlying till/fractured rock aquifer zone. *TI Zone* – The extent of the TI zone is undefined in the 1989 ROD but includes the area where the salvage yard operations took place on the Roger and Cynthia Pinette property. ICs (a restrictive covenant to the property, which applies to a 260-foot circle) have been issued to limit groundwater use, and other activities, on a portion of this property until Maine DEP determines that such restrictions are no longer necessary.
	Evaluation: *Remedial Timeframe Estimate (years)* – The timeframe to restore groundwater was not estimated in the ROD, because the removal of PCBs, sorbed to particulates, in groundwater was unlikely to be sufficient to meet Maine MEGs. *Remedial Action Alternatives* – Excavation and removal of PCBs and other organic COC-contaminated soils. Following excavation, collection and treatment of COC-contaminated groundwater in the alluvium using interceptor trenches. P&T was selected to address other organic contamination present in the aquifer underlying the clay unit.
	Current Status/Activities: The source control remedial action was completed in 1993, and VOC concentrations have decreased to below or near target cleanup goals, as established in the 1989 ROD. Thus, additional extraction and treatment of groundwater is no longer warranted. ICs, including a restrictive covenant, have been issued. The site was deleted from the NPL in 2002. As part of the 5-year review, groundwater samples were collected in 2009 and sampling results indicate that PCB concentrations in groundwater (within the IC area) remain above the cleanup goal.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Sullivan's Ledge *State:* MA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 6/29/89 *Stage:* Pre Construction *Media:* Groundwater *References:* (1) ROD, OU 1, 6/29/89, www.epa.gov/superfund/sites/rods/fulltext/r0188029.pdf; (2) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f03-01009.pdf; (3) Five-year review, 2008, www.epa.gov/superfund/sites/fiveyear/f2008010002480.pdf	***TI Decision:*** ARARs to achieve MCLs, and state drinking water and groundwater quality standards are being waived for groundwater in the bedrock due to geologic factors and the presence of DNAPL.
	Rationale: EPA concluded that the former granite quarry pits and bedrock fractures contain DNAPL, as a result of dumping liquid wastes into the pits at depths approaching 150 feet into the bedrock. The determination of technical impracticability is based on the nature of the wastes and contaminants within the pits and along the bedrock fractures and the geology of the site. Bedrock fractures are irregular both in length and orientation and, therefore, cannot be accurately located, especially at depths greater than 100 feet. In addition, pockets of highly contaminated wastes located within the pits and along fractures cannot be cleaned up by conventional excavation and pumping methods as it is technically not possible to locate and extract the contamination in all the pockets.
	Conditions: *NAPL (suspected or observed)* – DNAPL suspected in deep bedrock. TCE concentrations were observed in one Westbay multilevel sampling port (zone 5 of well ECJ-4 at more than 200 feet bgs at a location over 1,000 feet from the original disposal area) to be 270,000 ppb (or approximately 25 percent of its solubility). *COCs* – VOCs, SVOCs, PCBs, and metals *Concentration* – Initial concentrations observed for total VOCs during the RI were as high as 8,200 ppb (overburden); up to 54,000 ppb (shallow bedrock) including benzene at 1,200 ppb, 1,2-DCE at 51,000 ppb, TCE at 4,000 ppb, vinyl chloride at 6,900 ppb, and up to 95,000 ppb (deep bedrock). *Geology* – Fractured bedrock *TI Zone* – TI waiver applies to the groundwater on site (former granite quarry pit area) and immediately off site); however the extent of the TI zone is undefined in the references reviewed..
	Evaluation: *Remedial Timeframe Estimate (years)* – Because achievement of ARARs for groundwater in bedrock was determined to be impracticable, estimates of remedial timeframes were not provided in the ROD. *Remedial Action Alternatives* – Install an impermeable cap over source area and a passive underdrain on top of bedrock to collect groundwater contamination moving through the overburden. Implement active groundwater collection system using deep bedrock extraction well in close proximity to disposal pits. The cleanup goal for the passive system is achievement of AWQS for the designated uses of the receiving waters, and significant reduction in bedrock contamination for the active collection system. Accomplishment of the active system goal will be determined by either an achievement of 1-10 ppm of total VOCs, an asymptotic curve using groundwater monitoring data, or both, indicating that significant reductions are no longer being achieved. A ROD Amendment to revise the active collection system performance goal is contemplated if monitoring data indicate that increasing or decreasing the concentration goals is needed.
	Current Status/Activities: The active groundwater collection system began operation in 1999 and continues to operate; draft ICs restricting groundwater use and deed restrictions regulating land use are currently being reviewed as of the 2008 5-year review.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Old Springfield Landfill *State:* VT; *OU:* 2 *Decision Doc. (Type & Date)*: ROD, 9/29/90 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/29/90, www.epa.gov/superfund/sites/rods/fulltext/r0190033.pdf; (2) Five-year review, 2003, www.epa.gov/region01/superfund/sites/oldspringfield/48677.pdf; (3) Five-year review, 2008, www.epa.gov/region1/superfund/sites/oldspringfield/295800.pdf	***TI Decision:*** The ARAR to achieve the Vermont Groundwater Protection Act Enforcement Standard for PCE is being waived. Other groundwater ARARs have not been waived.
	Rationale: At this site, two state enforcement standards have been established that are more stringent than MCLs (for PCE and xylenes). EPA is invoking a waiver of the enforcement standard for PCE, because EPA has determined that in this circumstance, it is technically impracticable from an engineering perspective to establish a standard below a PQL. The PQL determined in accordance with SDWA methods will be the cleanup level for PCE, which is equivalent to its MCL.
	Conditions: *NAPL (suspected or observed)* – Maximum concentrations of chlorinated VOCs found in groundwater are less than 10 percent of their respective solubility limits. However, the potential for entry of NAPLs into the subsurface cannot be dismissed with certainty given the sources of waste materials and historic disposal practices at this landfill. *COCs* – 15 VOCs, 4 SVOCs, naphthalene, 2 PCBs, 3 metals *Concentration* – Groundwater concentrations are in Tables 1 and 2 of ROD. *Geology* – Overburden materials include glacial till overlying a zone of permeable sand and gravel. These materials are underlain by fractured bedrock. *TI Zone – The* compliance boundary is the downgradient edge of the waste management unit; however, the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – At least 30 years *Remedial Action Alternatives* – Installation of an impermeable cap, leachate collection using underground drains, and P&T using source control extraction wells.
	Current Status/Activities: P&T started in 1993 and operation continues. An alternate water supply (municipal water line) has been provided, and ICs restricting groundwater use are in place. The Vermont standard for PCE was revised in 2005. The state standard (and ARAR) is now equal to the MCL, thus rendering the original waiver moot. According to the 2008 5-year review, operation of the P&T system, periodic cap inspections, and maintenance are currently being conducted at the site.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Pease Air Force Base, Site 32/36 *State:* NH; *OU:* 4 *Decision Doc. (Type & Date):* ROD, 9/26/95 *Stage:* Pre- construction *Media:* Groundwater *References:* (1) ROD, OU4, 9/26/95, www.epa.gov/superfund/sites/rods/fulltext/r0195109.pdf; (2) Revised Site 32 TI Evaluation, March 1995; (3) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009010003308.pdf	***TI Decision:*** ARARs to achieve MCLs are being waived for TCE and its degradation products (1,2-DCE; 1,1-DCE; and vinyl chloride) due to residual DNAPL and complex hydrogeology.
	Rationale: Residual DNAPL is difficult to mobilize by P&T, which may result in extraction of excessive amounts of relatively uncontaminated groundwater with relatively minimal removal of contaminant mass. In addition, complex hydrogeology is present at the site and consists of four different overburden units, which are all hydraulically interconnected. Two of the four units (Lower Sand and Glacial Till units) have a low yield, which makes groundwater extraction difficult. Geotechnical evaluations also found that groundwater extraction from the shallow fractured bedrock may dewater and cause consolidation of the overlying Marine Clay and Silt unit, potentially resulting in excessive settlement of nearby buildings. The shallow depth to groundwater, irregular depth to bedrock, and fractured nature of the bedrock also would limit the potential success of soil vapor extraction, air sparging, and physical barriers (particularly horizontal barriers) to contain source area contamination.
	Conditions: *NAPL (suspected or observed)* – Free-phase DNAPL has not been observed or recovered but it is believed that residual DNAPL exists based on TCE concentrations. *COCs* – Chlorinated VOCs *Concentration* – TCE: 940,000 µg/L maximum *Geology* – 4 different units (clay and silt) underlain by fractured bedrock at shallow depths *TI Zone* – The TI zone includes residual DNAPL and contaminated groundwater that does not meet ARARs and is restricted to the source area and that portion of the dissolved-phase plume that can be hydraulically contained by the vertical barrier and groundwater P&T. Vertically, the zone extends approximately 20 feet into the shallow bedrock.
	Evaluation: *Remedial Timeframe Estimate (years)* – An estimate of 16,985 gallons of residual DNAPL and additional assumptions were used to calculate the restoration timeframe of 175 years to reduce TCE to acceptable levels using P&T (assuming that all residual TCE could be mobilized). *Remedial Action Alternatives* – The selected remedy includes a vertical barrier coupled with groundwater P&T from two aquifer units to achieve containment (not restoration) of contaminant plume.
	Current Status/Activities: Based on a 2009 5-year review, groundwater containment consisting of a vertical barrier and P&T system is ongoing at Site 32/36 to protect a drinking water well. ICs (including groundwater and land use restrictions) and groundwater monitoring are also ongoing.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Tansitor Electronics, Inc. *State:* VT; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/29/95 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/29/95, www.epa.gov/superfund/sites/rods/fulltext/r0195117.pdf: (2) Final Draft TI Evaluation Report, Feb 1995; (3) Five-year review, 2004, www.epa.gov/superfund/sites/fiveyear/f04-01019.pdf , (4) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009010003145.pdf	***TI Decision:*** ARARs to achieve MCLs are being waived for 1,1,1-TCA; 1,1-DCE; TCE; PCE; and vinyl chloride.
	Rationale: The restoration potential of the groundwater was evaluated with computer modeling, which took the following factors into account: (1) low permeability of the overburden soils, (2) high concentrations of dissolved contaminants, (3) difficulty of extracting 1,1,1-TCA and 1,1-DCE, and (4) the assumption that DNAPLs are present. Modeling also was used to evaluate whether short term pumping would significantly decrease the volume and/or shorten the time to achieve drinking water standards through natural attenuation. See *Remedial Timeframe Estimate* below for modeling results.
	Conditions: *NAPL (suspected or observed)* – DNAPLs have not been observed at the site, but high dissolved concentrations of 1,1,1-TCA (up to approximately 470,000 ppb) suggest that DNAPL is present. *COCs* – Chlorinated VOCs *Concentration* – Based on Table 1 in ROD, maximum concentrations were as follows: 1,1,1-TCA–470,000 ppb; 1,1-DCE–3,800 ppb; PCE–31 pbb; and vinyl chloride–4 pbb. *Geology* – Low permeability soils *TI Zone* – The 9.6-acre TI zone is larger than the area of groundwater contamination. The TI zone was chosen to correspond to the state's Class IV Aquifer zone (for water management purposes). Only a portion of the TI zone is currently contaminated. The entire 44-acre site is within the Tansitor property boundary. Vertically, the TI zone extends to the bedrock surface (approximately 180 ft bgs) and consists of ablation till and basal till.
	Evaluation: *Remedial Timeframe Estimate (years)* – The timeframe required to meet drinking water standards by extraction/treatment ranged from 160 years to more than 630 years (with 300 years being the most likely) and the time required to meet drinking water standards by natural attenuation ranged from 220 years to more than 1,150 years (with 420 years being the most likely). Based on the modeling results, EPA concluded that even after 50 years of pumping, it would still take approximately 300 more years for natural attenuation to restore groundwater. *Remedial Action Alternatives* – Monitoring
	Current Status/Activities: Monitoring is ongoing and ICs (deed and groundwater use restrictions) have been implemented. The site was deleted from the NPL in 1999.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: South Municipal Water Supply Well *State:* NH; *OU:* 1 *Decision Doc. (Type & Date):* ESD, 2/3/97 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ESD, OU1, 2/3/97, www.epa.gov/superfund/sites/rods/fulltext/e0197007.pdf; (2) Site summary, www.yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/8a38a5b7fd3ee7d38525691f0063f6f8!OpenDocument	***TI Decision:*** MCLs were waived for 1,1,1-TCA; 1,1-DCE; TCE; PCE; toluene; and vinyl chloride. The state cleanup level was waived for 1,1-DCA. The "major" COCs are 1,1,1-TCA; TCE; and PCE.
	Rationale: When the ROD was issued (9/27/1989) EPA believed, based on the information available at that time, that groundwater ARARs would be attained within an estimated 32 years. SVE, air sparging, and P&T systems were constructed and operated between 1994 and 1997. In 1997, EPA determined that it was technically impracticable from an engineering perspective to restore contaminated groundwater within the responsible party's property to drinking water quality in a reasonable time frame. This was based on reviewing quarterly groundwater sampling data and considering changes in DNAPL understanding, which occurred since the ROD was issued in 1989. An ESD formalizing the TI waiver was issued on 2/3/1997. The 1997 ESD and TI Evaluation changed pumping rates and extraction well configurations to hydraulically contain, not extract and treat, the NHBB area plume within a defined TI Waiver Area.
	Conditions: *NAPL (suspected or observed)* – DNAPLs have been observed in a portion of the site; other source areas are suspected based on past disposal practices and groundwater quality data. *COCs* – Chlorinated VOCs *Concentration* – Groundwater data from February 1996 (reported in 1997 ESD Attachment) showed the highest levels of PCE at 21,000 ppb and TCE at 1,300 ppb. *Geology* – Site is underlain by glacial/fluvial deposits approximately 20 to 90 ft in thickness. Deposits are predominantly sands and gravels with silt layers interspersed throughout the subsurface. *TI Zone* – The TI zone includes a portion of the site that is currently affected by DNAPLs, which is referred to as the "NHBB area plume." This zone includes both the overburden and bedrock aquifers.
	Evaluation: *Remedial Timeframe Estimate (years)* – EPA's reevaluation indicates that the ARARs may not be attainable for 108 years or more (based on an estimated DNAPL mass of 20,400 ppm), and due to factors related to hydrogeology and contaminants that limit the effectiveness of groundwater remediation at the site. *Remedial Action Alternatives* – P&T will be continued to maintain hydraulic containment of the plume.
	Current Status/Activities: In 2005, a long-term pumping test indicated the hydraulic containment system was not containing the plume within the TI Waiver Area and in 2008 EPA concluded the remedy was not functioning as intended. A 2009 Focused Feasibility Study identified and evaluated new remedial alternatives. An amendment to the 1989 ROD was prepared in 2010 to include *in situ* treatment for soil and groundwater, including a PRB for groundwater because the P&T system failed to provide sufficient hydraulic control. ICs to restrict groundwater use have been established.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Hocomonco Pond *State:* MA; *OU:* 1 *Decision Doc. (Type & Date):* ESD, 9/21/99 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ESD, OU1, 9/21/99, www.epa.gov/superfund/sites/rods/fulltext/e0199116.pdf: (2) Site summary, www.yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/ee9536bdef65eb8d8525691f0063f6ce!OpenDocument; (3) Five-year review, 2009, www.epa.gov/region1/superfund/sites/hocomonco/457922.pdf	***TI Decision:*** ARARs to achieve cleanup levels for COCs in groundwater as established in the 1992 Supplemental Decision Document were waived upon the approval of the TI waiver.
	Rationale: In 1994 and 1995, a P&T system was constructed in an attempt to remove DNAPLs and treat associated groundwater; however, investigations have revealed that DNAPL (creosote) is present at the site at depths greater than 120 ft bgs. The presence of DNAPLs results in a limitation in achieving the groundwater cleanup goals. This determination is based on experience gained at other similar sites, which are contaminated with creosote in sufficient quantities and concentrations to form DNAPLs. Most of the sites where EPA already has determined that groundwater restoration is technically impracticable have been DNAPL sites. The contamination in the TI waiver area is believed to be hydraulically contained; that is, its size (the area over which it is distributed) and its concentrations will not increase.
	Conditions: *NAPL (suspected or observed)* – DNAPL is currently being recovered (as of 1999 ESD). *COCs* – 8 PAHs, 4 SVOCs, 3 VOCs, 8 metals *Concentration* – Concentration ranges listed in Tables 1 through 4 of 1985 ROD. *Geology* – The site is underlain by stratified and unstratified glacial drift deposits of varying grain size (clay and silt to gravel and larger) and thickness. These materials are in turn underlain by fractured bedrock. The topography of the upper surfaces of finer-grained unconsolidated units and bedrock has influenced DNAPL distribution and transport. *TI Zone* – The TI zone is undefined in the references reviewed; however it is described in Figures 3-1 and 3-2 of the TI Demonstration report.
	Evaluation: *Remedial Timeframe Estimate (years)* – unknown/indefinite. Both DNAPL and dissolved phase contamination will continue to be present for a long period of time; therefore, groundwater clean-up goals will not be met in a reasonable time frame. *Remedial Action Alternatives* – The 1999 ESD calls for continued recovery of DNAPL/creosote and long-term monitoring to contain the plume and prevent the increase in contaminant levels and extent.
	Current Status/Activities: DNAPL (creosote) recovery continues using gravity drainage to collector wells with periodic removal and shipment to an offsite disposal facility. As of the 1999 ESD, DNAPL recovery had removed almost 63,000 gallons (about 50-100 gal/month) of pure creosote. This system will continue until recovery is no longer practicable. COCs have been detected above clean-up levels in a well located outside the TI zone. An investigation is underway to determine the extent of the exceedance and evaluate alternatives. The 2009 5-year review recommends (1) that deed restrictions be finalized and recorded and (2) that the DNAPL recovery system currently in operation be evaluated for optimization.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Loring Air Force Base, Entomology Shop (ES) and Jet Engine Build-up Shop (JEBS) *State:* ME; *OU:* 12 *Decision Doc. (Type & Date):* ROD, 9/19/99 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU12, 9/19/99, www.epa.gov/superfund/sites/rods/fulltext/r0199118.pdf; (2) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010010003579.pdf	***TI Decision:*** ARARs (federal MCLs and state MEGs) are waived for TCE; cis-1,2-DCE; vinyl chloride; naphthalene; and benzene.
	Rationale: Two large groundwater contaminant plumes (JEBS North and South Plumes) are present in the fractured bedrock aquifer. The physical and chemical data, coupled with aquifer test analysis, 3-D fracture flow, and fate and transport modeling, indicate residual chlorinated and fuel-related compounds are being retained within the primary and secondary porosity features of the bedrock aquifer matrix and will continue to contribute contaminants to the groundwater.
	Conditions: *NAPL (suspected or observed)* – DNAPL may be present as "ganglia" or "residual" product. *COCs* – Chlorinated VOCs, naphthalene, benzene *Concentration* – Maximum concentrations are as follows for the JEBS North Plume (in ppb): TCE–1,556; cis-1,2-DCE–700; vinyl chloride–71; and naphthalene–1,436. Maximum concentrations are as follows for the ES/JEBS South Plume (in µg/L): TCE–2,800; cis-1,2-DCE–500; vinyl chloride–300; naphthalene–100; and benzene–370. *Geology* – Fractured bedrock *TI Zone* – TI zone encompasses an area of 2,000 feet by 1,000 feet, and vertically from the water table to 300 feet bgs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Although source areas have been excavated and treated using bioventing and SVE, P&T and *in situ* treatments were determined to be ineffective at achieving groundwater cleanup within a reasonable timeframe (100 years). *Remedial Action Alternatives* – MNA is the selected remedy, which is expected to achieve goals in 320 years, based on numerical, groundwater-contaminant fate and transport modeling.
	Current Status/Activities: Based on a 2010 5-year review, bioventing and SVE are still being conducted to address potential leaching of COCs from soils to groundwater in this area. The 2010 5-year review recommends that a new technologies review document be prepared per TI waiver site requirements. The ROD selected implementing ICs (land use and well restrictions, which have been established) and providing an alternate water supply to current and future areas/residents affected.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Loring Air Force Base, Quarry site *State:* ME; *OU:* 12 *Decision Doc. (Type & Date):* ROD, 9/19/99 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU12, 9/19/99, www.epa.gov/superfund/sites/rods/fulltext/r0199118.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-01004.pdf; (3) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2008010002480.pdf	***TI Decision:*** ARARs (federal MCLs and state MEGs) are being waived for PCE; cis-1,2-DCE; 1,2-DCA; TCE; vinyl chloride; 1,1-DCE; benzene; toluene; and naphthalene.
	Rationale: It is believed that residual LNAPL and/or DNAPL contamination retained within the vadose zone of the fractured bedrock aquifer is the current source of contamination in the groundwater. Source removal activities have been conducted. Given the large degree of uncertainty regarding the amount of contaminant mass remaining and the hydraulic conditions at the site, it has been determined that no currently available remedial technology can achieve cleanup of the groundwater within a reasonable timeframe (100 years), based on calculations and computer modeling.
	Conditions: *NAPL (suspected or observed)* – DNAPL is likely due to PCE concentration (38,000 µg/L). LNAPL also was observed in site wells. *COCs* – Chlorinated VOCs, BTEX, naphthalene *Concentration* – Maximum concentrations were as follows (in µg/L): PCE–38,000; cis-1,2-DCE–5,500; 1,2-DCA–21; TCE–8,100; vinyl chloride–500; 1,1-DCE–250; benzene–1,400; toluene–1,600; naphthalene–160. Investigations in 1998 found previously unidentified VOCs at the following concentrations (in µg/L): 1,1,2-TCA–250; carbon tetrachloride–4,300; chlorobenzene–200; and ethylbenzene–1,700. *Geology* – Fractured bedrock *TI Zone* – Based on the area where PCE and TCE exceed federal MCL and state MEG, the TI zone encompasses an area approximately 1,700 feet by 600 feet, and vertically from the water table to 300 feet bgs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Based on an estimated contaminant release of 12 to 242 gallons of PCE, cleanup time ranges from 168 to 1,152 years for the no action and MNA alternatives and from 87 to 308 years for *in situ* chemical treatment. *Remedial Action Alternatives* – Given the large degree of uncertainty associated with the amount of contaminant mass remaining and the hydraulic conditions at the site, it has been determined that no currently available remedial technology can achieve cleanup of the groundwater within a reasonable timeframe (100 years), based on calculations and computer modeling.
	Current Status/Activities: Groundwater management zones and ICs (groundwater use restrictions) have been established. An alternate water supply will be provided to future transferees of property within the groundwater use restriction boundaries. The 2010 5-year review indicates that the Air Force is determining a reasonable method for assuring water is available. Long-term groundwater monitoring is currently being conducted.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: McKin Superfund Site *State:* ME; *OU:* 2 *Decision Doc. (Type & Date):* ROD Amendment, 3/30/01 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU2, 3/30/01, www.epa.gov/superfund/sites/rods/fulltext/a0101015.pdf; (2) TI Evaluation and Determination Report, Jan 2001; (3) Five-year review, 2008, www.epa.gov/superfund/sites/fiveyear/f2009010003306.pdf	***TI Decision:*** ARARs to achieve MCLs and MEGs are waived for all COCs in groundwater: TCE; 1,1,1-TCA; cis-1,2-DCE; 1,1-DCE; PCE; and vinyl chloride.
	Rationale: Restoration of the bedrock aquifer is not practical for the following reasons: (1) there is a pathway from the McKin property to the bedrock aquifer and residential wells; (2) data indicate that the potential DNAPL entry zone into the bedrock could extend for several hundred feet north, making the identification of the actual pathway(s) difficult; (3) the presence of TCE in shallow bedrock wells suggest the lateral extent of the bedrock contamination; (4) TCE concentrations suggest the presence of a nearby residual source; (5) the discovery of TCE in the overburden east of Collyer Brook without an identified overburden plume connecting it to the McKin Site suggests bedrock transport; and (6) contaminants remain in the bedrock and have not been flushed out by natural groundwater flow. Additional factors apply to restoration of the surficial aquifer: (1) the saturated thickness varies from a few feet near the facility to over 100 feet in the southerly trending bedrock trough; (2) drilling logs indicate a discontinuous glacial till unit above the bedrock, which can adsorb DNAPL and act as a source for the more permeable units; and (3) it is likely that DNAPL in residual form is present in the bedrock and there are likely to be multiple areas where seepage occurs from the bedrock into the overburden.
	Conditions: *NAPL (suspected or observed)* – DNAPL may be present in the overburden and bedrock aquifers. Soil concentrations indicate free-phase chlorinated VOCs were probably released and entered the overburden aquifer. Source control actions in the mid-1980s treated the contaminated soils above the water table in the McKin property. Groundwater concentrations indicate that residual DNAPL is also likely in the bedrock aquifer. *COCs* – Chlorinated VOCs, primarily TCE *Concentration* – Initial concentrations were 16,000 ppb for TCE and 170 ppb for 1,1,1-TCA in the surficial aquifer, while bedrock aquifer concentrations were 29,000 ppb and 500 ppb, respectively. *Geology* – Two aquifers: overburden and underlying fractured bedrock *TI Zone* – The TI zone covers the same horizontal area as the ICs zone and vertically extends to the bedrock. The zone includes the McKin property (7 acres) and extends primarily in the downgradient direction to and beyond the Royal River and Collyer Brook. See Figure 2 in the 2001 ROD Amendment or Figure 6 of the Final TI Report.
	Evaluation: *Remedial Timeframe Estimate (years)* – Extrapolation of monitoring data indicate that the concentrations will achieve drinking water standards in the surficial and bedrock aquifers at the perimeter of the plume in about 20 years and about 50 years at the center of the plume. *Remedial Action Alternatives* – The remedial alternative includes long-term monitoring of groundwater, surface water, and institutional controls.
	Current Status/Activities: An alternate water supply was provided for this site (emergency water supplies followed by extension of the municipal system). P&T operated from 1990 to 1995 when it was shut down to evaluate for TI. A 2001 ROD Amendment was issued to replace P&T with ICs (town zoning ordinance and covenants to restrict groundwater use) and long-term monitoring. According to the 2008 5-year review, all but one of the overlapping ICs have been implemented and the source control remedy, which involved the excavation, treatment, and stabilization of VOC-impacted soil, is complete.

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: O'Connor Superfund Site *State:* ME; *OU:* 2 *Decision Doc. (Type & Date):* ROD Amendment, 9/26/02 Stage: Post-construction Media: Groundwater *References:* (1) ROD Amendment, OU2, 9/26/02, www.epa.gov/superfund/sites/rods/fulltext/a0102023.pdf; (2) TI Evaluation Report, June 2002; (3) Site summary, www.yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/86cca6f85c3a63b38525691f0063f6e2!OpenDocument	***TI Decision:*** ARARs to achieve MCLs and state MEGs are waived for all groundwater contaminants: benzene; 1,4-dichlorobenzene (DCB); PCBs; chlorobenzene; 1,2-DCB; 1,3-DCB; 1,2,3-trichlorobenzene (TCB); 1,2,4-TCB; and 1,3,5-TCB.
	Rationale: The continued presence of separate phase PCB-laden oil four years after the successful completion of the source control action suggested that restoration of groundwater using extraction and treatment is not possible. Following the source removal action, post-ROD data indicated the primary source of both oil and chlorobenzenes was the fractures in the clay. A VER system was selected rather than a traditional P&T because it was capable of removing oil and groundwater without significantly lowering the water table, and thereby would limit the mobility of the oil. VER operated actively between 1996 and 2002 and removed approximately 55 gallons of oil. Based on the observed trends of decreasing VOC concentrations before the ROD Amendment, it was estimated that VOC concentrations would be below MCLs and MEGs at wells outside the TWA II Area within the next 5 to 10 years. However, it could take hundreds of years to remove the residual oil and meet drinking water standards for PCBs and VOCs within the TWA II Area. Even though the VER system has removed a moderate amount of residual oil, and may continue to remove oil, the difficulty of inducing oil movement within the clay desiccation cracks and the bedrock fractures makes it unlikely that the residual oil can be completely removed. Therefore, there will always be residual oil available to water infiltrating into the TWA II Area.
	Conditions: *NAPL (suspected or observed)* – DNAPL is not present but separate-phase PCB-laden oil is present *COCs* – VOCs SVOCs, PCBs *Concentration* – Maximum dissolved concentrations in 2001 were as follows in µg/L: benzene–8; 1,4-DCB–720; PCBs–44; chlorobenzene–240; 1,2-DCB–210; 1,3-DCB–160; 1,2,3-TCB–98; and 1,2,4-TCB–770 *Geology* – Fractured clay and fractured bedrock *TI Zone* – The TI Zone includes areas where VOCs and PCBs are present in groundwater at concentrations above ROD target cleanup goals and current MCLs and MEGs. Laterally, the TI Zone covers approximately 3 acres and includes the TWA II Area and the area associated with shallow groundwater flow to the south of the TWA II Area. Vertically, the TI Zone extends into bedrock.
	Evaluation: *Remedial Timeframe Estimate (years)* – Based on the observed trends of decreasing VOC concentrations, it is estimated that VOC concentrations will be below MCLs and MEGs at wells outside the TWA II Area within the next 5 to 10 years. However, it could take hundreds of years to remove the residual oil and meet drinking water standards for PCBs and VOCs within the TWA II Area itself. *Remedial Action Alternatives* – The remedial action alternative was annual active oil recovery using vacuum extraction in TWA II wells, passive oil recovery throughout the year, monitoring, and ICs.
	Current Status/Activities: According to site summary, source removal activities have been completed. Groundwater monitoring is ongoing. Groundwater monitoring shows that performance standards for VOCs and PCBs beyond the TI Zone have been attained and maintained since fall 2002 and spring 2006, respectively. ICs have been implemented for the entire site, including the groundwater.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Durham Meadows *State:* CT; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/30/05 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/30/05, www.epa.gov/superfund/sites/rods/fulltext/r0105007.pdf; (2) Draft TI Evaluation Report, June 2005; (3) Site summary, www.yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/9434a73086e515c18525690d00449688!OpenDocument; (4) ESD, September 2011, www.epa.gov/region1/superfund/sites/durham/492341.pdf	***TI Decision:*** ARARs to achieve cleanup levels (either MCLs, state standards, or health-based standards) are waived for all groundwater contaminants (see Table 30 in ROD).
	Rationale: EPA concluded that restoration of the overburden and bedrock aquifers is not practicable within a reasonable timeframe because (1) there is widespread contamination in the fractured, sedimentary bedrock aquifer; (2) the depth of contamination in the bedrock aquifer is not known and would require significant investigations to characterize the vertical extent of contamination; (3) operation of water supply wells within, and near two DNAPL source areas have contributed to the spread of contamination, both vertically and horizontally, by borehole short-circuiting and plume mobilization; (4) the overburden aquifer is a fractured, low permeability glacial till formation, which would limit hydraulic accessibility and removal of DNAPL; and (5) it is likely that pooled or residual DNAPL may be present in the fractures and matrix of overburden and bedrock units, and these would act as a continuing source for contamination to the dissolved plume. According to the ROD, there is little benefit to attempting to remediate co-located compounds (chlorinated VOCs, PAHs, BTEX compounds, metals); therefore, the TI waiver will apply to all dissolved contaminants found at the Site.
	Conditions: *NAPL (suspected or observed)* – DNAPL is likely to be present based on a converging lines of evidence method of assessment (see pg. 24 of ROD) of two source areas. *COCs* – 14 VOCs; 8 PAHs; pentachlorophenol; 1,4-dioxane; 6 metals *Concentration* – Maximum concentrations of groundwater contaminants are presented in Table 30 of ROD. *Geology* – Two aquifers: overburden and bedrock *TI Zone* – The TI Zone encompasses all areas in the overburden and bedrock aquifers that are currently or conceivably could be impacted by groundwater contamination from the Merriam Manufacturing Company and the Durham Manufacturing Company study areas; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – The RI/FS determined that no remedial alternative was available to achieve cleanup of the source zones within a reasonable timeframe. *Remedial Action Alternatives* – All homes and businesses in the area use individual onsite bedrock supply wells. Overburden materials in the area do not support a permanent water table nor provide a dependable source of water. Aggressive remediation alternatives were deemed deleterious to current use of individual supply wells; therefore, the only alternatives presented were for hydraulic containment (greater than 100 years) and for no action (see pg. 65 of ROD).
	Current Status/Activities: Bottled water and residential treatment units are being provided as an alternate water supply, and water sampling is being conducted on individual wells. ICs (land and groundwater use restrictions) and extension of the municipal water supply were selected in the 2005 ROD. The 2011 ESD modifies the 2005 ROD IC requirement that groundwater use for drinking water purposes be prohibited. Future groundwater use for drinking water will be prevented unless the water supply is approved and meets Connecticut health code requirements. The 2011 ESD also specifies that excavation or any other activity below the groundwater table is prohibited and activities within a 25-foot radius around the groundwater monitoring wells are prohibited. Operation and maintenance environmental monitoring requirements for groundwater are removed.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: West Site/Hows Corner *State:* ME; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/28/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/28/06, www.epa.gov/superfund/sites/rods/fulltext/r2006010001236.pdf; (2) TI Evaluation, 4/7/06	***TI Decision:*** ARARs to achieve state MEGs for PCE; trans-1,2-DCE; vinyl chloride; dieldrin; PCBs; and manganese, and MCLs for TCE; 1,1-DCE; cis-1,2-DCE; 1,2,4-TCB; and 1,1,1-TCA in groundwater are waived.
	Rationale: EPA reached the conclusion that the source area groundwater could not be restored in a reasonable timeframe based on the following factors: (1) contaminant concentrations suggest the presence of DNAPL in the fractured bedrock; (2) the source is entirely located in fractured bedrock; (3) the bedrock has a complex, heterogeneous structure, making extraction difficult; (4) *in situ* chemical oxidation would not be effective based on a pilot study; and (5) no other technology was identified that could restore the groundwater.
	Conditions: *NAPL (suspected or observed)* – DNAPL is suspected based on concentrations of chlorinated VOCs *COCs* – Chlorinated VOCs; dieldrin; PCBs; manganese; 1,2,4-trichlorobenzene *Concentration* – Maximum concentrations are as follows (in ppb): PCE–32,000; trans-1,2-DCE–12; vinyl chloride–0.2; dieldrin–0.24; PCBs–119; manganese–8,540; TCE–7,250; 1,1-DCE–57; cis-1,2-DCE–1,000; 1,2,4-TCB–160; and 1,1,1-TCA–1,000. *Geology* – Fractured bedrock *TI Zone* – The TI waiver applies to source areas where VOC concentrations exceed 10,000 ppb and the probable DNAPL zone. The lateral extent is approximately 10-12 acres (shown graphically in TI Evaluation Report, Figure 3-1) and extends vertically to the deep bedrock.
	Evaluation: *Remedial Timeframe Estimate (years)* – Source area groundwater is not expected to meet restoration goals for more than 100 years. *Remedial Action Alternatives* – A P&T system will be installed to contain the source area groundwater and prevent it from continuing to contaminate non-source area groundwater. Upon containment of the source area, the downgradient non-source area groundwater is expected to be restored in 40-80 years (based on MNA estimates).
	Current Status/Activities: The 2002 interim ROD selected P&T to contain the source area groundwater and institutional controls. The 2006 final ROD included a TI waiver for the source area groundwater, MNA for non-source area groundwater, and a requirement for vapor intrusion investigation. ICs have been implemented. An alternate water supply has already been provided (through construction and operation of municipal water supply system) and construction of the groundwater hydraulic containment system was completed in 2011.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Elizabeth Mine Superfund Site *State:* VT; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/28/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/28/06, www.epa.gov/region1/superfund/sites/elizmine/259306.pdf; (2) Site summary, www.yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/22814871317824268525 69e400719bbe!OpenDocument	***TI Decision:*** MCLs, MCLGs, and Vermont Primary Groundwater Quality Standards are being waived for all inorganic constituents (cadmium, copper, manganese, mercury, and nickel) present in naturally occurring material.
	Rationale: The primary basis for this waiver is that the source of contamination, wall rock and waste rock within the Underground Workings, will generate conditions that cause the water to exceed the standards for hundreds, if not thousands, of years. The Underground Workings are flooded in some areas and act as a large tunnel or drain having an infinite hydraulic conductivity. While it would be practicable to collect and treat the discharge from the Underground Workings or to prevent the spread of the contamination from the Underground Workings into the adjacent aquifer, EPA has determined that there are no practicable actions that would result in the water within the Underground Workings to consistently meet groundwater standards. EPA retains the MCLs, MCLGs, and Vermont Primary Groundwater Quality Standards as compliance criteria for the groundwater at the edge of the TI zone, which is the aquifer surrounding the Underground Workings. EPA has also determined that contaminated water within the Underground Workings is not causing the adjacent bedrock aquifer to exceed federal or state drinking water or groundwater standards.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue at this site. *COCs* – Cadmium, copper, manganese, mercury, and nickel *Concentration* – Maximum concentrations in the Underground Workings (in mg/L, from Table 58 of ROD): cadmium–88.3; manganese–3,030; mercury–10.2; and zinc–16,200. *Geology* – Two water-bearing zones present at the site are separated by a glacial basal till layer that has a thickness of up to 75 feet. The shallow water-bearing zone has a thickness of 2 to 3 feet and consists of sand, gravel, and debris. The deeper zone is in the fractured bedrock layer. *TI Zone* – Waiver applies to groundwater in the Underground Workings area and does not apply to adjacent bedrock aquifer; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – The continuing source of contamination will cause the water to exceed the standards for hundreds, if not thousands, of years. *Remedial Action Alternatives* – The selected remedy includes ICs (land use, well and groundwater use restrictions) and long-term monitoring. The only other remedy evaluated for site-wide groundwater in the 2006 ROD was the No Action alternative.
	Current Status/Activities: A time-critical removal action was conducted from 2003 to 2005 to stabilize the Tailings Dam and improve surface water drainage. A non-time-critical removal action began in 2006 and continues to control the release of acid mine drainage. Additional containment and surface water controls were selected in the 2006 ROD, in addition to monitoring and ICs. According to the site summary (November 2011), the cover system for 22 acres of the 45-acre tailing impoundment was completed in 2011. Remaining activities at the site include the installation of the passive treatment system and the Remedial Design of the Lord Brook Source areas. Land use restrictions and the long-term monitoring program will continue.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 2: 11 sites
Site Name: Caldwell Trucking Co. *State:* NJ; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/28/89 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/28/89, www.epa.gov/superfund/sites/rods/fulltext/r0289096.pdf; (2) Five-year review, 2002; www.epa.gov/superfund/sites/fiveyear/f02-02004.pdf; (3) Site summary, www.epa.gov/Region2/superfund/npl/0200340c.pdf; (4) Five-year review, 2007, www.epa.gov/superfund/sites/fiveyear/f2007020001676.pdf	***TI Decision:*** Federal and state MCLs are being waived for all contaminants, predominantly TCE.
	Rationale: Due to the extent and concentration of the groundwater plume and the impact of other sources in the area, it would take more than 100 years to clean the aquifer to drinking water standards. Computer modeling indicated that after using P&T for 100 years, TCE concentrations would range from 0.9 to 19 µg/L in the upper and lower aquifers, respectively.
	Conditions: *NAPL (suspected or observed)* – NAPL is suspected because of reported extremely high concentrations of VOCs, particularly TCE in the soil, with an unconfirmed reference to pure contaminant product during early remediation work. TCE concentration in one groundwater monitoring well was 680,000 µg/L. *COCs* – TCE *Concentration* – In the 1989 ROD, TCE concentrations ranged from 1,004 to 3,637 µg/L in the water table aquifer and 556.2 to 5,250 µg/L in the lower bedrock aquifer. *Geology* – Two aquifers: upper water table and lower bedrock. The upper and lower aquifers are divided into four zones. The "A Zone" is shallow surface aquifer, which is separated from the deeper bedrock aquifer zone by a clay layer. The deeper bedrock groundwater is divided into three zones: the "B Zone," the "C Zone," and the "D Zone" based on structure of the material comprising the zone. *TI Zone* – The TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Due to the extent and concentration of the groundwater plume and the impact of other sources in the area, it would take more than 100 years to clean the aquifer to drinking water standards. *Remedial Action Alternatives* – The selected remedy includes P&T to reduce contaminant levels, ICs, and alternate water supply. In 1993, an ESD was issued that implemented the contingent remedy, which includes P&T to intercept the most contaminated portions of the plume (lower water table aquifer and upper bedrock aquifer).
	Current Status/Activities: According to the 2007 5-year review and site summary (August 2011), P&T has been installed, an alternate water supply has been provided, *in situ* bioremediation and PRB pilot studies have been conducted, and the area downgradient of the Site has been placed into the State's Classification Exception Area. The groundwater recovery wells have been installed, but additional work needs to be completed to ensure that containment of the source groundwater is achieved. Information obtained since the 1989 ROD has confirmed that MCLs cannot be achieved within a reasonable timeframe.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: GE Moreau *State:* NY; *OU:* 1 *Decision Doc. (Type & Date):* ESD, 10/6/94 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ESD, 10/6/94; (2) Five-year review, 1998, www.epa.gov/superfund/sites/fiveyear/f98-02004.pdf; (3) Site summary, www.epa.gov/region02/superfund/npl/0201858c.pdf; (4) Five-year review, 2008, www.epa.gov/superfund/sites/fiveyear/f2008020002572.pdf	***TI Decision:*** Federal MCLs waived: TCE–5 µg/L; vinyl chloride–2 µg/L; 1,1-DCE–7 µg/L; total trihalomethanes–100 µg/L; and state ambient water quality criteria waived: trans-1,2-DCE–50 µg/L; methylene chloride–50 µg/L.
	Rationale: The original remedy selected in the 1987 ROD included groundwater restoration using natural gradient flushing to the nearby brook, where groundwater would be treated along with surface water via air stripping. Alternate water supply and ICs were also selected. Following the ROD, additional evaluation was conducted and it was determined that either remedy (natural gradient flushing with treatment or P&T) would take 200 years or more to achieve restoration (based on modeling). This is due to (1) heterogeneity of the aquifer (such as variations in hydraulic conductivity and geologic stratigraphy); (2) contaminant-related constraints (such as the nature and extent of release [large volume over long time], chemical and physical properties); and (3) contaminant phases (dissolved, gaseous, sorbed, and DNAPLs). In addition, in 1985, a containment system (cap and VEB) was installed to isolate DNAPL contamination. Dewatering was conducted (1994-1996 and 2003-2004) to ensure an inward gradient and limit outward migration.
	Conditions: *NAPL (suspected or observed)* – NAPL is present. TCE was disposed in DNAPL form and is encapsulated behind the slurry wall and cap. *COCs* – Chlorinated VOCs, total trihalomethanes *Concentration* – TCE concentrations averaged from 10,000 to 20,000 µg/L in the upper zone, with a maximum concentration of 81,000 µg/L. The maximum TCE concentration was 1,800 µg/L in the lower zone. *Geology* – The surrounding aquifer is primarily sand and gravel from glacial outwash. *TI Zone* – ARARs waived for entire groundwater plume area (4,800 feet long by 2,000 wide and an average thickness of 60 feet).
	Evaluation: *Remedial Timeframe Estimate (years)* – Following the 1987 ROD, additional evaluation was conducted and it was determined that either remedy (natural gradient flushing with treatment or P&T would take 200 years or more to achieve restoration (based on modeling). *Remedial Action Alternatives* – In 1985, a containment system (cap and VEB) was installed to isolate DNAPL contamination. Dewatering was conducted (1994-1996 and 2003-2004) to ensure an inward gradient and limit outward migration.
	Current Status/Activities: Based on the site summary (February 2011), an air stripper continues to operate at the brook to treat both groundwater and surface water. In addition, an alternate water supply has been provided and ICs are in place. The 2008 5-year review documented dewatering activities of the containment system in 2003 and 2004. Reportedly, more than 1 million gallons of contaminated groundwater were removed, treated, and disposed of on-site.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Niagara Mohawk Power Corp. (Saratoga Springs Plant) *State:* NY; *OU:* 00 *Decision Doc. (Type & Date):* ROD, 9/29/95 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, 9/29/95, www.epa.gov/region02/superfund/npl/0202182c.pdf; (2) Five-year review, 2006, www.epa.gov/region02/superfund/npl/0202182c.pdf; (3) Five-year review, 2011, www.epa.gov/superfund/sites/fiveyear/f2011020004031.pdf	***TI Decision:*** Federal and state drinking water standards and state groundwater quality standards for the shallow groundwater contained within a containment system on the Niagara Mohawk property are being waived for a variety of VOCs, PAHs, and inorganics. This waiver does not apply to other contaminated areas at the site.
	Rationale: ARARs are being waived on the shallow aquifer contained within a cap and VEB only under the Niagara Mohawk property based on two technical limitations: (1) approximately 7 acres of contaminated aquifer materials residing above a thick subsurface clay layer (which begin at 20 feet bgs) would require excavation and off-site disposal to remove all the DNAPL from the Niagara Mohawk property area; and (2) all operating facilities on the Niagara Mohawk property area would need to be demolished to allow access to the contaminated area underneath. It is technically impracticable to excavate an area this large; as a result, DNAPL and PAHs will remain contained within the cap and VEB system after the selected remedy is implemented.
	Conditions: *NAPL (suspected or observed)* – DNAPL is present. *COCs* – VOCs, PAHs, inorganics *Concentration* – Maximum concentrations in the shallow aquifer (in ppb): benzene–14,000; ethylbenzene–3,500; toluene–5,700; xylene–3,700; and naphthalene–6,400. Additional concentrations provided in Table 2 of ROD. *Geology* – In descending order: fill, upper glaciolucustrine clay (thickness ranging from 27 to 53 feet), and till. *TI Zone* – TI applies to the shallow aquifer contained within a cap and VEB system on the Niagara Mohawk property; however, the extent of the TI zone is undefined in the references reviewed. This waiver does not apply to other contaminated areas at the site.
	Evaluation: *Remedial Timeframe Estimate (years)* – No time frame was estimated. *Remedial Action Alternatives* – The selected remedy is to establish hydraulic control of the Niagara Mohawk property contaminated groundwater, specifically to prevent groundwater and DNAPL from flowing off site by using a containment system (VEB and cap) and P&T, soil and sediment removals, ICs, and monitoring.
	Current Status/Activities: Based on a 2011 5-year review, source and sediment removal activities have been conducted, a VEB has been installed and is being used with P&T for containment, post-remedy monitoring is being conducted, and ICs (deed restrictions) are in place.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Love Canal *State:* NY; *OU:* 9 *Decision Doc. (Type & Date):* ROD, 5/15/91 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU9, 5/15/91, www.epa.gov/superfund/sites/rods/fulltext/r0291165.pdf; (2) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f03-02018.pdf; (3) Site summary, www.epa.gov/Region2/superfund/npl/0201290c.pdf; (4) Five-year review, 2008, www.epa.gov/superfund/sites/fiveyear/f2008020002577.pdf	***TI Decision:*** ARARs are waived for all contaminants, including iron and others (list not provided in ROD).
	Rationale: ARARs are being waived based on the following considerations: (1) groundwater is not used and is not planned to be used for drinking purposes; (2) there is no route of exposure for groundwater to the population; (3) regional groundwater quality compares to groundwater quality in the Niagara Falls area; (4) treatment of groundwater may not be practicable, due to low contamination levels; and (5) all contaminated soils are being excavated and disposed off-site.
	Conditions: *NAPL (suspected or observed)* – NAPL is being recovered in the barrier drain system. *COCs* – Iron and others (list not provided in ROD) *Concentration* – Table 3 of ROD not provided in online version. *Geology* – Overburden bedrock varies from 25 to 27 feet thick and consists of glacial till covered by layers of clay, silt, fine sand, and fill. *TI Zone* – TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Assessment not done. *Remedial Action Alternatives* – No remedy for groundwater was selected in this ROD; excavation and off-site disposal was the selected remedy for this OU.
	Current Status/Activities: The 2008 5-year review mentions that ICs in the form of zoning restrictions, deed restrictions, and land use restrictions are in place. The only groundwater remedies found were a shallow interceptor trench (barrier drain system) installed in 1978 to collect shallow groundwater and groundwater monitoring. This site was deleted from the NPL in 2004.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Dupont/Necco Park *State:* NY; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/18/98 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/18/98, www.epa.gov/superfund/sites/rods/fulltext/r0298144.pdf	***TI Decision:*** Federal and state drinking water standards and state groundwater quality standards for the groundwater are being waived.
	Rationale: Groundwater remediation in the source area is impracticable because (1) removal of all the DNAPL would require excavation of more than 1 million cubic yards of landfill materials and (2) DNAPL has migrated into the fractured bedrock, the on-site landfill, and nearby waste cells, and no technologies are currently available to completely remove DNAPLs from the fractured bedrock.
	Conditions: *NAPL (suspected or observed)* – DNAPL is present *COCs* – Chlorinated VOCs and SVOCs (hexachlorobutadiene; hexachlorobenzene; carbon tetrachloride; chloroform; PCE; TCE; 1,1,2,2-PCA) *Concentration* – DNAPL at 330,000 µg/L *Geology* – Fractured bedrock *TI Zone* – TI applies to source area (24-acre landfill); however the vertical extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – EPA expects MCLs will never be achieved within the source area. *Remedial Action Alternatives* – The selected remedy for the source area includes hydraulic containment via P&T, VEB, or both; DNAPL recovery; and ICs. It is expected that groundwater outside of the source area (known as far-field) would naturally attenuate to groundwater standards; however, a degree of uncertainty exists and additional information will be required to fully evaluate the potential for achievement of MCLs in the far-field area.
	Current Status/Activities: This site is not on the NPL and additional information is not available online.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Federal Creosote *State:* NJ; *OU:* 3 *Decision Doc. (Type & Date):* ROD, 9/30/02 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU3, 9/30/02, www.epa.gov/superfund/sites/rods/fulltext/r2002020001368.pdf; (2) Draft Final FS, 6/28/02; (3) Site summary, www.epa.gov/region02/superfund/npl/0204097c.pdf; (4) Five-year review, 2007, www.epa.gov/superfund/sites/fiveyear/f2007020001680.pdf	***TI Decision:*** The following Federal or state standards are being waived (or the PQL was waived for standards that were less than the PQL): benzo(a)pyrene–5 ppb; dibenzo(a,h)anthracene–5 ppb; benzo(a)anthracene–5 ppb; chrysene–5 ppb; benzo(b)fluoranthene–5 ppb; benzo(k)fluoranthene–5 ppb; indeno(1,2,3-cd)pyrene–5 ppb; benzene–1 ppb; and naphthalene–300 ppb.
	Rationale: The determination of a TI waiver is based on three factors: (1) the persistence of DNAPL contaminants and their presence in fractured bedrock are expected to result in the inability to meet ARARs for the foreseeable future; (2) limited options are available to successfully treat DNAPL in fractured bedrock; and (3) alternatives would cause short-term and/or long-term disruptions in a residential and commercial community. While several alternatives offered some prospect of success at treating at least a portion of the DNAPL contamination, this benefit was weighed against the significant community disruptions and other implementability concerns. The selected remedy includes soil excavation and ICs for both soil and groundwater.
	Conditions: *NAPL (suspected or observed)* – DNAPL has been detected at depths of 120 feet bgs. *COCs* – PAHs, benzene *Concentration* – Maximum concentrations in OU3 groundwater: benzo(a)pyrene–11 ppm; dibenzo(a,h)anthracene–ND; benzo(a)anthracene–21 ppm; chrysene–14 ppm; benzo(b)fluoranthene–9 ppm; benzo(k)fluoranthene–13 ppm; indeno(1,2,3-cd)pyrene–1 ppm; benzene–68 ppm; naphthalene–13,000 ppb. *Geology* – Fractured bedrock *TI Zone* – TI Zone covers 119 acres and both the overburden and bedrock aquifers.
	Evaluation: *Remedial Timeframe Estimate (years)* – No timeframe estimate was provided in the RI. *Remedial Action Alternatives* – The selected remedy includes soil excavation and ICs for both soil and groundwater.
	Current Status/Activities: ICs are partially in place and some residents have been relocated. NJDEP has applied deed notices to 5 residential properties and EPA is in the process of placing deed notices on 13 other residential properties. NJDEP plans to have three residential and one commercial property owner apply deed notices to their properties. NJDEP plans to institute a Classification Exception Area for groundwater (that is, an area, projected out five years, of no groundwater use). According to the 2007 5-year review, the first round of long-term groundwater monitoring was conducted in 2005 and the Classification Exception Area was anticipated to be in place by 2008. According to the Site Summary (February 2011), source removal and remediation activities have been completed.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Hudson River PCBs *State:* NY; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 2/1/02 *Stage:* Pre-construction *Media:* Surface water *References:* (1) ROD, OU2, 2/1/02, www.epa.gov/hudson/RecordofDecision-text.pdf; (2) Site summary, www.epa.gov/hudson/pdf/hudson_riverfactsheet_2011.pdf; (3) Fact Sheet, January 2012, www.epa.gov/hudson/Phase2_Dredging.pdf	***TI Decision:*** Three of seven standards are being waived for total PCBs in surface water: federal water quality criteria–1 ng/L; state standard for protection of wildlife–0.12 mg/L; and state standard for protection of human consumers of fish–0.001 ng/L.
	Rationale: Due to upstream sources of PCBs, EPA has determined that it is technically impracticable to meet 3 of 7 ARARs for the Hudson River for the 70-year forecast period.
	Conditions: *NAPL (suspected or observed)* – No *COCs* – PCBs *Concentration* – Total PCB concentrations averaged 90 ng/L from 1996 to 2000. *Geology* – The river is underlain by glacial Lake Albany clays and shale formations. *TI Zone* – The TI applies to the Hudson River; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Four of 7 ARARs can be met within 70-year forecast period. *Remedial Action Alternatives* – The selected remedy includes dredging river sediments, MNA for PCB contamination remaining in the river following excavation, and ICs. Additional actions are associated with nearby sites and other RODs for this site.
	Current Status/Activities: The site summary (November 2011) does not indicate if ICs have yet been implemented. The second and final phase of the cleanup project commenced in 2011 and sediment dredging is currently underway.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Roebling Steel Company *State:* NJ; *OU:* 5 *Decision Doc. (Type & Date):* ROD, 9/30/03 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU5, 9/30/03, www.epa.gov/superfund/sites/rods/fulltext/r2003020003518.pdf; (2) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009020002824.pdf	***TI Decision:*** NJ GWQS are being waived for arsenic, beryllium, and lead.
	Rationale: COCs at this site are arsenic, beryllium, and lead, which are all virtually immobile in the aquifer. A site-specific conceptual model and a contaminant transport model (using USGS MODPATH 96 and MT3DMS) were used to develop the following conclusions: (1) extraction of organics would be extremely difficult due to the high partition coefficient values of arsenic, beryllium, and lead; and if no source removal was conducted, the metal contaminant plumes would double in concentration but will not expand; (2) if source removal was implemented, MNA would achieve goals in 90,000 years; P&T would take 35,000 years and require treatment of 1.7 trillion gallons of water; and (3) if source removal is not conducted, the aquifer would never be remediated (with or without P&T).
	Conditions: *NAPL (suspected or observed)* – Oil areas of contamination (LNAPL) in soils have been observed and remediated. Groundwater investigation of these areas is planned to take place as part of the Part 2 Pre-design Investigation. *COCs* – Metals *Concentration* – Concentrations in 1996 were 8.1 µg/L for arsenic and 67 µg/L for lead. *Geology* – The site is underlain by a sequence of fill materials, sands, clays, silts, and gravels. These soils, excluding the fill material, appear to correlate to the Raritan or Magothy Formations, which outcrop along the eastern bank of the Delaware River throughout much of southern New Jersey. These two formations are major aquifers of the Atlantic Coastal Plain in New Jersey. *TI Zone* – TI Zone is undefined in the references reviewed, but contaminated area is 200 acres (size of site).
	Evaluation: *Remedial Timeframe Estimate (years)* – If source removal was implemented, MNA would achieve goals in 90,000 years, and P&T would take 35,000 years and require treatment of 1.7 trillion gallons of water; and if source removal is not conducted, the aquifer would never be remediated (with or without P&T). *Remedial Action Alternatives* – The selected remedy includes (1) implementing a long-term groundwater sampling and analysis program to monitor the contaminant concentrations in the groundwater at the site, to assess the migration and attenuation of these contaminants in the groundwater over time, and (2) establishing ICs to restrict the installation of wells and the use of contaminated groundwater in the vicinity of the site.
	Current Status/Activities: Capping of site soils and ICs (groundwater well and use restrictions) were selected in the 2003 ROD. Remediation of soil areas of concern associated with OU 4 is being conducted. According to the 2009 5-year review, additional ICs (deed restrictions) are needed and remedial activities at the site have not been fully implemented. Soil capping was conducted for 5 acres under OU 5 in 2005 and a pre-design investigation is underway to develop a groundwater baseline for assessing potential groundwater impacts to surface water and identity future monitoring needs.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Atlantic Resources *State:* NJ; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/30/04 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/30/04; (2) Site summary, 2007, www.epa.gov/region02/superfund/npl/atlanticresources/	***TI Decision:*** Cleanup goals being waived for VOCs, SVOCs, and metals are state standards and background levels. See Table 9 of ROD for complete list.
	Rationale: A TI waiver is being issued based on the following factors: (1) the ineffectiveness of active remedies in the low permeable soils found at the site; (2) the expected removal of substantial quantities of contaminants during source removal activities; (3) the expected limited mobility of residual groundwater contamination; and (4) the absence of current and potential receptors. Groundwater contamination was observed no deeper than 30 feet bgs, which is a zone of very low permeability. Pumping tests have shown that five of six wells could not maintain a pumping rate of 0.5 gallons per minute, and limited plume migration is expected in this zone.
	Conditions: *NAPL (suspected or observed)* – NAPLs were suspected because of high concentrations in groundwater; however, there was no direct evidence. *COCs* – 15 VOCs, 5 SVOCs, and 11 metals *Concentration* – Concentrations provided in Table 1 of ROD. *Geology* – Low permeability soils (clay with some silt/sand lenses) *TI Zone* – TI Zone includes a 17-acre area; however the vertical extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – About 2,000 years *Remedial Action Alternatives* – The selected remedy includes ICs (land and groundwater use restrictions), groundwater monitoring, and source excavation/disposal.
	Current Status/Activities: ICs selected for OU2 include deed notice, covenant, and a groundwater use/well drilling regulation; however, their status is not provided in the documents reviewed. This TI waiver applies at two sites (Horseshoe Road and Atlantic Resources).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Horseshoe Road *State:* NJ; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/30/04 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/30/04, www.epa.gov/superfund/sites/rods/fulltext/r2004020001405.pdf; (2) Site summary, http://www.epa.gov/Region2/superfund/npl/0200781c.pdf	***TI Decision:*** The cleanup goals being waived for VOCs, SVOCs, and metals are state standards and background levels. See Table 9 of ROD for complete list.
	Rationale: A TI waiver is being issued based on the following factors: (1) the ineffectiveness of active remedies in the low permeable soils found at the site; (2) the expected removal of substantial quantities of contaminants during source removal activities; (3) the expected limited mobility of residual groundwater contamination; and (4) the absence of current and potential receptors. Groundwater contamination was observed no deeper than 30 feet bgs, which is a zone of very low permeability. Pumping tests have shown that five of six wells could not maintain a pumping rate of 0.5 gallons per minute, and limited plume migration is expected in this zone.
	Conditions: *NAPL (suspected or observed)* – NAPLs were suspected because of high concentrations in groundwater; however, there was no direct evidence. *COCs* – 15 VOCs, 5 SVOCs, and 11 metals *Concentration* – Concentrations provided in Table 1 of ROD. *Geology* – Low permeability soils (clay with some silt/sand lenses) *TI Zone* – TI Zone includes a 17-acre area; however the vertical extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – About 2,000 years *Remedial Action Alternatives* – The selected remedy includes ICs (land and groundwater use restrictions), groundwater monitoring, and source excavation and disposal.
	Current Status/Activities: ICs selected for OU2 include deed notice, covenant, and a groundwater use/well drilling regulation; however, their status is not provided in the documents reviewed. This TI waiver applies at two sites (Horseshoe Road and Atlantic Resources).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Chemical Insecticide *State:* NJ *OU:* 4 *Decision Doc. (Type & Date):* ROD, 12/22/03 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU4, 12/22/03, www.epa.gov/superfund/sites/rods/fulltext/r2004020001416.pdf; (2) Site summary, www.epa.gov/Region2/superfund/npl/0200517c.pdf; (3) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009020002903.pdf	***TI Decision:*** Federal and state drinking water standards are being waived, which include but are not limited to arsenic (8 ppb), dinoseb (7 ppb), TCE (1 ppb), and PCE (1 ppb).
	Rationale: The overburden and bedrock aquifers at the site are highly contaminated. It was concluded that based on the nature of contaminants and aquifer characteristics, an active pumping remedy was unlikely to be successful in restoring the site groundwater. Although reducing contaminant mass was considered, it was not selected as the final remedy when weighed against other factors.
	Conditions: *NAPL (suspected or observed)* – NAPL was never observed *COCs* – Arsenic, dinoseb, and chlorinated VOCs *Concentration* – Maximum concentrations were as follows: arsenic–17,400 ppb; dinoseb–1,400 ppb; TCE–1,800 ppb off-site and 28 ppb on-site; and PCE–51 ppb off-site and 41 ppb on-site. *Geology* – Fill material, fluvio-glacial deposits, red clay and silt, and consolidated bedrock. The area has two water-bearing units separated by a leaky confining unit. The overburden and bedrock groundwater on site are highly contaminated. *TI Zone* – TI applies to a 50-acre area, which corresponds to a majority of the site with limited off-site migration; however the vertical extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – At least several hundred years for groundwater restoration *Remedial Action Alternatives* – The selected remedy includes ICs and groundwater monitoring. It is anticipated that work on ICs will begin in the beginning of FY 2009 with final implementation later that year.
	Current Status/Activities: Data have been collected from the existing network of groundwater monitoring wells since 2005. Based on this data, it is apparent that the OU 2 remedy, which consisted of removing contaminated soil and source materials, has shown a decrease in the concentration of contaminants. TCE was determined to be an off-site contaminant, as specified in the ROD. As stated in the 2009 5-year review, overall, concentrations of arsenic and alpha-BHC are decreasing. VOCs and herbicides have gradually stabilized, and low-level detections of these constituents are attributed to stable plume conditions. A Classification Exception Area, which will include groundwater use restrictions, is currently being prepared.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 3: 18 sites (19 waivers)
Site Name: Dorney Road Landfill *State:* PA; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/30/91 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/30/91, www.epa.gov/reg3hwmd/npl/PAD980538763.htm; (2) TI Waiver, undated; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD980508832.htm; (4) Five-year review, 2008, www.epa.gov/superfund/sites/fiveyear/f2008030002622.pdf	***TI Decision:*** Requirements being waived are the state regulation to remediate on-site groundwater to background levels and off-site groundwater to MCLs (for metals and VOCs).
	Rationale: ARARs are being waived for the following reasons: (1) lack of discharge areas with the necessary capacity within a reasonable distance (less than 1 mile) from the site, and (2) lack of confidence in the reliability of reinjection of treated water within the vicinity due to highly fractured bedrock.
	Conditions: *NAPL (suspected or observed)* – No *COCs* – Metals, VOCs *Concentration* – Tables not included in online version of ROD. *Geology* – Fractured bedrock *TI Zone* – TI Zone applies to on-site and off-site groundwater, however the extent of the TI zone is undefined in references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not applicable *Remedial Action Alternatives* – No action will be taken to actively remediate the groundwater; data indicate that groundwater appears to be naturally attenuating. The selected remedy is well-head treatment for affected residences.
	Current Status/Activities: Based on the site summary (January 2012), monitoring showed no wells above standards; therefore, no well-head treatment units have been installed. According to a 2008 5-year review, EPA is working towards implementing ICs (to prevent disturbance of the landfill cap and installation of groundwater wells in the capped area of the property). Additional groundwater sampling needs to be conducted for 1,4-dioxane.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Heleva Landfill *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD Amendment, 9/30/91 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU1, 9/30/91, www.epa.gov/superfund/sites/rods/fulltext/a0391124.pdf; (2) Site summary, www.epa.gov/reg3hwmd/npl/PAD980537716.htm	***TI Decision:*** Requirements being waived are the state ARAR to remediate on-site groundwater to background levels and the federal ARARs of MCLs and non-zero MCLGs for VOCs.
	Rationale: The original remedy called for reduction of concentrations of VOCs in groundwater under the landfill. However, during design, it was determined that this was not feasible due to the presence of DNAPLs. The ROD states that there are no technologies presently in existence capable of locating or remediating all the DNAPL present because of the heterogeneous distribution (both horizontally and vertically) of fractures within the bedrock.
	Conditions: *NAPL (suspected or observed)* – Free-phase DNAPLs have not been observed but are likely present. *COCs* – VOCs (TCE, acetone, and vinyl chloride are listed in ROD – Tables 1 and 3 not provided in online version) *Concentration* – Maximum concentrations: TCE–930,000 µg/L; acetone–1,900,000 µg/L; and vinyl chloride–19,000 µg/L. *Geology* – Heterogeneous layers and bedrock *TI Zone* – TI waiver applies to "neargradient" groundwater (the area in which DNAPLs are present); however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time (indefinite) *Remedial Action Alternatives* – The amended remedy includes P&T to contain the neargradient portion of the plume associated with DNAPLs and P&T to restore downgradient groundwater to background levels. If implementation of the amended remedy demonstrates that is it technically impracticable to remediate to background levels, an amendment or ESD may be issued with a TI waiver for the downgradient area.
	Current Status/Activities: The site summary (January 2012) indicates an alternate water supply (bottled water followed by extension of municipal water line in 1986), has been provided and P&T is operational.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Middletown Air Field *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 12/17/90 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD, OU1, 12/17/90, www.epa.gov/superfund/sites/rods/fulltext/r0391107.pdf; (2) ROD, OU3, 9/19/96, www.epa.gov/superfund/sites/rods/fulltext/r0396237.pdf; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD980538763.htm	***TI Decision:*** State background levels being waived as ARARs. MCLs will be achieved.
	Rationale: State requirement to achieve background levels is being waived because (1) VOCs are being treated using air stripping, the current BAT, but cannot achieve background levels, which are zero upgradient of the site; (2) background concentrations for inorganics would require treating to zero or below detection limits and for some contaminants, the BATs are not capable of achieving those levels; (3) a number of the chemicals do not have sufficient associated risk to either human health or the environment to warrant their treatment; and (4) since the edge of the waste management unit is the Susquehanna River, any treatment at this area would be treating river water, making it impractical to achieve background levels due to the large volume of water requiring treatment.
	Conditions: *NAPL (suspected or observed)* – Suspected *COCs* – 4 chlorinated VOCs, 6 inorganics (metals) *Concentration* – Chlorinated VOCs and inorganics are present at elevated levels, with TCE being the primary COC. TCE concentrations ranged from 6 to 1,000 ppb. *Geology* – Fractured rock *TI Zone* – The TI zone is undefined in references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The selected remedy included continued operation of the existing drinking water supply treatment system and ICs (groundwater use restrictions).
	Current Status/Activities: The site summary (January 2012) indicates P&T continues and ICs (groundwater use restrictions) are in place. The remedy in place at the North Base Landfill portion is protective and no additional investigation is necessary. The Susquehanna Area Regional Airport Authority will require monitoring and a VI study because it was not assessed previously. The VI study will be evaluated in the 2012 FYR. This site was deleted from the NPL in 1997.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Whitmoyer Laboratories *State:* PA; *OU:* 3 (since changed to OU 6) *Decision Doc. (Type & Date):* ROD, 12/31/90 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU3, 12/31/90, www.epa.gov/superfund/sites/rods/fulltext/r0391109.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-03032.pdf; (3) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010030003458.pdf	***TI Decision:*** ARARs being waived in the selected remedy are background levels. The contingent remedy would waive MCLs. Health-based cleanup goals were selected for arsenic at 50 µg/L and aniline at 10 µg/L.
	Rationale: The extent of groundwater contamination was defined by the arsenic and aniline plume. Based on health-based cleanup levels, the quantity of groundwater was estimated to be 350 million gallons for the dissolved portion of contaminants. Substantial amounts of the contaminants may also be adsorbed onto clays found within the bedrock fractures, and VOCs may be present in NAPL form.
	Conditions: *NAPL (suspected or observed)* – NAPL could be present. *COCs* – arsenic, aniline, PCE *Concentration* – Average concentrations were 17 mg/L for arsenic, 6.4 mg/L for aniline, and 0.25 mg/L for PCE. *Geology* – Clay and fractured bedrock *TI Zone* – The contaminated area totals 215 acres to an estimated depth of 500 feet bgs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The selected remedy consists of P&T remediation to health-based standards and waives remediation to background levels due to the extent of contamination and presence of fractured bedrock. Phase II of P&T is the same as Phase I. No changes were made in Phase I of P&T based on remedy performance.
	Current Status/Activities: The 2010 5-year review states full-scale P&T began in 1998 and is maintaining hydraulic control. It is unclear if the contingent remedy (P&T for containment and a TI waiver for MCLs) has been implemented. An evaluation is necessary to see if the current remedy can meet the more stringent cleanup standard of arsenic (changed from 50 µg/L to 10 µg/L). ICs (groundwater well restriction) have been established and groundwater monitoring will continue.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Lindane Dump *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 3/31/92 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 3/31/92, www.epa.gov/superfund/sites/rods/fulltext/r0392147.pdf; (2) FS, Appendix A; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD980712798.htm; (4) Five-year review, 2008, www.epa.gov/superfund/sites/fiveyear/f2008030003189.pdf	***TI Decision:*** ARARs being waived are background levels for pesticides, VOCs, and metals. Cleanup goals will be MCLs for lindane (0.2 µg/L) and benzene (5 µg/L).
	Rationale: The ARAR for remediation to background levels is being waived for the shallow aquifer because of the following: (1) based on the industrial land use and the fact that no wells exist downgradient, it is unlikely that groundwater would be considered for use as a drinking water source; (2) past site activities (coal mining) have rendered the groundwater a poor source of drinking water; (3) existing leachate/groundwater collection is effectively capturing shallow groundwater; and (4) it is technically impracticable to extract all shallow groundwater at the site due to complex hydrogeological conditions, possibility of subsidence, and site damage due to extensive pumping.
	Conditions: *NAPL (suspected or observed)* – No *COCs* – 5 pesticides, 4 VOCs, 3 metals, and phenol *Concentration* – Concentrations are included in Tables 13-18 in the ROD (not included in online version). *Geology* – Two aquifers (shallow and deep bedrock) *TI Zone* – TI Zone includes shallow aquifer; however the lateral extent of the TI zone is undefined in the references reviewed. Groundwater in the deep bedrock aquifer already meets MCLs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The selected remedy includes upgrading the existing leachate/groundwater collection treatment system and ICs (deed and access restrictions).
	Current Status/Activities: According to the 2008 5-year review, O&M of the landfill cap, leachate and groundwater collection and treatment, sampling and groundwater monitoring are being conducted at the Site. An IC in the form of a restrictive covenant that encompasses the 47.5 acres of the Lower Project Area was established in 2000.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Westinghouse Elevator Co *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 6/30/92 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 6/30/92, www.epa.gov/superfund/sites/rods/fulltext/r0392148.pdf; (2) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f2006030001084.pdf; (3) Site summary www.epa.gov/reg3hwmd/npl/PAD043882281.htm	***TI Decision:*** ARARs being waived are background levels for VOCs: TCE; 1,1,1-TCA; 1,1-DCE; 1,1-DCA; 1,2-DCE; and 1,2-DCA. Goals will be non-zero MCLGs or MCLs.
	Rationale: Based on the complex hydrogeology and likely presence of DNAPL, hydrogeologists recommended that the entire plume not be remediated because wells in the more dilute portion of the plume could draw water from the center of the plume and spread the contamination. The ARAR to remediate to background levels is being waived because (1) it is technically impracticable from an engineering perspective and (2) it will result in greater risk to human health and the environment.
	Conditions: *NAPL (suspected or observed)* – DNAPL is likely present due to high VOC concentrations. *COCs* – Chlorinated VOCs *Concentration* – Total VOCs were as high as 200,000 ppm, with TCE at more than 81,000 ppb. *Geology* – Complex. The geology beneath the site consists of red and gray siltstones and shale bedrock. The shallow groundwater flow direction mostly follows the topography toward nearby Rock Creek and there also appears to be some structural influence (that is, bedding). The deeper flow is strongly influenced by the bedding and is anisotropic. *TI Zone* – TI Zone includes on-plant and off-plant groundwater; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – The selected remedy includes P&T to contain the plume and achieve non-zero MCLGs or MCLs.
	Current Status/Activities: The 2006 5-year review states that P&T was installed in 1997, ICs are in place to restrict groundwater use, and an alternate water supply would be provided if requested. The site summary (January 2012) states that monitoring is in place and the protectiveness of the remedy will be determined after a VI study is conducted.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: E.I. Dupont Nemours (Newport Landfill) *State:* DE; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/29/93 *Stage:* Pre-construction *Media:* Surface water *References:* (1) ROD, OU1, 9/29/93; www.epa.gov/superfund/sites/rods/fulltext/r0393170.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f2011090004165.pdf; (3) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010030003634.pdf	***TI Decision:*** State and federal surface water quality standards are being waived for lead, copper, zinc, cadmium, aluminum, iron, chromium, mercury, dichlorobenzenes, and PCE.
	Rationale: Upstream sources of zinc and possible background sources of iron and aluminum make it technically impracticable to achieve surface water standards for the north wetlands and Christiana River. The containment remedy prevents discharge to the river.
	Conditions: *NAPL (suspected or observed)* – No formal DNAPL investigation was performed, but contaminant levels are indicative of DNAPL. *COCs* – Metals, dichlorobenzenes, and PCE *Concentration* – Concentrations not provided. *Geology* – Coastal plain (unconsolidated sands, silts, and clays), Columbia and Potomac formations *TI Zone* – TI Zone applies to the Christiana River and the north wetlands; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Groundwater has no evaluation of timeframe because TI is based on greater risk to human health and the environment waiver. Ambient water quality controls for surface water waived using TI waiver. *Remedial Action Alternatives* – The selected remedy includes dredging of the river, actions to limit contaminant migration in the northern area, alternate water supply, and ICs for groundwater.
	Current Status/Activities: The 2005 5-year review indicated that alternate water supply and ICs (groundwater well restrictions) have been implemented. P&T is being used to limit migration to the river and dredging has been completed. According to the 2010 5-year review, soil cleanup standards have changed and an updated risk assessment should be performed. Further evaluation of potential plume migration at the southern perimeter of the Site was also recommended.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Hunterstown Road *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 8/2/93 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 8/2/93, www.epa.gov/superfund/sites/rods/fulltext/r0393176.pdf; (2) ESD, 8/25/98, www.epa.gov/superfund/sites/rods/fulltext/e0398045.pdf; (3) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-03023.pdf ; (4) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010030003541.pdf	***TI Decision:*** ARARs waived include background levels, MCLs, and MCLGs for VOCs.
	Rationale: The TI waiver was issued based on probable DNAPLs in fractured bedrock at extreme depths (RI indicated that DNAPLs may have migrated deeper than 2,000 feet). The ROD selected waiving background levels, MCLs, and MCLGs for groundwater at depths greater than 800 feet bgs and indicated that groundwater above 800 feet bgs will be remediated to background levels (defined as "no detection of VOCs"). The ROD also stated that after the remedy (P&T) was operational for several years, it may be determined that background levels cannot be achieved at depths less than 800 feet bgs and may be waived due to TI. A 1998 ESD stated that it may be possible to make a determination as to the engineering feasibility and practicability of remediating the aquifer above 800 feet bgs during the remedial design phase. However, documentation reviewed for this summary does not clearly indicate if this waiver above 800 feet has been issued.
	Conditions: *NAPL (suspected or observed)* – DNAPLs are likely present based on past site activities and concentrations. *COCs* – Primarily TCE, DCE, vinyl chloride, TCA, and DCA *Concentration* – Total VOCs were detected above 2,000 ppb at 500 feet bgs. *Geology* – Fractured bedrock *TI Zone* – Standards waived for groundwater at depths greater than 800 feet bgs, but may be expanded to all groundwater depths, at the Lagoon Area and Drum Burial Areas.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – P&T for the upper 800 feet of the aquifer, and ICs
	Current Status/Activities: P&T began at the site in 2003. The 2010 5-year review recommended that 1,4-dioxane be included into the Groundwater Monitoring Plan. All ICs to restrict groundwater use and protect the constructed remedy have been implemented at the site. VI pathways have been assessed, and sub-slab VI mitigation equipment was installed in one potentially impacted residence.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Aladdin Plating *State:* PA; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 12/30/93 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 12/30/93, www.epa.gov/superfund/sites/rods/fulltext/r0394179.pdf; (2) Five-year review, 2004, www.epa.gov/superfund/sites/fiveyear/f04-03015.pdf; (3) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009030003038.pdf	***TI Decision:*** The ARAR being waived is for background levels of chromium (25 PA Code Sections 264.90-100).
	Rationale: A TI waiver has been issued because (1) migration is very limited (chromium contamination in the shallow aquifer is not expected to migrate to a drinking water aquifer for at least 2,000 years due to the tightly bound site soils) and (2) there are no technically practicable alternatives for achieving background quality in the shallow and intermediate water-bearing zones. MCLs and federal standards will continue to be attained where relevant and appropriate (bedrock aquifer for MCLs and in nearby creeks for surface water standards).
	Conditions: *NAPL (suspected or observed)* – No *COCs* – Chromium *Concentration* – Maximum total dissolved chromium in shallow groundwater was 188,000 ppb. *Geology* – Shallow and intermediate water-bearing zones with low permeability soils, deeper bedrock aquifer *TI Zone* – TI Zone includes shallow and intermediate groundwater zones; however the lateral extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The selected remedy includes ICs and monitoring. Currently, no pumping is ongoing. The source has been removed and the contamination has been isolated.
	Current Status/Activities: Based on the 2009 5-year review, ICs preventing disturbances to the shallow contaminated groundwater have been put in place, semi-annual groundwater monitoring is being conducted, and the site has been deleted from the NPL.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Butler Mine Tunnel *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 7/15/96 Stage: Pre-construction Media: Surface water *References:* (1) ROD, OU1, 7/15/96, www.epa.gov/superfund/sites/rods/fulltext/r0396224.pdf; (2) Site summary, www.epa.gov/reg3hwmd/npl/PAD980508451.htm; (3) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009030002935.pdf	***TI Decision:*** ARARs being waived are state water quality criteria and NPDES standards for VOCs, SVOCs, naphthalene (PAH), and cyanide (see Table 4 of ROD).
	Rationale: This remedy addresses the possible future releases of hazardous substances from the Butler Tunnel to the Susquehanna River. It is estimated that 50,000 to 90,000 gallons of oil could still be contained in the mine workings. Releases from the mine would allow significant contamination to discharge to the river, and as a result, state water quality criteria would be exceeded because no technologies are currently available to prevent the flow of contaminants to the river. In addition, if a release creates a point source discharge of pollutants to surface waters, NPDES criteria would be applicable. However, because of the potential volume of tunnel flushout, compliance with NPDES requirements are technically impracticable from an engineering perspective.
	Conditions: *NAPL (suspected or observed)* – Oily wastes are in the mine and may discharge to the river *COCs* – 8 VOCs, 6 SVOCs, PAH, and cyanide *Concentration* – Concentrations provided in Table 2 of the ROD. *Geology* – The tunnel is a subsurface mine drainage system that was constructed prior to 1930 to drain interconnected mine shafts above an elevation of 595 feet above mean sea level into the Susquehanna River. Releases occur when the waste oils that exist in the mine network get flushed out during rain events that raise the water elevation to the Butler Mine tunnel interconnected drainage system. *TI Zone* – TI waiver applies to the Susquehanna River; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – The selected remedy includes ICs (deed restrictions) and preparation for responding to a release.
	Current Status/Activities: According to the 2009 5-year review, ICs (deed restrictions) are currently being negotiated. Site summary (June 2011) indicates the remedial action (as set forth in the ROD) has been performed.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Brodhead Creek *State:* PA; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 6/30/95 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 6/30/95, www.epa.gov/superfund/sites/rods/fulltext/r0395211.pdf; (2) FS, Appendix C, 3/14/95; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD980691760.htm; (4) Five-year review, 2009, www.epa.gov/superfund/sites/fiveyear/f2009030002934.pdf	***TI Decision:*** MCLs are being waived for benzene, pentachlorophenol, benz(a)anthracene, chrysene, BEHP, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, arsenic, and cyanide. The requirement of the PA DER Groundwater Protection Strategy, which requires groundwater to be restored to background levels, is also being waived.
	Rationale: Two free coal tar accumulations are immobilized and confined in the upper surface of the silty sand unit, and coal tar at residual levels is also present in the site soils. However, there are no existing or potential exposures to either the shallow or deep groundwater at any on- or off-site supply wells. In addition, although the groundwater discharging to Brodhead Creek is the principal potential route of migration for coal tar-related constituents in the dissolved phase, no site-related impacts on the stream are expected to occur. Previous actions have included installation of a slurry wall, recovery of 8,000 gallons of coal tar using extraction wells, and removal of 1,500 gallons of coal tar using CROW, which have reduced most coal tar (except the 2 accumulations) to residual levels. Given that there is no technically viable method for remediating subsurface soils containing residual levels of coal tar (either by complete removal or *in situ* treatment), the restoration timeframe for groundwater in the shallow aquifer is indefinite, as these soils will continue to be a source of continuing releases of coal tar-related constituents to the groundwater in the stream gravel unit.
	Conditions: *NAPL (suspected or observed)* – Free coal tar (a DNAPL) has been detected at 2 separate areas. Additional areas contain coal tar at residual levels. *COCs* – Benzene, pentachlorophenol, 7 PAHs, bis(2-ethylhexyl)phthalate, arsenic, and cyanide *Concentration* – Concentrations not provided in FS, Appendix C (TI Demonstration) *Geology* – Two water-bearing zones (silty sand unit, stream gravel unit) *TI Zone* – The horizontal area (2.7 acres) includes the area containing free and residual coal tar from the slurry wall to the west of the site. The vertical extent includes the stream gravel unit between the fill and silty sand units. This TI Zone has a volume of approximately 26,000 cubic yards.
	Evaluation: *Remedial Timeframe Estimate (years)* – The restoration timeframe for groundwater in the shallow aquifer is indefinite because soils will be a continual source of contamination. *Remedial Action Alternatives* – No further action was selected for this OU.
	Current Status/Activities: According to site summary (January 2012), ICs as land use and groundwater restrictions are in place. The site was deleted from the NPL in 2001. In August 2007, two coal tar seeps were discovered in McMichael Creek and a stormwater runoff channel. The PRP undertook immediate action to contain the seeps. The 2009 5-year review states that investigations conducted in 2008 to determine the probable cause of the seeps concluded that the seeps were likely the result of northward erosion of McMichael Creek and heating of coal tar in the subsurface in the summer months resulting from a lack of vegetation. Excavation of coal tar impacted soils was conducted in 2008 and disposed offsite. No coal tar seeps have since been identified.

Summary of Technical Impracticability Waivers at Superfund Sites
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General Site Information	TI-Relevant Information
Site Name: Revere Chemical Co *State:* PA; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 6/20/96 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 6/20/96, www.epa.gov/superfund/sites/rods/fulltext/r0396220.pdf; (2) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f0603025.pdf; , (3) Five-year review, 2011, www.epa.gov/superfund/sites/fiveyear/f2011030004092.pdf	***TI Decision:*** MCLs are being waived for VOCs (TCE, TCA, PCE, and toluene) and SVOCs (1,2,4-TCB, BEHP, and 1,2-DCB).
	Rationale: The use of P&T for groundwater restoration is not practicable because of the limited capacity of the shallow groundwater to recharge the wells and produce sufficient water quantities. The contaminated zone has not been expanding and does not extend beyond the area to be capped. The cap is expected to have a direct influence on improving the quality of the shallow groundwater unit at this site.
	Conditions: *NAPL (suspected or observed)* – No *COCs* – VOCs, SVOCs *Concentration* – Maximum TCE concentration was 200 ppb. Concentration ranges were as follows (in ppb): 1,2,4-TCB–41–150; 1,2-DCB–3–5; and BEHP–3–42. *Geology* – Very tight Triassic shale *TI Zone* – TI zone includes the shallow groundwater; however the lateral extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – less than 30 years (Note: Groundwater contamination was marginally above the MCLs and limited in area. The shale aquifer is very tight and wells tend to purge dry and take days to recover). *Remedial Action Alternatives* – The selected remedy for groundwater includes ICs and monitoring.
	Current Status/Activities: Based on the 2011 5-year review, groundwater restrictions are in place at the site and groundwater migration is under control. With the recording of a revised covenant in 2010, the ICs are complete. Remedial actions were implemented pursuant to the RODs for both OUs, and the site is considered protective of human health and the environment.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Aberdeen Proving Ground, Edgewood Area *State:* MD; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/24/97 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/24/97, www.epa.gov/superfund/sites/rods/fulltext/r0397090.pdf; (2) FFS, Appendix J, June 1996; (3) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f04-03028.pdf ; (4) Five-year review, 12/16/08, www.epa.gov/superfund/sites/fiveyear/f2009030002827.pdf	***TI Decision:*** Federal and state standards are being waived for organics and inorganics.
	Rationale: An evaluation determined that the DNAPL zone could neither be contained nor removed, and that the aqueous-phase plume could not be restored. A TI waiver was justified because of the following: (1) difficulty to locate all DNAPL as a high degree of stratigraphic and hydrogeologic discontinuities have been identified; (2) human health and ecological risk assessments have show no unacceptable levels of risk; (3) groundwater discharges into Bush River and appears to result in surface water concentrations that are nondetectable or at non-toxic levels; and (4) upward migration is not likely due to the hydraulic disconnection between this area with the mainland surficial aquifer and its low production yield. In addition, the presence of UXO and the ability to clear such ordnance makes containment and removal efforts infeasible. Although DNAPL is the main reason for the TI waiver, inorganics are also included in the waiver because (1) there is no benefit from attempting to remediate these compounds alone, (2) inorganic compounds do not suggest a continuous plume, and (3) several contaminants were found to be within natural background concentration ranges.
	Conditions: *NAPL (suspected or observed)* – DNAPLs are likely residual and pooled (1,1,2,2-PCA and TCE). *COCs* – 15 organics (VOCs), 20 inorganics *Concentration* – Maximum concentrations: antimony–0.312 mg/L; beryllium–0.005 mg/L; cadmium–0.028 mg/L; lead–0.015 mg/L; nickel–0.443 mg/L; vinyl chloride–1 µg/L; 1,2-DCE–340 µg/L; chloroform–10 µg/L; TCE–2400 µg/L; 1,1,2-TCA–150 µg/L; PCE–120 µg/L and 1,1,2,2-PCA–22,000 µg/L. *Geology* – High degree of stratigraphic and hydrogeologic discontinuities in unconsolidated coastal plain sediments *TI Zone* – TI Zone includes all portions of the groundwater where cleanup levels are not met and extends to the base of the aquifer (75 feet bgs); however the lateral extent of the TI zone is undefined in the references provided.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The selected remedy includes ICs (groundwater use restrictions).
	Current Status/Activities: According to the 2008 5-year review, many activities are being conducted at the site. ICs (groundwater use restrictions) are in place and the annual status was reported in a formal certificate from Aberdeen Proving Ground.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Aberdeen Proving Ground, Edgewood Area *State:* MD; *OU:* 8 *Decision Doc. (Type & Date):* ROD, 9/28/01 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU8, 9/28/01, www.epa.gov/superfund/sites/rods/fulltext/r0301025.pdf; (2) TI Evaluation, October 2001; (3) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f04-03028.pdf ; (4) Five-year review, 12/16/08, www.epa.gov/superfund/sites/fiveyear/f2009030002827.pdf	***TI Decision:*** MCLs and MCLGs are being waived for VOCs, primarily chlorinated ethanes and ethenes, as well as inorganic constituents (metals).
	Rationale: Groundwater contamination (mainly VOCs) is present throughout the surficial aquifer but mostly in the upper 20 feet. DNAPL has been observed in a free-phase form and is likely also present in residual form. The low permeability and heterogeneity of the aquifer materials, the presence of UXO, and the large size of the contaminated area complicate removal, treatment, or containment actions for NAPL. Metals contamination is co-located with the VOC contaminants, and MCLs for metals will also be waived because the inability to clean up VOCs precludes the use of the aquifer.
	Conditions: *NAPL (suspected or observed)* – Free-phase DNAPL has been observed and residual DNAPL is likely present. *COCs* – 15 organics (mostly chlorinated ethanes and ethenes), 21 inorganics (metals) *Concentration* – Maximum concentrations in 1999 (in mg/L): 1,1,2,2-PCA–390; DCE–110; TCE–93; PCE–11; TCA–7.1; and vinyl chloride–4.2. See Tables 4-11 and 4-13 of TI Evaluation Report for additional concentrations. *Geology* – Low permeability and heterogeneous *TI Zone* – TI Zone encompasses all portions of the J-Field Surficial Aquifer that do not meet MCLs and extends to the confining layer (approximately 40 feet bgs).
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The selected remedy includes DNAPL recovery, phytoremediation, and ICs (land and groundwater use restrictions).
	Current Status/Activities: According to the 2008 5-year review, many activities are being conducted at the site. ICs (land and groundwater use restrictions) have been implemented.

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Rodale Manufacturing Co., Inc. *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/30/99 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/30/99, www.epa.gov/superfund/sites/rods/fulltext/r0399086.pdf; (2) TI Evaluation, 9/99; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD981033285.htm	***TI Decision:*** MCL at 5 µg/L is being waived for TCE.
	Rationale: An overburden and fractured bedrock aquifer are present at the site. Both units are highly heterogeneous and complex at a small scale. The bedrock matrix porosity represents a significant storage capacity for VOCs that diffuse into the matrix from the fractures, as confirmed by bedrock matrix VOC analysis; this diffusion will significantly hinder efforts to restore bedrock groundwater quality. P&T began in 1996 and after 2 years of operation, approximately 21 million gallons of groundwater had been pumped while groundwater concentrations of influent are showing asymptotic levels approximately 3 orders of magnitude above regulatory criteria. At these mass-removal rates, it has been estimated that the DNAPL mass will dissolve in 592 to 2,370 years. VOC mass calculations indicate the estimated total subsurface VOC mass may range up to 647,000 mg/kg, with up to 592,000 mg/kg in the form of DNAPLs and the remainder in the dissolved, sorbed, or vapor phase. Currently, no technology is capable of restoring groundwater; technologies are capable of removing some mass but they pose unacceptable risks, such as mobilizing DNAPL or drilling through DNAPL to install wells.
	Conditions: *NAPL (suspected or observed)* – DNAPL is likely present based on TCE concentrations. *COCs* – TCE *Concentration* – Maximum TCE concentration was 570,000 µg/L. *Geology* – Overburden and fractured bedrock aquifers (both units are highly heterogeneous and complex at a small scale) *TI Zone* – The TI Zone coincides with the probable DNAPL zone, which has been identified by wells that indicate the likely presence of proximal DNAPL based on groundwater VOC concentrations exceeding 1 percent of the solubility of TCE in groundwater (source area is approximately 350 feet long, 200 feet wide, and extends an average of 320 feet bgs).
	Evaluation: *Remedial Timeframe Estimate (years)* – It has been estimated that DNAPL mass will dissolve in 592 to 2,370 years. *Remedial Action Alternatives* – According to site documents, an appropriate remedial action objective is to minimize the risk of DNAPL mobilization; this will be achieved by hydraulic containment, ICs, and MNA.
	Current Status/Activities: In 1990, municipal well-head treatment (air strippers) was implemented at three wells. Based on the site summary (January 2012), P&T is being conducted to limit migration and MNA is ongoing. ICs (land use and groundwater use restrictions) have been selected but it is not clear if they have been implemented. A VI study was conducted in 2010 with additional sampling planned for February 2012.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Naval Air Development Center *State:* PA; *OU:* 12A *Decision Doc. (Type & Date):* ROD, 9/27/00 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD, OU12A, 9/27/00, www.epa.gov/superfund/sites/rods/fulltext/r0300014.pdf; (2) RI/FS, Appendix E, June 2000; (3) Five-year review, 2002, www.epa.gov/superfund/sites/fiveyear/f02-03024.pdf ; (4) Five-year review, 8/14/07, www.epa.gov/superfund/sites/fiveyear/f2007030001712.pdf	***TI Decision:*** The TI waiver is for federal and state drinking water standards for chemicals present in DNAPL form. The waiver is for TCE (5 µg/L) and potentially for standards for carbon tetrachloride, PCE, or both, if present.
	Rationale: Chlorinated VOCs are present in the fractured bedrock aquifer below the site (and TCE has been observed as a DNAPL). P&T began at OU1 as an interim remedy in 1999 (selected in 1993) until additional evaluations could be conducted and a final remedy selected. On-site concentrations have remained relatively constant but P&T has decreased concentrations downgradient of the system and is controlling migration. The evaluation concluded that extraction processes may be effective in restricting the migration of the plume in the immediate vicinity of DNAPL; however, extraction wells likely would not capture and remove all DNAPL, and collection trenches are not a viable option because DNAPL is present at depths of 70 feet bgs. Little destructive biological degradation activity was noted at this site. Soil removal actions have been conducted and an alternate water supply was provided.
	Conditions: *NAPL (suspected or observed)* – TCE was confirmed in DNAPL form. Carbon tetrachloride, PCE, or both may also potentially exist as DNAPL. *COCs* – TCE, carbon tetrachloride, PCE *Concentration* – The maximum TCE concentration measured during extraction well installation was 1,219 mg/L in 1999. *Geology* – Fractured bedrock *TI Zone* – The TI Zone is approximately 80 feet in diameter and a depth from the water table to 75 feet bgs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Based on an estimated TCE release of 75 to 374 gallons, the estimated time to dissolve DNAPL is 199 years. After DNAPL is dissolved, cleanup to the MCL should proceed relatively quickly (5 to 11 years). Since TCE is the most prominent contaminant, it is expected that other contaminants will achieve goals in an equal or lesser timeframe. *Remedial Action Alternatives* – P&T will continue to limit DNAPL migration. ICs were also selected as part of the remedy.
	Current Status/Activities: Based on 2007 5-year review, ICs prohibiting groundwater usage have been implemented and P&T is ongoing.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Keystone Sanitation Landfill *State:* PA *OUs:* 01 *Decision Doc. (Type & Date):* Amd, 6/1999 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) Amd, OU 1, 6/1999, www.epa.gov/superfund/sites/rods/fulltext/a0399505.pdf; (2) Five-year review report, 9/2010, www.epa.gov/superfund/sites/fiveyear/f2010030003542.pdf; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD054142781.htm; (4) Institutional Controls for Keystone Sanitation Landfill, July 2008, www.epa.gov/ictssw07/public/export/03/PAD054142781/PAD054142781_report.HTM	***TI Decision:*** ARARs waiver of state secondary MCLs for iron and manganese in both on-site and off-site groundwater (Class IIA aquifer).
	Rationale: Since the secondary MCL (SMCL) for both iron and manganese is less than the upper range of naturally-occurring iron and manganese, EPA has determined it is technically impracticable from an engineering perspective to clean up these contaminants to the state SMCL levels. Groundwater extraction will capture and remediate the manganese associated with releases from the Site but would not reduce ambient levels. The risk-based cleanup standards for iron and manganese are sufficiently health-protective.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue *COCs* – Metals and VOCs *Concentration* – Not provided *Geology* – Fractured bedrock *TI Zone* – On-site and off-site groundwater.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not provided *Remedial Action Alternatives* – Groundwater P&T was selected as the original remedy for on-site groundwater. This amendment adds off-site groundwater to the remedy. When the amendment was signed, the P&T system was under construction. Point-of-use treatment units were also selected for affected residents.
	Current Status/Activities: P&T has been operational since 2000 and treatment units have been installed on 34 residences. The landfill cap has been upgraded and the landfill gas extraction system is also operational. ICs are in place for soil and groundwater to prohibit any activity that may disturb the integrity of engineering controls at the site.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Westinghouse Electric (Sharon Plant) *State:* PA; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 2/20/03 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 2/20/03, www.epa.gov/superfund/sites/rods/fulltext/r0303067.pdf; (2) TI Evaluation Report, 3/22/02; (3) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f2006030001101.pdf ; (4) Five-year review, 9/22/11, www.epa.gov/superfund/sites/fiveyear/f2011030004096.pdf	***TI Decision:*** The TI waiver is for MCLs and non-zero MCLGs for PCBs, VOCs and metals, and chlorinated benzenes (the demonstrated DNAPL constituents). Additional contaminants are present at this site but are not included in the TI waiver.
	Rationale: The release of DNAPL at this site is classified as "a large-volume, long duration, continual release to a heterogeneous, low to moderate permeability medium." The estimated DNAPL mass present in the alluvial aquifer is approximately 3,000 to 7,300 tons; and the estimated volume of LNAPL is 60,000 gallons. LNAPL recovery is being conducted and after 6.5 years of operation (as of 2002) had recovered a total of 648 gallons of LNAPL, which is about 1 percent of the total estimated volume. The NAPLs have remained relatively immobile and there is concern that *in situ* treatment may increase NAPL mobilization by creating preferential pathways or by increasing solubility of the contaminants. "Based on the mass of COPCs in NAPLs within the source area at the site and the stable and hydrophobic nature of PCBs, there is no reasonable basis to expect that these NAPL zones can be remediated to ARAR-based criteria in a time frame less than hundreds of years." Physical containment of NAPL source areas is not feasible because of anthropologic conditions (2 active industrial plants and an active railroad line). There are no receptors of impacted groundwater in the site vicinity, no threats posed to human health, and no threats posed to the environment from groundwater discharge to a nearby river. Contamination in the bedrock aquifer is limited.
	Conditions: *NAPL (suspected or observed)* – Both LNAPL and DNAPL are present. *COCs* – PCBs, 5 chlorinated benzenes *Concentration* – In 2011, the following concentrations were observed in the alluvial aquifer: 1,2,4-TCB 6,300 µg/L; total dichlorobenzene up to 1,000+ µg/L; chlorobenzene 2,000 µg/L; TCE 70 µg/L; and PCBs up to 7,300 µg/L. *Geology* – Two aquifers (alluvial and bedrock aquifers) *TI Zone* – TI Zone fully encompasses the alluvial aquifer where LNAPL and DNAPL exist and downgradient areas where MCLs and non-zero MCLGs might be exceeded in the foreseeable future. The extent of the TI zone is approximately 100 acres.
	Evaluation: *Remedial Timeframe Estimate (years)* – According to site documents reviewed, it is not possible to extrapolate remedial time frame estimates at this site because there are no mass-removal rates available for innovative or emerging DNAPL treatment technologies. Based on the mass of contamination within the source area, there is no reasonable basis to expect that remediation can occur in less than 100 years. *Remedial Action Alternatives* – Monitoring is the only action to be taken for groundwater.
	Current Status/Activities: Based on a 2011 5-year review, soil removal actions have been conducted, site-wide ICs (groundwater well restrictions and deed restrictions) are in place, and groundwater monitoring is ongoing.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: UGI Columbia Gas Plant *State:* PA; *OU:* 1 *Decision Doc. (Type & Date):* *ROD*, 9/24/07 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/24/07, www.loggerhead.epa.gov/arweb/public/pdf/2084262.pdf; (2) TI Evaluation Report, October 2003; (3) Site summary, www.epa.gov/reg3hwmd/npl/PAD980539126.htm	***TI Decision:*** The TI waiver is for MCLs and risk-based concentration ARARs for 27 contaminants within and above the DNAPL (TI) zone.
	Rationale: Currently, no technologies are capable of restoring groundwater to ARARs in the area of the DNAPL under present site conditions. A large amount of viscous DNAPL is present in the fractured bedrock. The more soluble and mobile source fractions of the original DNAPL have likely been removed through naturally occurring attenuation processes, leaving behind the more intractable fractions (residual DNAPL). This residual DNAPL will likely continue to slowly dissolve for centuries (or longer). Any technology capable of removing the DNAPL in such an environment would first have to mobilize the DNAPL and then extract the mobilized DNAPL. No known technologies are capable of extracting DNAPL from such a complicated fractured bedrock geologic system. Moreover, any attempt to remobilize the DNAPL may cause ecological and human health risks, which do not currently exist in the vicinity of the site and Susquehanna River. A dissolved phase plume presumably discharges to the Susquehanna River; however, discharge points/discharge area into the River was not detected, nor was contamination from the DNAPL found in the River. The Susquehanna River eliminates the potential for further expansion of the groundwater plume; however, the Lancaster Water Authority cooling water wells had pulled a small lobe of the dissolved plume into the pre-treated public water supply. These wells stopped pumping in 2007. Reducing the plume size would be extremely expensive and will not provide further risk reduction for human health; ecological risks could not be quantified because the discharge points/area into the River could not be identified. Additionally, the site vicinity is supplied with public water and no risks are associated with the current use of groundwater.
	Conditions: *NAPL (suspected or observed)* – DNAPL present *COCs* – VOCs (7), SVOCs (14) and inorganics (6) *Concentration* – Maximum concentrations provided in Table 3-1 of TI Evaluation Report. *Geology* – Fill and alluvium underlain by fractured bedrock *TI Zone* – TI zone applies to areas within and above the DNAPL zone, including the overburden, shallow bedrock, and deep bedrock aquifers. Zone covers approximately 6 acres and includes the site, area south of the site to the Susquehanna River, and area west of the site.
	Evaluation: *Remedial Timeframe Estimate (years)* – DNAPL description above states that DNAPL will continue to dissolve for centuries (or longer). *Remedial Action Alternatives* – Monitored natural gradient flushing and ICs.
	Current Status/Activities: Former gas holders were emptied and stabilized, on-site soils were capped, and sediments were removed. In 2007, no further action was selected for site soils. ICs such as groundwater use and well restrictions are in place, and additional ICs, including land use restrictions, are planned. Long-term groundwater monitoring is currently being performed.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Region 4: 0 sites	
Region 5: 4 sites	
Site Name: Continental Steel Corp *State:* IN; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/30/98 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, 9/30/98, www.epa.gov/superfund/sites/rods/fulltext/r0598091.pdf; (2) Five-year review, 2002, www.epa.gov/superfund/sites/fiveyear/f02-05013.pdf	***TI Decision:*** Cleanup standards are being waived for all contaminants; the most prominent contaminants in site groundwater are PCE; TCE; 1,2-DCE; and vinyl chloride.
	Rationale: It was estimated that with or without treatment, groundwater would take more than 200 years to be restored.
	Conditions: *NAPL (suspected or observed)* – DNAPL is present in all three water-bearing zones. *COCs* – Chlorinated VOCs *Concentration* – Ranges of concentrations in intermediate water-bearing zone (in µg/L): 1,2-DCE–2,000; PCE–76–99; TCE–1–5,100; and vinyl chloride–1–150. Ranges of concentrations in lower water-bearing zone (in µg/L): PCE–130; TCE–1–160; and vinyl chloride–1–330. *Geology* – Three water-bearing units (deepest is fractured bedrock) *TI Zone* – TI Zone includes the intermediate and lower water-bearing zones (fractured bedrock) for the entire site.
	Evaluation: *Remedial Timeframe Estimate (years)* – More than 200 years *Remedial Action Alternatives* – The selected remedy included use of a nearby P&T system to contain the plume in the lower water-bearing zones and restore the shallow zone, MNA for plume remediation of lower 2 zones, and ICs.
	Current Status/Activities: Remedial actions for OUs 3, 4, 5 and 6 have been completed. Remedial action for OU1 (SVE and groundwater extraction) and OU2 (the Lagoon Area) are ongoing. SVE is expected to be completed in September 2012.

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General Site Information	TI-Relevant Information
Site Name: Conrail Rail Yard (Elkhart) *State:* IN; *OU:* 2 *Decision Doc. (Type & Date):* ROD Amendment, 9/27/00 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU2, 9/27/00, www.epa.gov/superfund/sites/rods/fulltext/a0500160.pdf; (2) Petition for TI Waiver; (3) Five-year review, 2004, www.epa.gov/superfund/sites/fiveyear/f04-05031.pdf ; (4) Five-year review, 6/15/09, www.epa.gov/superfund/sites/fiveyear/f2009050002956.pdf	***TI Decision:*** MCLs are waived for the following compounds: carbon tetrachloride; 1,1-DCE; TCE; 1,2-DCE; PCE; chloroform; and vinyl chloride.
	Rationale: The 2000 ROD Amendment changes the remedy from P&T for restoration to hydraulic containment of DNAPL source areas (where DNAPL was likely present but not observed or recovered). In addition, subsurface geology is heterogeneous both vertically and horizontally, and contamination ranges as deep as 60 to 80 feet bgs. Active railyard operations also present a formidable restriction on the engineering practicability of available alternatives. Based on these factors, it was determined that groundwater contaminant concentrations may be lowered, but they could not be lowered enough to restore the groundwater.
	Conditions: *NAPL (suspected or observed)* – DNAPL is likely but not observed or recovered *COCs* – Chlorinated VOCs *Concentration* – Historical maximum concentrations have been detected at 15,000 µg/L for TCE and 110,000 µg/L for tetrachloride. More recent sampling indicated TCE concentrations from ND-2,800 µg/L and tetrachloride from 110–7,200 µg/L. *Geology* – Heterogeneous, both vertically and horizontally *TI Zone* – TI waiver applies to 2 DNAPL source areas (Track 65/66 and Track 69); however the vertical extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long timeframe (no quantitative evaluation of the restoration). *Remedial Action Alternatives* – P&T for hydraulic containment of DNAPL source areas.
	Current Status/Activities: An alternate water supply was provided at this site (bottled water followed by residential treatment units, then extension of municipal supply) as well as SVE systems in some homes. P&T was constructed to limit migration and continues to operate, and MNA is being monitored; however ICs (deed restrictions to protect the P&T system) are not fully implemented. A third 5-year review was completed by EPA in 2009, which concluded that the groundwater remedy is not operating as intended and that some groundwater contamination is escaping the capture system. The PRPs initiated an investigation in 2009 to address the issues raised in the 5-year review. EPA is currently evaluating the results of the investigation for potential modifications to the groundwater remedies in both the rail yard and drag strip areas.

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General Site Information	TI-Relevant Information
Site Name: Lemon Lane Landfill *State:* IN; *OUs:* 2 & 3 *Decision Doc. (Type & Date):* ROD Amendment, OUs 2 and 3, 9/29/06 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD Amendment, OUs 2 and 3, 9/29/06; (2) Site summary, www.epa.gov/region5superfund/npl/indiana/IND980794341.htm; (3) Five-year review, 5/24/10, www.epa.gov/superfund/sites/fiveyear/f2010050003424.pdf	***TI Decision:*** The TI waiver is for the NPDES substantive requirements for stormwater flow greater than 1,000 gpm, which bypasses the water treatment plant. The following ARARs are waived: 327 IAC 2-1-6 Table 1; 327 IAC 5-2-8 (10), (11), (12), (13) (14); 327 IAC 5-2-11 (a)(1), (2), (3), (4), (5)(c), (d), (e), (f), (g), (h); 327 IAC 5-2-11.1 (a), (b), (d), (f), (g), (h).
	Rationale: The Illinois Central Spring (ICS) is a discharge point for an approximately 300-acre groundwater basin, of which Lemon Lane Landfill is 11 acres. Hydrologic tests since 1998 have not successfully demonstrated that PCBs in karst bedrock can be effectively contained, removed, or treated by remedial action focused at the landfill and there is no location between the landfill and ICS where groundwater drainage can be captured and treated for PCBs. Instead, groundwater must be treated as it emerges from the groundwater system, which includes water from the entire 300-acre basin. The ICS has a mean hourly flow rate of 300 gpm, and peak rates are approximately 4,500 gpm. Due to the infrequent and episodic nature of the PCB releases at ICS, the large quantities of DNAPL deep in the rock near the landfill, and the volume of water requiring treatment, the EPA is granting a TI waiver of NPDES substantive requirements for spring water which is not treated within the existing 1,000-gpm treatment plant. The State of Indiana typically sets an effluent limit of 0.3 µg/L for PCBs discharged by treatment plants into waters other than the Great Lakes System. As result of this TI waiver, no discharge criteria will be given to spring water that is not treated by the 1,000-gpm treatment plant. The remedial action objective of reducing the amount of PCBs released into Clear Creek will continue to be achieved.
	Conditions: *NAPL (suspected or observed)* – DNAPL present in bedrock *COCs* – PCBs *Concentration* – PCBs generally range from 5 to 20 µg/L under low flow conditions in ICS and can exceed 500 µg/L during storm events. *Geology* – Karst terrain, 5 to 20 feet of soil above limestone layers (70 to 80 feet thick each). Four springs located near the landfill. *TI Zone* – TI waiver applies to groundwater flow greater than 500 gpm during storm events; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not applicable *Remedial Action Alternatives* – This TI waiver is common to all remedial alternatives. The selected remedy includes a storage overflow tank system, which will treat 5,000 gpm and when combined with the existing 1,000-gpm treatment plant, can address a 25-year, 6-hour storm event. This alternative treats nearly 100 percent of the ICS flow and addresses 99 percent of the PCB mass released from ICS.
	Current Status/Activities: Source removal, on-site consolidation, and capping for OU1 have been conducted. OU2 and OU3 (sediments and groundwater) are approximately 99% construction completed. Groundwater is being treated at the existing treatment plant, which has been expanded. ICs have not been finalized.

Summary of Technical Impracticability Waivers at Superfund Sites
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General Site Information	TI-Relevant Information
Site Name: Neal's Landfill *State:* IN; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/25/07 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD, OUs 2 and 3, 9/25/07	***TI Decision:*** The TI waiver is for the NPDES substantive requirements for stormwater flow greater than 500 gpm, which bypasses the water treatment plant. The following ARARs are waived: 327 IAC 2-1-6 Table 1; 327 IAC 5-2-8 (10), (11), (12), (13) (14); 327 IAC 5-2-11 (a)(1), (2), (3), (4), (5)(c), (d), (e), (f), (g), (h); and 327 IAC 5-2-11.1 (a), (b), (d), (f), (g), (h).
	Rationale: The State of Indiana typically sets an effluent limit of 0.3 µg/L for PCBs discharged by treatment plants into waters other than the Great Lakes System. Spring water up to 500 gpm from the Northwest Spring System will be captured, treated, and subject to the 0.3 µg/L discharge criterion. Based on the fate and transport model, it is not necessary to capture and treat more water because the additional water does not pose an unacceptable risk to human health and the environment. Due to the large volume of stormwater produced from the karst geology and the inability to store and eventually treat all the stormwater, it is technically impracticable from an engineering standpoint. Average spring flows are approximately 400 gpm, but flows as high as 11,000 gpm have been observed during storm events. During one event that lasted 21 days beginning on December 29, 2004, 61.4 million gallons of water (or 188-acre feet) bypassed the existing 500-gpm water treatment plant. Storing this large amount of water for eventual treatment would require over 100 storage tanks able to contain 600,000 gallons each, or a 47-acre storage lagoon 4 feet in depth.
	Conditions: *NAPL (suspected or observed)* – NAPL not mentioned in ROD *COCs* – PCBs *Concentration* – Non-storm concentrations of PCBs range from 0.34 to 2.6 µg/L. Peak concentrations during storm events have been observed as high as 30 µg/L (in 2000). *Geology* – Unconsolidated overburden consists of residual clay and silts and is separated from the karst limestone bedrock by a clay layer. The Northwest Spring System, consisting of two springs and five overflow stormwater springs, is the discharge point for a 350 to 400-acre groundwater drainage basin. *TI Zone* – TI waiver applies to groundwater flow greater than 500 gpm during storm events; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not applicable *Remedial Action Alternatives* – Storage and treatment of maximum stormwater flow would require more than 100 storage tanks able to contain 600,000 gallons each, or a 47-acre storage lagoon with a depth of 4 feet. The selected remedy continues the treatment of groundwater up to 500 gpm and includes ICs to prevent groundwater use at the site.
	Current Status/Activities: The 2007 ROD amendment selected continued operation of the current water treatment plant (with improvement of the water collection system) and sediment cleanup. The 2007 ROD amendment is the final action for groundwater at this site. Remedy construction (sediment/floodplain PCB cleanup and improvements in the water treatment plant) is nearly complete.

Summary of Technical Impracticability Waivers at Superfund Sites
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General Site Information	TI-Relevant Information
	Region 6: 12 sites
Site Name: Hardage/Criner *State:* OK; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 11/22/89 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 11/22/89, www.epa.gov/superfund/sites/rods/fulltext/r0690054.pdf; (2) Five-year review, 2002, www.epa.gov/superfund/sites/fiveyear/f02-06006.pdf; (3) Five-year review, 2007, www.epa.gov/superfund/sites/fiveyear/f2007060001812.pdf	***TI Decision:*** Contaminants not specified for bedrock aquifer.
	Rationale: Restoration of the bedrock aquifer is technically impracticable because DNAPL is present in the aquifer, and some contaminants have diffused into the dead-end cracks and fine-grained pores of the rock matrix. Cleanup goals could not be met within a reasonable time (noted as a few decades in the ROD). The ROD does not specifically state that "ARARs are being waived."
	Conditions: *NAPL (suspected or observed)* – DNAPL is present. *COCs* – Contaminants not specified for bedrock aquifer. *Concentration* – Concentrations not provided for bedrock contaminants. *Geology* – Two aquifers (shallow and bedrock). *TI Zone* – TI waiver applies to the bedrock aquifer; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – The selected groundwater remedy includes containment of both aquifers using interceptor trenches and wells, followed by treatment, along with MNA in other areas, leading to restoration of the alluvial aquifer. Source removal with on-site containment, treatment using SVE, ICs, and alternate water supplies were also selected.
	Current Status/Activities: Based on the 2007 5-year review, ICs (site access and use [land and groundwater] restrictions) and an alternate water supply (extension of a municipal water line) have been implemented. Trenches have been installed and are containing groundwater (in most areas). Monitoring and maintenance of the trenches will continue.

Summary of Technical Impracticability Waivers at Superfund Sites
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General Site Information	TI-Relevant Information
Site Name: Crystal Chemical Co. *State:* TX; *OU:* 1 *Decision Doc. (Type & Date):* ESD, 3/19/97 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ESD, OU1, 3/19/97, www.epa.gov/superfund/sites/rods/fulltext/e0697153.pdf; (2) Assessment of the TI of Groundwater Remediation, 2/96; (3) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f0506011.pdf; (4) Site summary, www.epa.gov/earth1r6/6sf/pdffiles/0603555.pdf	***TI Decision:*** TI waives the MCL for arsenic (50 µg/L).
	Rationale: Geologic, hydrogeologic, and geochemical conditions at the site make it technically impracticable to achieve the cleanup goal for arsenic. The site is geologically more complex than hypothesized at the time of the ROD (1990) with off-channel deposits, which are fine-grained sediments and represent lacustrine (lake deposits), overbank, relic channel, and flood plain deposits. This geology will inhibit migration of arsenic to extraction wells and limit the ability of P&T to remove arsenic from this area. In addition, arsenic adsorbs onto these sediments. The current estimate for the areal extent of groundwater exceeding 50 µg/L is 420,000 square feet (5 times more than the ROD estimated) and the volume of groundwater exceeding 50 µg/L is between 6 and 8 million gallons (more than 2 times greater than the ROD estimated).
	Conditions: *NAPL (suspected or observed)* – No *COCs* – Arsenic *Concentration* – Concentration of arsenic not provided. *Geology* – The site is geologically more complex than hypothesized at the time of the ROD (1990) with off-channel deposits, overbank, relic channel, and flood plain deposits. *TI Zone* – The areal extent of the TI Zone is that portion of the site north of the southern boundary of the Crystal Chemical property where arsenic concentrations are above 50 µg/L in the shallow aquifer.
	Evaluation: *Remedial Timeframe Estimate (years)* – Based on modeling, P&T will require a minimum time of 650 years to reach a concentration of 50 µg/L for the entire site, if it can be achieved at all. *Remedial Action Alternatives* – A slurry wall will be constructed to isolate the TI Zone and a limited pumping system will be installed south of the property boundary.
	Current Status/Activities: According to the site summary (March 2012), VEB and P&T were used for groundwater containment. The system was shut down in 2010 for a pilot study of phytoremediation, which is ongoing. ICs are not yet in place.

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General Site Information	TI-Relevant Information
Site Name: Highway 71/72 Refinery *State:* LA; *OU:* 00 *Decision Doc. (Type & Date):* ROD, 9/28/00 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, 9/28/00, www.epa.gov/superfund/sites/rods/fulltext/r0600098.pdf; (2) Site summary, www.epa.gov/region6/6sf/pdffiles/0600641.pdf	***TI Decision:*** The TI waiver applies to all groundwater COCs (including benzene).
	Rationale: Groundwater restoration is not feasible from an engineering standpoint. The TI waiver was based on (1) the presence of a potentially large source area that will remain at the site, (2) the nature and extent of contaminated groundwater plume, and (3) community requests. First, there are several LNAPL plumes floating on top of groundwater (approximately 325,000 gallons). This layer fluctuates as much as 15 feet and has created a "smear zone." Second, more than half of the site is covered with pavement or buildings, and the community wanted a remedy that didn't disturb the site and its development. Without extensive soil and source removal, it is impossible to address the source of groundwater contamination. Third, the contaminant plume appears to have stabilized beneath the site likely due to natural degradation processes and the reversal of groundwater flow. The groundwater is not currently being used and likely will not in the future due to high TDS levels and because all residents are on city water.
	Conditions: *NAPL (suspected or observed)* – LNAPL is present. Several plumes are floating on groundwater. *COCs* – all groundwater COCs (including benzene) *Concentration* – Concentrations ranged from ND to 49 ppm for VOCs, ND to 4.2 ppm for SVOCs, ND to 0.154 ppm for lead, and ND to 0.24 for chromium. *Geology* – Alluvial aquifer is composed of sands and clayey/silty sands. *TI Zone* – The TI Zone includes the entire shallow aquifer (10-60 feet bgs) at the site (215 acres).
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – Enhanced LNAPL recovery by dual phase extraction, and ICs for groundwater use restrictions.
	Current Status/Activities: The site summary (April 2012) indicates that a pilot test of dual-phase extraction was operating properly in July 2010 with system optimization ongoing, and that ICs (groundwater use restrictions) were selected in the ROD. Soil contamination reached remedial action completion in September 2011.

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General Site Information	TI-Relevant Information
Site Name: Popile Inc. Superfund Site *State:* AR; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/28/01 Stage: Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/28/01, www.epa.gov/superfund/sites/rods/fulltext/a0601549.pdf; (2) TI Determination, 9/01; (3) Site summary, www.epa.gov/region6/6sf/pdffiles/0603790.pdf	***TI Decision:*** MCLs are being waived for PAH compounds expressed as benzo(a)pyrene at 0.2 ppb and PCP at 1 ppb.
	Rationale: The extent of the NAPLs is approximately 4 acres (horizontally) and 30 feet (vertically) in site soils and groundwater. An *in situ* pilot study for bioremediation of soils was unsuccessful, and other *in situ* treatments of the soils are unlikely to succeed due to low permeability. Based on available site data, the contaminant concentrations have already achieved static levels indicating steady-state conditions between the NAPL and the surrounding dissolved phase plume. These conditions are further demonstrated by the lack of plume growth with little or no predicted changes based on modeling (the plume has changed little in the past 43 years and is predicted to remain static for the next 48 years). P&T would have a limited impact in achieving restoration due to characteristics of the aquifer and physical properties of the creosote and PCP. Pumping to maintain gradient control is unnecessary since the dissolved plume has demonstrated little or no migration from the source area due to physical adsorption and biodegradation within the aquifer.
	Conditions: *NAPL (suspected or observed)* – Waste generated from past wood preserving operations occurs as DNAPL and LNAPL. Contamination exists as both residual and free-phase NAPL. *COCs* – 7 PAHs and PCP *Concentration* – The solubilities of the PAHs identified range from relatively insoluble to 31 mg/L. *Geology* – Low permeability soils *TI Zone* – The TI Zone includes groundwater beneath the current site boundary eastward to the Ouachita Railroad; this horizontal extent is based on presence of residual contamination and NAPL. The vertical extent is to the base of the Cockfield aquifer (approximately 55 feet bgs).
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – The long-term management solutions for the groundwater contamination includes the use of ICs to prevent exposure and the use of a TI waiver for the previously established remedial goals (chemical-specific ARARs).
	Current Status/Activities: According to the site summary (February 2012), groundwater is not migrating off-site and EPA concluded that no further remedial action is necessary because natural attenuation is occurring. Groundwater monitoring is still ongoing and ICs have been maintained since 2001 (fencing and signage preventing excavation and drilling into the aquifer), but EPA is in the process of ensuring deed restrictions are implemented.

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General Site Information	TI-Relevant Information
Site Name: Garland Creosoting *State:* TX; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/15/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/15/06, www.epa.gov/superfund/sites/rods/fulltext/r2006060001492.pdf; (2) Final FS, Evaluation of TI, 6/20/06, (3) Site summary www.epa.gov/earth1r6/6sf/pdffiles/0601644.pdf	***TI Decision:*** ARARs waived are MCLs for PCP and benzo(a)pyrene.
	Rationale: Based on monitoring data, DNAPL was found from 2 to 15 inches in thickness over 1 acre. However, assuming the DNAPL is 6 inches thick and the aquifer has an effective porosity of 25 percent, more than 35,700 gallons of DNAPL are present. DNAPL may not be adequately delineated and its movement in the subsurface is difficult to predict. Previous non-time critical removal actions included soil removal and interceptor trenches that collect and treat water and NAPL before it migrates off-site; these trenches continue to operate. It is believed the trenches will be required to operate indefinitely to contain the groundwater contamination.
	Conditions: *NAPL (suspected or observed)* – DNAPL is present. *COCs* – PCP and benzo(a)pyrene *Concentration* – Maximum concentrations in 2002 were 16.4 µg/L for pentachlorophenol and 10.8 µg/L for benzo(a)pyrene. *Geology* – Silt and fine-grained sand unit overlain and underlain by clay unit. *TI Zone* – The TI Zone encompasses the entire site and areas that are captured by the existing trenches. Vertically, the zone extends through the shallow water-bearing zone down to the clay layer.
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – Selected remedy consists of continued operation of the interceptor trench, installation of additional groundwater recovery wells, MNA, and ICs to restrict future use of the groundwater.
	Current Status/Activities: According to the site summary (March 2012), the Site achieved construction complete status in August 2010. The long term action consists of collecting leachate from two trenches and treating it on-site for 10 years. ICs were selected in the ROD (deed restrictions and land use restrictions) but their status is not reported.

Summary of Technical Impracticability Waivers at Superfund Sites
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General Site Information	TI-Relevant Information
Site Name: Petro-Chemical Systems Inc. (Turtle Bayou) *State:* TX; *OU:* 2 *Decision Doc. (Type & Date):* ROD Amendment, 9/22/06 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU2, 9/22/06, www.epa.gov/superfund/sites/rods/fulltext/a2006060001486.pdf; (2) TI Demonstration, 3/06; (3) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f2006060001401.pdf; (4) Five-year review, 2011 www.epa.gov/earth1r6/6sf/pdffiles/0601644.pdf	***TI Decision:*** MCLs are being waived for all contaminants (PAHs and VOCs).
	Rationale: Previous actions include excavation at this area; SVE, *in situ* thermal treatment, P&T, and *in situ* bioremediation for other areas at the site. However, these actions have not been effective at restoring the shallow aquifer. Complex hydrogeology is present at this site, which consists of a complex and heterogeneous stratigraphy of interbedded silts and clays and some sand, low hydraulic conductivity, a downward vertical gradient, and high temporal variation in the water levels. Two saturated zones are affected and form the basis of the TI waiver: S1 zone (clayey soils from 18-24 feet bgs) and S2 (sand from 30-80 feet bgs). P&T and *in situ* treatment would be limited because of (1) the low hydraulic conductivity of the S1 layer and (2) the distribution of constituents in the clay layer between the S1 and S2 units because the clays/silty clays will serve as an ongoing diffusion-limited source of constituents. Based on mass calculations, over 99 percent of the total COC mass is contained within the low permeability soils, which will act as a continuing source, and less than 1 percent of the mass is present as dissolved COCs. It is estimated that an extraction or injection technology would remove less than 10 percent of the mass in these zones based on empirical data for similar site conditions.
	Conditions: *NAPL (suspected or observed)* – No recoverable NAPL was encountered during site investigations but are likely present. *COCs* – PAHs and VOCs *Concentration* – No concentrations provided in TI Demonstration Report. *Geology* – Complex hydrogeology is present at this site, which consists of a complex and heterogeneous stratigraphy of interbedded silts and clays and some sand, low hydraulic conductivity, a downward vertical gradient, and high temporal variation in the water levels. Two saturated zones are affected and the basis of the TI waiver: S1 zone (clayey soils from 18-24 feet bgs) and S2 (sand from 30-80 feet bgs). *TI Zone* – The TI Zones include the affected areas of the S1 (3 acres) and S2 (5 acres) units. The boundary was drawn, as requested by the State of Texas, through the peripheral well sample points with groundwater concentrations below MCLs. The S1 and S2 units extend 18-24 and 30-80 feet bgs, respectively.
	Evaluation: *Remedial Timeframe Estimate (years)* – Calculations determined that restoration of the site would require over 100 years because mass removal will be diffusion-limited regardless of which technology (active versus MNA) is implemented. *Remedial Action Alternatives* – The selected remedy consists of (1) excavation and *in situ* chemical treatment for soils, (2) *in situ* chemical injection to destroy about 80 percent of COCs in the groundwater, and (3) ICs (deed notices, signage, and restrictions on use of land and groundwater). Although this remedy will not achieve groundwater restoration, it is technically practicable, protective of human health and the environment, and results in partial remediation of the source area and groundwater.
	Current Status/Activities: Based on the 2011 5-year review, *in situ* treatments were used at several areas of the site for soil and groundwater through 2005. ICs have been developed for a portion of the site and are being developed for the remaining area. The remedy is protective of human health and the environment in the short term in most areas, but site monitoring is ongoing. The possibility of VI pathways will be assessed and final O&M plans are needed.

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General Site Information	TI-Relevant Information
Site Name: Hart Creosoting *State:* TX; *OU:* 1 *Decision Doc. (Type & Date):* ROD, OU1, 9/21/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/21/06, www.epa.gov/superfund/sites/rods/fulltext/r2006060001481.pdf; (2) Site Summary, www.epa.gov/earth1r6/6sf/pdffiles/0601975.pdf	***TI Decision:*** MCLs are being waived for all contaminants; the prominent one is naphthalene (MCL–100 µg/L). Groundwater PRGs will also not be achieved. See Table 3 of the 2006 ROD for all PRGs.
	Rationale: A TI waiver is necessary because the presence of PAHs in the dissolved phase groundwater plume and free-phase and residual DNAPL in multi-lithology zones make it technically impracticable to restore groundwater within a reasonable timeframe.
	Conditions: *NAPL (suspected or observed)* – Free-phase and residual DNAPL has been observed. *COCs* – 12 PAHs, 4 SVOCs, and benzene *Concentration* – Naphthalene was detected between 0.11 and 15.2 mg/L in 1986. *Geology* – Multi-lithology zones *TI Zone* – TI Zone includes all portions of on-site groundwater where naphthalene exceeds the PRG and extends from 10 to 200 feet bgs (groundwater zones P-2 and P-4); however the lateral extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – The selected remedy includes a NAPL recovery system, treatment of surface water, excavation and on-site landfilling for site soils and sediments, a TI waiver, MNA, and ICs (land and groundwater use restrictions).
	Current Status/Activities: The site summary (March 2012) indicates the site is in the long-term remedial action phase, and construction completion was achieved in September 2008. The remedy included a NAPL recovery system and soil excavation with on-site disposal.

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Midland Products *State:* AR; *OU:* 1 *Decision Doc. (Type & Date):* ROD Amendment, 6/9/06 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU1, 6/9/06, www.epa.gov/earth1r6/6sf/pdffiles/old_midland_amended_rod.pdf; (2) Site summary, www.epa.gov/earth1r6/6sf/pdffiles/0600216.pdf	***TI Decision:*** MCLs are being waived for 2 contaminants: PCP (1 µg/L) and benzo(a)pyrene (0.2 µg/L).
	Rationale: The ROD Amendment changes the remedy from P&T to MNA with a TI waiver and ICs. P&T has treated more than 12 million gallons of groundwater, which is more than 20 times greater than the contaminated plume volume of 450,000 gallons estimated in the 1988 ROD; however, high contaminant levels remain in the aquifer. LNAPL and DNAPL are still present in several wells.
	Conditions: *NAPL (suspected or observed)* – LNAPL and DNAPL have been observed. *COCs* – PCP, PAHs *Concentration* – Maximum concentrations in 2005 were 910 µg/L for PCP and 9.2 µg/L benzo(a)pyrene. *Geology* – Fractured bedrock *TI Zone* – TI Zone consists of the DNAPL source area and the area enclosed by downgradient monitoring wells. Vertically, the zone extends to 40 feet bgs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – Amendment changes remedy from P&T to MNA with a TI waiver and ICs (groundwater use restrictions).
	Current Status/Activities: Based on the site summary (January 2012), the groundwater remedy included a P&T system that has treated 12 million gallons of groundwater. The groundwater plume is currently stable and not expanding. The site is protective of human health and the environment, and is ready for non-residential use.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Jasper Creosoting *State:* TX; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/20/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/20/06, www.epa.gov/superfund/sites/rods/fulltext/r2006060001482.pdf; (2) Site summary, www.epa.gov/earth1r6/6sf/pdffiles/0601735.pdf	***TI Decision:*** MCLs are being waived for all contaminants; the prominent one is naphthalene (MCL–100µg/L). Groundwater PRGs will also not be achieved. See Table 3 of 2006 ROD for all PRGs.
	Rationale: A TI waiver is necessary because the presence of PAHs in the dissolved phase groundwater plume and free-phase and residual DNAPL in multi-lithology zones make it technically impracticable to restore groundwater within a reasonable timeframe.
	Conditions: *NAPL (suspected or observed)* – Free-phase and residual DNAPL has been observed. *COCs* – PAHs *Concentration* – Maximum concentrations were 307,000 µg/L for total PAH and 105,000 µg/L for naphthalene in 2004. *Geology* – Multi-lithology zones *TI Zone* – TI Zone covers 12 acres and includes all portions of on-site and off-site groundwater where site COCs are above PRGs. Vertically, the zone includes groundwater zones P1 and P3 and extends to 150 feet bgs on-site and to 130 feet off site.
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – The selected remedy includes a NAPL recovery system, excavation and on-site landfilling for site soils, MNA for sediments and groundwater, a TI waiver, ICs, and P&T for containment (if necessary).
	Current Status/Activities: The site summary (March 2012) does not include any new information (since the ROD was issued).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Vertac *State:* AR; *OU:* 3 *Decision Doc. (Type & Date):* ROD, 9/17/96 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU3, 9/17/96, www.epa.gov/superfund/sites/rods/fulltext/r0696103.pdf; (2) Request for TI Waiver, OU3, 9/96; (3) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f04-06002.pdf; (4) Site summary, www.epa.gov/earth1r6/6sf/pdffiles/0600023.pdf	***TI Decision:*** Groundwater constituents include chloride; 2-chlorophenol; 4-chlorophenol; 2,4-dichlorophenol; 2,6-dichlorophenol; 2,4,5-trichlorophenol; 2,4,6-trichlorophenol; toluene; tetrachlorobenzene; 2,6-D; 2,4-D; 2,4,6-T; 2,4,5-T; 2,4,5-TP; and 2,3,7,8-TCDD. MCLs were only listed for chloride; toluene; 2-4D; 2,4,5-TP; and 2,3,7,8-TCDD.
	Rationale: The OU3 FS concluded that restoration of groundwater under much of the central process area to concentrations below MCLs is technically impracticable due to the presence of NAPLs and the hydrologic characteristics of the weathered and fresh bedrock. Free-phase NAPL has been observed at 3 locations; it may be possible to recover these localized NAPLs. Throughout the northern part of the central process area, residual NAPLs are present in limited quantities or are trapped interstitially such that direct recovery is not possible. According to the Request for TI Waiver, there are no available remediation technologies that could effectively remove the residual product in the fractured bedrock. In these locations, the NAPL and residual product will continue to contribute to dissolved-phase concentrations as long as pure product remains in contact with the groundwater. In addition, some of the contaminants, particularly 2,3,7,8-TCDD, have relatively low solubilities and will biodegrade slowly, persisting in the soil and rock matrices for many decades.
	Conditions: *NAPL (suspected or observed)* – Free-phase NAPLs were observed (greater than 1-inch thickness) in 3 locations. Other locations have NAPL as residual product. *COCs* – Chloride; chlorinated SVOCs; toluene; pesticides *Concentration* – Concentrations not provided in Request for TI Waiver. *Geology* – weathered and fractured bedrock *TI Zone* – The TI Zone includes groundwater located beneath the north part of the central process area, the North Landfill and the Reasor Hill Landfill; this zone includes areas north and west of the known and suspected NAPL areas in order to account for potential DNAPL migration. The vertical extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Exceeds reasonable timeframe estimate for site conditions. *Remedial Action Alternatives* – Hydraulic containment system composed of extraction wells and a French drain system plus ICs to prevent the installation of water supply wells.
	Current Status/Activities: Based on the site summary (March 2012), source control activities are complete and P&T for hydraulic control will continue. Almost half of the site will be available for beneficial use.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: City of Perryton Well #2 *State:* *TX*; *OUs:* 1 *Decision Doc. (Type & Date):* ROD Amendment, 9/29/11 *Stage:* Post-construction *Media:* Groundwater *References:* (1) Site Summary, January 2012, www.epa.gov/earth1r6/6sf/pdffiles/0605015.pdf; (2) Five-year review, 9/9/08, www.epa.gov/superfund/sites/fiveyear/f2008060002676.pdf	***TI Decision:*** ARARs to achieve MCLs for carbon tetrachloride (5 µg/L) and nitrate (10 mg/L) in the Upper Zone and Lower Unit 2 of the Ogallala aquifer.
	Rationale: The original remedy was a groundwater P&T system composed of two extraction wells and an air stripper treatment plant to remove the carbon tetrachloride from the extracted groundwater. EPA temporarily shut down the groundwater P&T system in late September 2007 to evaluate potential contaminant rebound in the extraction wells after the July 2007 sample results confirmed that groundwater in the lower zone had been cleaned up. The first rebound sampling event occurred on October 29, 2007 and the second event was completed on November 28, 2007. The October 29th sample results indicated no change in contaminant concentration in extraction well MW-17EX, but carbon tetrachloride concentrations in Well #2 rebounded to 27.9 µg/L in Upper Unit 2 and Unit 3 (similar to pre-cleanup conditions). Following the November 28th sampling, Well #2 was re-started to ensure that the lower zone did not become contaminated again. The results for Well #2 indicated that contamination from the upper zone of the aquifer was migrating downward along the gravel packed annulus of Well #2 and contaminating the lower zone. The P&T system was restarted in November 2007 because continued operation of Well #2 was necessary to prevent recontamination of the lower zone. The two extraction wells were sampled again during the week of January 7, 2008, and well MW-17EX contained 1 µg/L of carbon tetrachloride and Well #2 contained 3.6 µg/L of carbon tetrachloride. The cleanup goal has been achieved for the lower zone in the Ogallala aquifer. The upper flow zone still has contamination above the cleanup goal but behaves as a perched zone and not a part of the primary water production zone in the Ogallala. Site data collected since October 2002 demonstrates that the existing P&T system, which pumps groundwater from aquifer Unit 3, has had little or no effect on the contamination present in these perched zones. EPA plugged and abandoned Well #2 in January 2011, which will allow unrestricted use of the aquifer, the source of drinking water for the City of Perryton. A site-wide groundwater sampling event was completed in August 2011, and no changes were detected in the carbon tetrachloride concentrations since the last site-wide sampling events in April 2008 and July 2007. According to the 5-year review (2008), the ROD did not include the use of ICs to protect the remedy effectiveness because the remedy was anticipated to achieve the cleanup goals throughout the Ogallala aquifer. However, since groundwater standards will likely not be achieved in the Upper Zone and Lower Unit 2, the use of ICs may be necessary to prevent the installation of a private well that would create a migration pathway between the contaminated Upper Zone and the remediated Lower Unit 3. *The ROD Amendment (2011) was not available for review to determine if ICs were indeed selected along with the TI waiver.*
	Conditions: *NAPL (suspected or observed)* – NAPL not mentioned in Site Summary. *COCs* – Carbon tetrachloride, nitrate *Concentration* –Concentrations for carbon tetrachloride in Upper Unit 2 and Unit 3 ranged from 40 µg/L in 1990 to 27.9 µg/L in October 2007 to 3.6 µg/L in April 2008. Monitoring data are provided in Attachment 6 of the 2008 5-year review. *Geology* – The aquifer at the site is composed of interbedded sand, silt, and clay layers, and is divided into an Upper and Lower Zone (which are separated by low permeability silt and clay layers). The Upper Zone consists of Unit 1 and Upper Unit 2, and the Lower Zone is composed of Lower Unit 2, Unit 3, and Unit 4. *TI Zone* – TI zone includes the Upper Zone and Lower Unit 2 of the Ogallala aquifer and covers approximately 20 acres (based on estimates obtained from figures in Site Summary).
	Evaluation: *Remedial Timeframe Estimate (years)* – Not provided in Site Summary *Remedial Action Alternatives* – Well #2 was abandoned and sealed in January 2011 to prevent contaminant migration. The P&T system continues to be shutdown. The current status of ICs is not available in the documentation reviewed.
	Current Status/Activities: The P&T system was shutdown in 2007 to allow for rebound sampling and plans are for it to be decommissioned. Well #2 was restarted in 2007 and continued pumping until it was plugged in 2011. The remaining city water supply wells are not threatened by the contaminant plume and are routinely monitored as part of the requirements of the Federal Safe Drinking Water Act.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: North Cavalcade *State:* TX; *OU:* 3 *Decision Doc. (Type & Date):* ROD Amendment, 8/26/11 *Stage:* Post-construction *Media:* Groundwater *References:* (1) Five-year Review, 9/29/08, www.epa.gov/superfund/sites/fiveyear/f2008060002683.pdf; (2) Site summary, January 2012, www.epa.gov/earth1r6/6sf/pdffiles/0602956.pdf; (3) TI Technical Memorandum, 7/6/11, www.epa.gov/earth1r6/6sf/texas/north_cavalcade/tx_ncavalcade_ncra_tm-ti_2011-0706_draftfinal.pdf	***TI Decision:*** ARARs waived are MCLs for benzene (5 µg/L) and benzo(a)pyrene (0.2 µg/L), and a state promulgated standard for naphthalene (1,500 µg/L onsite and 490 µg/L offsite) in the shallow sand and interbedded units.
	Rationale: Dissolved phase contamination exceeding these cleanup levels is limited to within 2 blocks west of the site despite wood treating operations ceasing at the site over 50 years ago. P&T was conducted for the shallow aquifer and removed an estimated 8,000 pounds of creosote from the shallow sand. Later investigation verified that contamination was also present in the underlying interbedded unit, a much siltier zone that was not conducive to the P&T remedy. TI of groundwater restoration is supported by the following: (1) the remaining residual and free-phase DNAPL, although limited in extent, will continue to act as a source for site-related contaminants in groundwater, essentially outpacing the natural degradation of these contaminants in the areas where DNAPL appears. In this case, natural attenuation serves as a process for plume stability and containment, rather than restoration; (2) the heterogeneity and lithologic complexity of the interbedded unit limits the effectiveness of treatment technologies for source material and contaminated groundwater. While the predominant clay and silt limit migration of contamination, material bound in the matrix will continue to serve as an active source of contamination through dissolution. However, it cannot be removed or treated effectively or sufficiently to eventually achieve cleanup levels throughout the contaminated area; (3) the occurrence of DNAPL accumulation is limited to 4 wells out of the 65-well network associated with the source areas. DNAPL accumulation will continue to be measured and recovered when observed; and (4) source treatment has already been implemented using P&T and in situ source stabilization (ISS). P&T was found to be ineffective for the interbedded unit where the majority of contamination is observed, and expansion of the implemented ISS remedy or application of other remedies is limited by site features (active commercial businesses onsite, active rail lines, and future above-ground construction extending a highway).
	Conditions: *NAPL (suspected or observed)* – Free-phase and residual DNAPL are present. *COCs* – Benzene, benzo(a)pyrene and naphthalene *Concentration* – Maximum concentrations in 2010 exceed 10,000 µg/L for naphthalene and 500 µg/L for benzene. Plume maps are provided in the Technical Memorandum. *Geology* – The site is underlain by two water-bearing zones (shallow sand and interbedded unit) located above a thick regional clay layer (approximately 100 feet thick), which serves as a barrier to downward groundwater flow. The shallow sand is mostly poorly graded sand or silt sand. The interbedded unit is comprised of various clays, silts, and sands. *TI Zone* –The TI zone applies to both the shallow sand and interbedded units. The TI zone covers approximately 16 acres and is defined by the extent of the naphthalene plume in the interbedded unit.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not provided in documents reviewed. *Remedial Action Alternatives* – The 2011 ROD Amendment selected containment of the shallow sand and interbedded unit dissolved phase plumes, as restoration throughout the impacted groundwater would not be achievable in the presence of DNAPL. The decision established a 16-acre TI Zone, wherein cleanup levels would be waived for benzene, benzo(a)pyrene, and naphthalene. ICs will be established to restrict the installation of groundwater wells within this zone to prevent exposure to contaminants.
	Current Status/Activities: GW P&T was suspended in 2003 to investigate additional (deeper) contamination. Source control activities including on-site consolidation (24,500 cy) and ISS (12,000 cy) were completed in 2011. The current remedy includes containment of groundwater via natural processes and site conditions. The 2011 ROD Amendment selects ICs to restrict use of or access to groundwater with contaminant concentrations above drinking water standards; their status is not provided in documents reviewed. Drinking water is provided by the City of Houston's public water supply in this area.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 7: 7 sites (8 waivers)
Site Name: Cherokee County, Baxter Springs and Treece Subsites *State:* KS; *OUs:* 3 & 4 Decision Doc. (Type & Date): *ROD, 8/20/97* *Stage:* Pre-construction *Media:* Groundwater and surface water *References:* (1) ROD, OUs 3 & 4, 8/20/97, www.epa.gov/superfund/sites/rods/fulltext/r0797073.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-07004.pdf; (3) Five-year review, 2010, www.epa.gov/earth1r6/6sf/pdffiles/0601735.pdf	***TI Decision:*** ARARs to be waived include MCLs (cadmium–5 ppb) and state standards (lead–15 ppb) for groundwater. Clean Water Act standards (dissolved cadmium–3 ppb, dissolved lead–11 ppb, and total recoverable zinc–412 ppb) are also being waived for nearby creeks.
	Rationale: There are several factors present that warrant the TI waiver at the Baxter Springs and Treece subsites. First, site conditions, such as karst-like topography, mine voids, and mining wastes at this site and neighboring sites cover 1,400 acres and total 7.5 million cubic yards. No alternatives evaluated were capable of achieving MCLs or Clean Water Act standards under these conditions. Secondly, nearby residents are supplied municipal water, and the shallow aquifer is not used for consumption. The deeper aquifer is not contaminated and is used for water supply to the area. Additionally, this site is contained within the Tri-State Mining District, which also includes Tar Creek in Oklahoma and Jasper County in Missouri.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue at this site. *COCs* – Metals *Concentration* – Concentrations for groundwater not included in ROD. *Geology* – Karst-like topography and mine voids, two aquifers *TI Zone* – TI Zone applies to the shallow aquifer and nearby creeks; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – not calculated (Note: There are no active groundwater remedies to remediate or clean up the groundwater. EPA is relying on ICs and the provision of clean drinking water via rural water districts and pipeline expansions – providing a safe source to consume but not remediating the groundwater.) *Remedial Action Alternatives* – Excavation and/or consolidation of mining wastes followed by capping and revegetation. For groundwater, ICs and the provision of clean drinking water via rural water districts and pipeline expansions.
	Current Status/Activities: According to the 2010 5-year review, not all county-wide ICs (land use restrictions and restrictions on use of mine wastes) have been implemented. An alternate water supply (extension of municipal water supply) was provided to affected residences. Many remedial activities have been conducted to address sources at this site. No groundwater actions were conducted at this OU.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Cherokee County, Galena Subsite *State:* KS; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/18/89 *Stage:* Pre-construction *Media:* Groundwater and surface water *References:* (1) ROD, OU1, 9/18/89, www.epa.gov/superfund/sites/rods/fulltext/r0789030.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-07004.pdf; (3) Five-year review, 2010, www.epa.gov/earth1r6/6sf/pdffiles/0601735.pdf	***TI Decision:*** ARARs to be waived include MCLs, state standards, and Clean Water Act standards for arsenic, barium, cadmium, chromium (VI), copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc.
	Rationale: The continued presence of waste materials on site, off site, and upgradient of the site make it technically impracticable to achieve MCLs in groundwater and water quality criteria in surface water. The only approach identified that could possibly remediate the site to achieve ARARs is to (1) treat all surface mine wastes and (2) strip mine the remaining mineralization at the Galena subsite. This alternative has several implications, such as destruction of an endangered species habitat, removal of all surface soils, and permanent relocation of the town of Galena. Inordinate costs would be associated with such an action.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue at this site. *COCs* – Metals *Concentration* – Maximum concentrations observed in private wells (in µg/L): barium–390; cadmium–180; chromium–120; copper–140; lead–230; manganese–3,400; mercury–0.44; nickel–270; selenium–24; silver–11; zinc–15,000 *Geology* – Karst-like topography and mine voids, two aquifers *TI Zone* –TI Zone applies to the area groundwater and Short Creek; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not calculated (Note: There are no active groundwater remedies to remediate or clean up the groundwater. EPA is relying on ICs and the provision of clean drinking water via rural water districts and pipeline expansions – providing a safe source to consume but not remediating the groundwater.) *Remedial Action Alternatives* – Alternate water supply included the construction of new public water supply wells and associated pipelines. A rural water district was created and serves as a permanent water supply to affected residents. Using ICs to control risk.
	Current Status/Activities: According to the 2010 5-year review, not all county-wide ICs (land use restrictions and restrictions on use of mine wastes) have been implemented. An alternate water supply (extension of municipal water supply) was provided to affected residences. Many remedial activities have been conducted to address sources at this site. No groundwater actions were conducted at this OU.

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General Site Information	TI-Relevant Information
Site Name: Aluminum Company of America-Davenport *State:* IA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/28/04 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 9/28/04, www.epa.gov/superfund/sites/rods/fulltext/r2004070003144.pdf; (2) Feasibility Study and Appendix A (TI Evaluation Report, September 2004), 5/2004; (3) ESD, 7/5/07, www.epa.gov/superfund/sites/rods/fulltext/e2007070003101.pdf	***TI Decision:*** ARARs to be waived include MCLs for a variety of VOCs, PAHs, SVOCs, and PCBs. The TI Determination also indicated that PRGs for a variety of VOCs, PAHs, SVOCs, and PCBs will not be achieved. See Table 5-1 in Appendix A of the FS for a complete list.
	Rationale: The multiple sources of NAPL, which cannot be delineated with a high degree of certainty, have resulted in a large volume of contaminated groundwater that extends to great depths (400 feet bgs) and will likely persist for a very long time due to the migration of low solubility DNAPL and LNAPL. In addition to the substantial depths of contamination, the poor connectivity of fractures common to fractured carbonate bedrock formations limits the ability to fully delineate the extent of DNAPL contamination areas. Given the properties of the contamination and the subsurface media, it is not possible to develop a meaningful estimate of the contaminant mass; therefore, the restoration timeframe cannot be estimated precisely but is known to be considerable (longer than 100 years). The TI waiver applies to the constituents in both the dissolved and NAPL phase within the TI Zone. The remedy selected in the 2004 ROD is groundwater containment, which includes groundwater P&T, source area remediation, groundwater monitoring, and ICs. The existing P&T system is containing the groundwater plume, and concentrations outside the containment area exhibit either background groundwater quality or are below ARAR thresholds. The 2007 ESD clarifies the compounds and chemical-specific ARARs that will be used as groundwater performance standards and monitoring levels for areas outside the TI Zone in the subsequent implementation of the groundwater monitoring program.
	Conditions: *NAPL (suspected or observed)* – Both DNAPL and LNAPL are present. *COCs* – 30 VOCs, 13 PAHs, 2 SVOCs, 3 PCBs *Concentration* – Tables L-3-1, L-3-2, and N-4 of the 2004 ROD show maximum groundwater concentrations for select VOCs within certain areas of the aquifer. A more comprehensive set of groundwater concentration data is included in Table A-1 of Appendix A to the Feasibility Study. *Geology* – Fractured limestone/dolomite bedrock formations to approximately 400 feet bgs *TI Zone* – The TI Zone includes locations where NAPL sources were identified based on direct observations or detections with a NAPL/water interface probe and the interpretation of groundwater concentrations. The vertical extent of the TI Zone consists of all saturated zones, which include the unconsolidated groundwater and underlying bedrock aquifer (both shallow and intermediate/deep bedrock zones).
	Evaluation: *Remedial Timeframe Estimate (years)* – More than 100 years *Remedial Action Alternatives* – The selected remedy included continuing P&T for hydraulic control, groundwater monitoring, and ICs (land and groundwater use restrictions).
	Current Status/Activities: According to the 2004 ROD and 2007 ESD, ICs restricting groundwater and land use are in place, and additional ICs will be implemented. The P&T system was implemented in 1989 and continues operating for plume containment. No additional information was available.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Missouri Electric Works *State:* MO; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 9/28/05 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/28/05, www.epa.gov/superfund/sites/rods/fulltext/r0705052.pdf; (2) Fractured Bedrock TI Evaluation Report, 7/5/05; (3) Site summary, www.epa.gov/region07/cleanup/npl_files/mod980965982.pdf	***TI Decision:*** The ROD is waiving MCLs and non-zero MCLGs for 1,1,1-TCA; TCE; PCE; 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; chlorobenzene; 1,2,4-TCB; 1,2-DCB; 1,3-DCB; 1,4-DCB; and PCBs within the TI Zone of the fractured bedrock.
	Rationale: In 1990, P&T was selected to address groundwater contamination. However, after the ROD was issued, new hydrogeologic information indicated contamination at depths greater than 300 feet bgs. The selected remedy in the 2005 ROD includes ICs, well-head treatment, monitoring, and a TI waiver for the bedrock aquifer. Enhanced bioremediation and MNA are being evaluated for the alluvium aquifer. Due to the fractured bedrock present at the site, it is difficult to accurately and completely predict the location and migration of COCs. The fracture network includes a complex set of vertical fractures and near-horizontal bedding plane fractures. The following limitations were identified: (1) identifying fractures, (2) locating COCs, (3) installing angled wells to intercept key fracture and karst features, and (4) adequately monitoring COCs within the aquifer. In addition, pumping or *in situ* injection may exacerbate contaminant migration. Based on these factors, the amount of time required to reach ARARs cannot be reliably determined; however, this period is expected to be greater than 30 years and may be more than 100 years. The TI Zone includes the areas of measured COC concentration above cleanup levels from approximately 80 feet upgradient of the known source areas to the downgradient area where groundwater discharges at depth from the fractures to the alluvium. A "buffer zone" is also provided in this zone to allow for the variability of the fractured bedrock system.
	Conditions: *NAPL (suspected or observed)* – NAPL has not been observed and is not expected to be present. *COCs* – Chlorinated VOCs and SVOCs; pesticides; PAHs, nitrobenzene; benzene; PCBs *Concentration* – Maximum concentrations reported in the ROD (µg/L): 1,2,4-TCB–62; 1,3-DCB–100; 1,4-DCB–120; 2-chlorophenol–9; aroclor-1260–110; benzene–83; bis(2-chloroethyl)ether–6; BEHP–120; chlorobenzene–3,200; chloroform–13; naphthalene–8.7; n-nitrosodi-n-propylamine–8.1; PCE–8.6; and TCE–13. *Geology* – Fractures, karst, bedrock. *TI Zone* – The TI Zone includes an area of the bedrock aquifer that measures approximately 1,150 feet by 1,000 feet. No vertical (depth) limitations are included for the TI Zone.
	Evaluation: *Remedial Timeframe Estimate (years)* – At least 30 years but possibly more than 100 years *Remedial Action Alternatives* – Well-head treatment and ICs (including notices, land use restrictions, and groundwater use and well installation restrictions) were also selected for this aquifer.
	Current Status/Activities: The site summary (March 2012) indicates that thermal desorption for contaminated soils was completed in 2002. A Consent Decree is currently being negotiated for OUs 2 and 3.

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Waterloo Coal Gasification Plant *State:* IA; *OU:* 1 *Decision Doc. (Type & Date):* ESD, 8/11/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ESD, OU1, 8/11/06, www.epa.gov/superfund/sites/rods/fulltext/e0706002.pdf; (2) TI Evaluation Report, 8/2/06; (3) ROD, 9/24/04, www.epa.gov/superfund/sites/rods/fulltext/r0704653.pdf; (4) Site summary, www.epa.gov/region07/cleanup/npl_files/iad984566356.pdf	***TI Decision:*** According to the TI Evaluation Report, the following ARARs are being waived: MCLs for antimony, arsenic, cadmium, chromium, lead, cyanide, benzene, ethylbenzene, and benzo(a)pyrene. The TI Evaluation Report also determined that PQLs for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene and Risk-Based Cleanup Levels for iron, manganese, nickel, 2-methylnaphthalene, chrysene, and naphthalene could not be met.
	Rationale: The following issues make it technically impracticable to achieve restoration of the alluvial aquifer within a reasonable timeframe: (1) approximately 99 percent of the estimated 85,900 pounds of organic contaminant mass remaining at the site consists of PAHs; (2) the alluvial aquifer is impacted by residual and free-phase NAPL, which will remain as a long-term source of contamination; (3) the complex stratigraphy of the alluvial aquifer presents intrinsic difficulties to remediation due to low permeability zones intermixed with higher permeability zones; and (4) the proximity of the Cedar River, which is hydraulically connected to the alluvial aquifer, would reduce contaminant mass removal rates of P&T due to infiltration of river water. Even with the most promising technologies, cleanup would require more than 35,000 years to achieve aquifer restoration for recalcitrant PAHs (specifically benzo(a)pyrene) based on SourceDK Remediation Timeframe Decision Support System estimates.
	Conditions: *NAPL (suspected or observed)* – NAPL is currently suspected at the site. During source removal activities, NAPL was removed from the site. *COCs* – 8 metals, cyanide, BTEX, 9 PAHs *Concentration* – Groundwater concentrations included in Tables of 3.9 and 3.10 of 2004 ROD. *Geology* – Alluvial aquifer consists of alluvial and glacial outwash units consisting of finer-grained layers and coarser-grained layers. *TI Zone* – Horizontally, the TI Zone encompasses the estimated area of residual soil contamination and suspected NAPL based on soil descriptions and groundwater concentrations exceeding 1 percent contaminant aqueous solubilities. Vertically, the TI Zone encompasses the alluvial aquifer, which extends from the water table (approximately 15 feet bgs) to the top of bedrock (varies between 40 and 65 feet bgs across the site). The bedrock aquifer is not included in the TI Zone.
	Evaluation: *Remedial Timeframe Estimate (years)* – More than 35,000 years based on SourceDK Remediation Timeframe Decision Support System estimates *Remedial Action Alternatives* – The selected remedy includes MNA, groundwater monitoring for COCs and MNA parameters, a TI waiver, and ICs, which will achieve remedial action objectives because (1) potential exposure will be controlled by ICs (prohibiting installation of groundwater wells, restrictions on future land use, and engineering future structures to address vapor intrusion unless sufficient testing demonstrates that vapor intrusion pathway will not present health risk); (2) previous source removal actions have removed coal tar and coal tar-impacted materials and soils to a depth of 15 feet bgs to limit further groundwater contamination and DNAPL migration; (3) the geologic/hydrogeologic setting minimizes the potential for further contaminant migration; and (4) natural attenuation processes have stabilized the plume and are controlling its migration.
	Current Status/Activities: The original remedy selected in the 2004 ROD indicated ACLs would be established for this site. The 2006 ESD selects a TI waiver in place of the ACLs. According to the site summary (June 2011), a restrictive covenant is in place that (1) prohibits the installation of groundwater wells and residential use and (2) addresses potential for VI. Groundwater monitoring for COCs and MNA parameters is ongoing (additional wells were installed in 2008).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Oronogo-Duenweg Mining Belt *State:* MO; *OU:* 4 *Decision Doc. (Type & Date):* ROD, 7/29/98 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU4, 7/29/98, www.epa.gov/superfund/sites/rods/fulltext/r0798026.pdf; (2) Site summary, www.epa.gov/region7/cleanup/npl_files/mod980686281.pdf	***TI Decision:*** The following ARARs are being waived: cadmium and nickel (MCLs); manganese (secondary drinking water standard); and lead (action level under SDWA).
	Rationale: Groundwater flow in the shallow aquifer occurs primarily in the fractured breccia zones and secondary openings created by both the dissolutioning of the bedrock formations and underground mining. Sampling and analysis conducted during site investigations have shown that distribution of metals in the shallow groundwater is extremely sporadic. Action level exceedance of metals in individual wells is dependent on the interception of fracture zones connected to contaminant sources; residual mineral deposits left in the mine openings are now in contact with oxygenated groundwater which contributes to metals leaching and further contamination of the groundwater. This condition prohibits effective cleanup by conventional groundwater P&T systems to restore the aquifer for safe drinking water use. EPA has determined that design of a groundwater recovery system and placement of pumping wells to intercept all fractures and openings conducting contaminated groundwater would be nearly impossible. The TI determination is based on the technical difficulty, as well as, the inordinate cost to attain the ARARs for the protection of human health. However, limited groundwater remediation may be conducted as part of a subsequent ROD to address ecological risks created by groundwater contributions to surface water. After consideration of all the facts in combination with the size and volume (nine million cubic yards) of mining wastes at the site, EPA considers remediation of site groundwater to be technically impracticable based on inordinate costs from an engineering perspective.
	Conditions: *NAPL (suspected or observed)* – DNAPL is not an issue at this site. *COCs* – Metals *Concentration* – Maximum concentrations in the shallow aquifer as of 1995 are as follows (in mg/L): cadmium–0.22; nickel–0.13; manganese–6.88; and lead–0.29. *Geology* – Shallow aquifer occurs primarily in the fractured breccia zones and secondary openings created by both the dissolutioning of the bedrock formations and underground mining. *TI Zone* – TI Zone is expected to cover the entire watershed within Jasper County (approximately 270 square miles). The TI Zone includes only the shallow aquifer, which ranges in thickness from 300 to 400 feet.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not calculated (Note: There are no active groundwater remedies to remediate or clean up the groundwater. EPA is relying on ICs and the provision of clean drinking water via rural water districts and pipeline expansions – providing a safe source to consume but not remediating the groundwater.) *Remedial Action Alternatives* – Alternate water supply included the expansion of an existing water supply system, which serves as a permanent water source to affected residents. Using ICs to control risk.
	Current Status/Activities: Based on the site summary (February 2010), the installation of public water supplies is complete. Residential properties with soil contamination have been cleaned, and the remedial action for mining wastes is underway. ICs (county building ordinance and state well restriction) are already in place.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Iowa City FMGP *State:* IA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 9/26/06 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, 9/26/06, www.epa.gov/superfund/sites/rods/fulltext/r2006070002463.pdf; (2) FS Report, Appendix A – TI Evaluation Report, 6/1/06, 8/2/06; (3) Site summary, www.epa.gov/region7/cleanup/npl_files/iad984591172.pdf	***TI Decision:*** According to the TI Evaluation Report, the following ARARs are being waived: MCLs for cyanide, benzene, ethylbenzene, toluene, xylenes, and benzo(a)pyrene. The TI Evaluation Report also determined that PQLs for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene and Risk-Based Cleanup Levels for 2-methylnaphthalene, acenaphthene, acenaphthylene, chrysene, fluorene, naphthalene, and phenanthrene could not be met.
	Rationale: The following issues make it technically impracticable to achieve restoration through the Devonian and Silurian aquifers within a reasonable timeframe: (1) approximately 92 percent of the estimated 40,200 pounds of contaminant mass remaining at the site consists of PAHs; (2) approximately 93 percent of contaminant mass is present as NAPL, which will remain as a long-term source of contamination of PAH and BTEX; (3) the complex fracture network present in the carbonate aquifer; and (4) further remediation in the source area is physically limited by the presence of an apartment building on the property. Even with the most promising technologies, cleanup would require more than 21,900 years to achieve aquifer restoration for recalcitrant PAHs (specifically benzo(a)pyrene) based on SourceDK Remediation Timeframe Decision Support System estimates.
	Conditions: *NAPL (suspected or observed)* – DNAPL and LNAPL have been observed in multiple wells at the site. During source removal activities, LNAPL was removed from the site. *COCs* – 13 PAHs, cyanide, and BTEX *Concentration* – Groundwater concentrations included in Table 7-3.6 ROD. *Geology* – Alluvial aquifer consists of loess, alluvial and glacial outwash units consisting of finer-grained layers and coarser-grained layers. The shallower Devonian bedrock is fractured dolomite. In the deeper bedrock zones, the bedrock is generally vuggy and exhibits karst and paleokarst features including the identification of two large solution cavities. *TI Zone* – Horizontally, the TI Zone encompasses the estimated area of residual soil contamination and suspected NAPL based on soil descriptions, confirmed presence of NAPL, and groundwater concentrations exceeding 1 percent contaminant aqueous solubilities. Vertically, the TI Zone encompasses the alluvial aquifer, which extends from the water table (approximately 15 feet bgs) to the Devonian and Silurian bedrock aquifers.
	Evaluation: *Remedial Timeframe Estimate (years)* – More than 21,000 years based on SourceDK Remediation Timeframe Decision Support System estimates *Remedial Action Alternatives* – In addition to the implementation of the TI waiver, the selected remedy included: (1) implementation of ICs in the form of environmental covenants, county and city ordinances and state laws; (2) MNA of groundwater; (3) sediment monitoring of the adjacent creek; (4) indoor air monitoring of the apartment building; and (5) recovery of LNAPL in the unconsolidated aquifer.
	Current Status/Activities: Site summary (November 2010) indicates the remedial action for the site, including LNAPL recovery, MNA, establishing ICs (environmental covenant) and monitoring, are currently ongoing. A preliminary close-out report was completed in 2010.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Riverfront *State:* MO *OUs:* 4 *Decision Doc. (Type & Date):* ROD, 3/26/09 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, 3/26/09, www.epa.gov/superfund/sites/rods/fulltext/r2009070002848.pdf; (2) Site summary, www.epa.gov/region07/cleanup/npl_files/mod981720246.pdf ; (3) ROD, 5/13/11, www.epa.gov/superfund/sites/rods/fulltext/r2011070003850.pdf	***TI Decision:*** ARARs waived are MCLs for PCE and TCE and non-zero MCLGs for cis-1,2-DCE and trans-1,2-DCE in the bedrock aquifer.
	Rationale: A TI waiver is warranted because of the following: (1) depth of contamination may extend more than 400 ft bgs; (2) detailed fracture diameter, spacing, orientation, vertical extent, and connectivity within and between formations are unknown and cannot be accurately determined because of the plume's size and depth, surface topography and residential area above the plume; (3) dissolved PCE may be present in fractures and/or as DNAPL; and (4) the area above the plume is steep/rugged and a heavily developed residential area making it difficult to find suitable locations for treatment and/or extraction wells. With the remediation of the contaminant source area, the contaminant levels in the groundwater are expected to decrease over time to a level that is protective of human health.
	Conditions: *NAPL (suspected or observed)* – Possible that PCE is present as DNAPL. *COCs* – PCE; TCE; cis-1,2-DCE; trans-1,2-DCE *Concentration(maximum)* – PCE-9,100 µg/L; TCE-100µg/L; cis-1,2-DCE-210µg/L; trans-1,2-DCE-30µg/L *Geology* – Two aquifers are present at the site: Ozark aquifer (fractured bedrock) and Missouri River aquifer (alluvial). *TI Zone* – TI zone is comprised of a block of fractured bedrock that is approximately 5,000 feet in length, between 2,000 and 4,500 feet wide, and between 20 and 450 feet deep. The zone includes the area of the PCE plume with concentrations above its MCL (5 µg/L).
	Evaluation: *Remedial Timeframe Estimate (years)* – 100 years *Remedial Action Alternatives* – The 2009 ROD selects in situ chemical oxidation, monitoring, and ICs to address residual PCE soil contamination at the site, and ICs (well drilling restrictions) and monitoring for groundwater. The source action will minimize contaminants migrating into the groundwater. Highly contaminated soils were removed in 2007.
	Current Status/Activities: According to the site summary (October 2011), well drilling restrictions are already in place. The remedial design has been proved for the remedy selected in the May 2011 ROD. OU 6 includes limited residential drinking water contamination and continues to be treated with whole house filtration systems.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 8: 9 sites (11 waivers)
Site Name: East Helena *State:* MT; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 11/22/89 *Stage:* Pre-construction *Media:* Surface water *References:* (1) ROD, OU1, 11/22/89, www.epa.gov/superfund/sites/rods/fulltext/r0890027.pdf; (2) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f2006080001359.pdf; (3) Five-year review, 2011, ftp://ftp.epa.gov/r8/temp/EHelena_3FYR_092711.pdf	***TI Decision:*** State water quality standards are being waived for arsenic (0.0022 µg/L), cadmium (0.0011 mg/L) and lead (0.0032 mg/L). Standards for copper and zinc can be achieved.
	Rationale: Lower Lake collected and stored process water from the plant and runoff from the site, resulting in metals contamination in the lake and sediments. The selected remedy in 1989 included replacing the lake with storage tanks, constructing a lined pond for stormwater runoff, treating the lake using *in situ* chemical treatment, and removing sediments. In 1993, an ESD implemented the contingent remedy of P&T for Lower Lake and treatment continues. Arsenic, cadmium, and lead standards were waived because they could not be attained and/or measured with available treatment and monitoring technologies; the selected standards were either equal to or lower than MCLs or other standards.
	Conditions: *NAPL (suspected or observed)* – NAPL not an issue. *COCs* – Metals *Concentration* – Concentrations from 1984-1987 (in µg/L): arsenic–19,900; lead–5,110; and cadmium–1,050. *Geology* – Lower Lake lies within the ancestral floodplain of Prickly Pear Creek. The channel and excavation into the alluvium are composed of highly porous tertiary cobbles, gravels, and sediments. The overbank areas of the floodplain are composed of sands, clays, fine sediments, and organic-rich deposits. *TI Zone* – *TI* waiver applies to Lower Lake; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – Continue P&T and excavate sediments
	Current Status/Activities: Based on the 2011 5-year review, completion of RCRA investigations and implementation of appropriate corrective actions are needed to ensure protectiveness. State standards for arsenic and copper have been changed since the ROD, but no change to the prescribed standards was recommended in the 5-year review.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Whitewood Creek *State:* SD; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 3/30/90 *Stage:* Pre-construction *Media:* Groundwater and surface water *References:* (1) ROD, OU1, 3/30/90, www.epa.gov/superfund/sites/rods/fulltext/r0890028.pdf; (2) Site summary, www.epa.gov/region8/superfund/sd/whitewood/index.html	***TI Decision:*** The TI waives standards for arsenic in groundwater and surface water.
	Rationale: Whitewood Creek would not achieve compliance with water quality criteria for the protection of human health from the consumption of fish because upstream surface water exceeds this criterion. In addition, groundwater discharge and surface erosion and runoff contribute additional arsenic to the creek. Due to the continued presence of mine tailings acting as a source of contamination, it will be technically impracticable to restore groundwater at the site.
	Conditions: *NAPL (suspected or observed)* – NAPL not an issue. *COCs* – Arsenic *Concentration* – Maximum concentrations of arsenic were 0.780 mg/L in groundwater and 0.20 mg/L in surface water. *Geology* – The headwaters of Whitewood Creek originate in predominantly Precambrian granite and schist, which is the host rock for gold ore. The bedrock lithology changes to thick-bedded limestone of Paleozoic age. Whitewood Creek passes over limestone beds and across Mesozoic sedimentary rocks containing shale and gypsum, with some thin sandstone and limestone beds. *TI Zone* – TI waiver applies to alluvial groundwater and Whitewood Creek; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – ICs with (1) covering of surface soils, (2) fencing of tailings, (3) partial soil cover of tailings, and (4) removal of surface soils and tailings.
	Current Status/Activities: The site summary (October 2011) indicates ICs (zoning regulations and groundwater well restrictions) have been implemented. This site was deleted from the NPL in 1996. The third 5-year review will be completed before August 2012.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Broderick Wood Products *State:* CO; *OU:* 2 *Decision Doc. (Type & Date):* ROD, 3/24/92 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 3/24/92, www.epa.gov/superfund/sites/rods/fulltext/r0892057.pdf; (2) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f2006080001189.pdf; (3) Five-year review, 2011, www.epa.gov/superfund/sites/fiveyear/f2011080004141.pdf	***TI Decision:*** ARARs waived as part of the 1992 ROD include MCLs (lead–0.05 mg/L) and state standards for groundwater (cadmium–0.01 mg/L; chromium–0.05 mg/L; benzene–1 µg/L).
	Rationale: The Denver aquifer is made up of small lenses of permeable sandstones interbedded with near-impermeable claystone, which significantly limits the ability of the P&T system. Due to these lenses, contaminated groundwater is confined to an area onsite.
	Conditions: *NAPL (suspected or observed)* – Both LNAPL and DNAPL are present. *COCs* – VOCs, SVOCs, metals, PAHs, dioxins, and furans (Table 1B not available in online version of ROD) *Concentration* – See Table 11 of 2006 5-year review for contaminant concentrations (text is unclear). *Geology* – Small lenses of permeable sandstones interbedded with near-impermeable claystone. *TI Zone* – TI waiver applies to the Denver aquifer; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – ICs and monitoring are required for the Denver aquifer. The surficial aquifer will be restored using P&T and the lowest aquifer (Arapahoe aquifer) will be monitored and action taken if necessary.
	Current Status/Activities: Based on the 2011 5-year review, P&T continues on a sporadic basis and monitoring has been discontinued because of financial issues. The P&T system should be operational full time for the site to be protective of human health and the environment. The ICs are currently in place (restricting soil activities, the use of groundwater, and installation of wells); the environmental covenant was recorded in February 2007.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Silver Bow Creek/Butte Area *State:* MT; *OU:* 3 (Butte Mine Flooding) *Decision Doc. (Type & Date):* ROD, 9/29/94 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU3, 9/29/94, www.epa.gov/superfund/sites/rods/fulltext/r0894102.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-08005.pdf; (3) Five-year review, 2011, www.epa.gov/superfund/sites/fiveyear/f2011080004074.pdf	***TI Decision:*** ARARs are waived for arsenic, cadmium, lead, copper, and sulfate (if a primary MCL is established for sulfate); these are the only site-related groundwater contaminants that exceed ARARs.
	Rationale: A TI is required because (1) the extremely large horizontal and vertical extent of the contamination problem—the sheer size of the source, calculated to be 27 billion cubic yards—would leave an open pit about 62 times larger than the current Berkeley Pit, would eliminate the historic city of Butte, and would have untold environmental consequences; (2) the potentially applicable remediation technologies are not proven in conditions similar to this site, the volume of contaminated groundwater contained within the bedrock aquifer of the TI area is approximately 125 billion gallons, implementation of P&T would cause a progressive deterioration of groundwater quality and reverse the currently observable trends of improving bedrock groundwater quality by exposing more source material to oxygen, and injection of either grout or acid neutralizing fluids is very uncertain due to the large extent of underground workings and the improbability of reaching all mine workings; and (3) even if one of the potentially applicable technologies were used, the cost of remediation would be inordinately high ranging from $9 billion to $462 billion, with the exception of inundation which will range between $27 and $213 million.
	Conditions: *NAPL (suspected or observed)* – NAPL does not seem to be an issue. *COCs* – Metals, sulfate *Concentration* – The maximum concentrations in 1991 were as follows (in µg/L): arsenic–726; cadmium–3.7; copper–129; lead–7.3; and sulfate–980,000. *Geology* – Bedrock *TI Zone* – The TI Zone (which covers 6.75 square miles) includes the potential contaminated bedrock aquifer and encompasses the area of underground mine workings. The vertical extent of the TI Zone is defined by the elevation of the lowest underground mine workings, which has been determined to be approximately 1,500 feet above mean sea level.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time (indefinite) *Remedial Action Alternatives* – The selected remedy includes inundation, but ARARs will not be met.
	Current Status/Activities: Based on the 2011 5-year review, the treatment plant where mine discharge is treated and then recycled for mine operations is operational; however, there have been several issues: the pH level of the effluent standard has not been met and the supersaturation of gypsum can cause the TSS discharge to be above standards, which may lead to cadmium above standards. These problems will all be addressed in the next 5-year review period, as well as a more practical approach to analyzing radionuclides for compliance with beta-photon emitter discharge criteria. Monitoring is ongoing and ICs have been implemented including land use access controls and restriction of groundwater use.

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General Site Information	TI-Relevant Information
Site Name: Anaconda Co. Smelter *State:* MT; *OU:* 4 *Decision Doc. (Type & Date):* ROD, 9/29/98 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU4, 9/29/98, www.epa.gov/superfund/sites/rods/fulltext/r0898096.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-08003.pdf; (3) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010080003610.pdf	***TI Decision:*** The TI waiver is for Montana Water Quality Standard for arsenic (18 µg/L).
	Rationale: Groundwater contamination in the bedrock aquifers has likely occurred as a result of transport of arsenic via infiltration and deep percolation of precipitation through contaminated soil. Due to this source and complex geology (fractured bedrock) it was determined that groundwater quality could not be restored in the bedrock aquifers at this site.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue at this site *COCs* – Arsenic *Concentration* – Dissolved arsenic concentrations ranged from 2.7–1,990 µg/L in the Smelter Hill TI Zone and from 17.4–414 µg/L in the Mt. Haggin zone. Concentrations were greater than 100 µg/L in some areas of Stucky Ridge. *Geology* – Fractured bedrock *TI Zone* – Area includes 3 TI Zones for more than 28,600 acres total: Stucky Ridge (4,771 acres), Smelter Hill (5,872 acres), and Mount Haggin (17,956 acres). TI Zone is for the bedrock aquifers with a maximum depth of 250 ft bgs.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – Removal, capping, reclamation, and MNA.
	Current Status/Activities: Based on the 2010 5-year review, the development of a final vegetation cover design for Milltown sediments, the removal of all Yellow Ditch material and resolution of the Georgetown railroad grade must be completed. Natural attenuation was selected for groundwater (at Regional Water, Waste, and Soils OU), but is being re-evaluated because of a new arsenic standard. ICs were selected but a final plan is not yet complete. A ROD modification was issued in September 2011 that expanded the TI zone and added surface water (according to the NPL fact sheet). A separate TI waiver summary has been prepared for the 2011 ROD Amendment and is included below on page 76.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Summitville Mine *State:* CO; *OU:* 5 *Decision Doc. (Type & Date):* ROD, 9/28/01 *Stage:* Pre-construction *Media:* Surface water *References:* (1) ROD, OU5, 9/28/01, www.epa.gov/superfund/sites/rods/fulltext/r0801538.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-08006.pdf; , (3) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010080003754.pdf	***TI Decision:*** Use classifications will be waived for two segments of the Alamosa River (agricultural use in Segment 6 and Class I - Cold Water in Segment 3B). Associated standards being waived are 200 µg/L for manganese in Segment 6 and 750 µg/L for aluminum and 12,000 µg/L for iron in Segment 3B.
	Rationale: Certain state standards and use classifications for Alamosa River Segments 3B and 6 are being waived because of technical impracticability. Metals upstream of these two segments are naturally occurring and not a result of mining related activities in the area.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue. *COCs* – Metals *Concentration* – Concentrations were estimated to be as high as 1,330 µg/L for aluminum in Segment 6. Maximum concentrations upgradient of Segment 3B were 8,070 µg/L for aluminum and 180,030 µg/L for iron. *Geology* – Wide-spread naturally-occurring mineralized zones within headwater basins of Alamosa River. *TI Zone* – TI waiver applies to Segments 6 and 3B of the Alamosa River; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – The selected remedy for this OU was to contain and treat acid mine drainage prior to discharge; ICs were not associated with this remedy.
	Current Status/Activities: Based on the 2010 5-year review, treatment is being conducted at OU5, but the water treatment plant is not large enough for the amount of water at the site. A new water treatment plant will be constructed with a capture and pump back system for acid mine drainage and a mine pool management system.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Milltown Reservoir Sediments *State:* MT; *OU:* 3 *Decision Doc. (Type & Date):* ROD, 4/29/04 *Stage:* Pre-construction *Media:* Surface water *References:* (1) ROD, OU3, 4/29/04, www.epa.gov/region8/superfund/mt/milltown/mrsrod.html; (2) ROD fact sheet, www.epa.gov/region8/superfund/mt/milltown/pdf/mrsRODfs.pdf; (3) Site summary, www.epa.gov/region8/superfund/mt/milltown/	***TI Decision:*** The state water quality standard for copper is being waived and replaced with the federal water quality criteria.
	Rationale: Current modeling projections indicate that none of the alternatives proposed, including total removal of all exposed and buried tailings, would achieve complete compliance with the state standard. Additionally, violations of the copper standard occur upstream due to other non site-related mining activities.
	Conditions: *NAPL (suspected or observed)* – NAPL not an issue. *COCs* – Copper *Concentration* – From 1991 to 1997, dissolved copper concentrations ranged from 2 to 20 µg/L. *Geology* – River valley alluvium with vertical and lateral sand, gravel, boulders, and some clay lenses. Anoxic conditions beneath reservoir sediments. *TI Zone* – TI waiver applies to the Clark Fork River; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Very long time *Remedial Action Alternatives* – The selected remedy in the 2004 ROD includes temporary ICs until the aquifer is restored using MNA for groundwater, which is expected to take 4 to 10 years after dam and sediment removal. ICs include zoning regulations, deed restrictions, and limitations on groundwater use.
	Current Status/Activities: An alternate water supply (including replacement or retrofitting of domestic wells) has been provided as necessary. The site summary (October 2011) indicates OU3 will be addressed in a 5-year review planned for 2015. In 2010, the Clark Fork River was diverted to a new channel through the site. No additional updates were available in the information sources reviewed.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Silver Bow Creek/Butte Area *State:* MT *OUs:* 08 *Decision Doc. (Type & Date):* ROD, 9/2006 *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD, OU 8, 9/2006; (2) Final Technical Memorandum. TI Evaluation for Alluvial Groundwater, 2/2006; (3) Five-year review, 2011, www.epa.gov/region8/superfund/mt/milltown/	***TI Decision:*** ARARs waiver of MCLs for COCs include arsenic, cadmium, copper, lead, mercury, and zinc in groundwater for the alluvial aquifer underlying the identified TI zone within the BPSOU.
	Rationale: Based on conclusions presented in the TI evaluation, EPA has determined that the water quality in the BPSOU alluvial aquifer cannot be improved by remedial action within a reasonable time frame even assuming implementation of the most extensive and costly mine waste removal alternatives. The most aggressive alternative included complete removal of the source area with an estimated cost of $189 million, but many diffuse sources would remain. Even with complete source removal and groundwater capture, the TI evaluation concluded that the groundwater would not attain ARARs within a reasonable time due to slow desorption kinetics in the aquifer.
	Conditions: *NAPL (suspected or observed)* – NAPL does not seem to be an issue *COCs* – Metals *Concentration* – Copper: 2,100 mg/L; Cadmium 3.5 mg/L, Zinc: 2,275 mg/L; Lead 1.3 mg/L *Geology* – Alluvial *TI Zone* – The TI zone generally extends from the Parrot tailings area to the groundwater capture system at Lower Area One within the area where groundwater exceeds ARARs for metals. The area is approximately 871 acres. The depth of the TI zone is the full thickness of the alluvial aquifer which is highly variable but extends to 268 feet below ground surface in one well.
	Evaluation: *Remedial Timeframe Estimate (years)* – EPA's evaluation indicates that ARARs may not be attainable for greater than 100 years and likely greater than 300 years even with extensive source removal. This is due to slow kinetics of desorption of metals from contaminated aquifer materials. *Remedial Action Alternatives* – Groundwater capture and treatment has been operational since 1998 at the downgradient edge of the plume and since 2005 in the middle of the plume and will be continued in perpetuity.
	Current Status/Activities: Based on the 2011 5-year review, a groundwater monitoring plan (with additional monitoring wells) is being prepared to ensure groundwater is not leaving the TI zone. ICs are being established to prevent residential use of groundwater, but are not yet in place. Groundwater collection and treatment has been operational since 1998 and refinement of the system is ongoing.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Libby Groundwater Contamination *State:* MT; *OUs:* 2 *Decision Doc. (Type & Date):* ESD, 9/14/93 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ESD, OU 2, 9/14/93, www.epa.gov/superfund/sites/rods/fulltext/e0893500.pdf; (2) 5-year review, 3/30/00, www.epa.gov/superfund/sites/fiveyear/f00-08006.pdf; (3) Five-year review, 2010, www.epa.gov/superfund/sites/fiveyear/f2010080003364.pdf	***TI Decision:*** The following ARAR requirements are waived in the Lower Aquifer: (1) reduction of PCP, chrysene, and benzo(a)anthracene concentrations below their primary MCLs of 1 µg/L, 0.2 µg/L, and 0.1 µg/L, respectively and (2) reduction of naphthalene concentrations below EPA's lifetime health advisory limit of 20 µg/L.
	Rationale: The initial remedy for the Lower Aquifer selected in the 1988 ROD consisted of feasibility testing of biorestoration remedial technologies, both alone and in conjunction with oil recovery and oil dispersion techniques. Bench-scale studies and additional investigations were conducted, and it was determined that remediation of DNAPL contamination using P&T or *in situ* bioremediation was technically impracticable in a cost-effective and timely manner. In addition, use of oil dispersion techniques (such as surfactants) could potentially result in greater risk to human health and the environment than currently exists or would exist in the future. The following additional conclusions were also noted: (1) the dissolved contaminant plumes have apparently stabilized, consequently there is no need for migration control of the dissolved phase plumes in the Lower Aquifer; (2) a small potential for cross-contamination of the Upper Aquifer could exist in an area of the Lower Aquifer plume where a natural upward gradient appears to occur; however, the estimated upward flux does not result in contaminant concentrations that exceed MCLs for drinking water; (3) potential for either the dissolved contaminant plumes or DNAPL to reach the Kootenai River is low; (4) although direct ingestion and dermal contact with dissolved contaminants would result in an unacceptable excess cancer risk, institutional controls are in place, eliminating the only potential pathway of concern.
	Conditions: *NAPL (suspected or observed)* – NAPL is present in the Lower Aquifer. *COCs* – COCs for the Lower Aquifer include PAHs and PCP. Tables are provided in the ROD but not included in the online version. *Concentration* – Tables are provided in the ROD but not included in the online version. *Geology* – The Lower Aquifer ranges in depth from 100 to 160 feet bgs and is separated from the Upper Aquifer by a relatively low permeability layer (35 feet thick) that may not be laterally continuous across the entire site. *TI Zone* – TI zone includes the Lower Aquifer; however the lateral extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Due to the presence of NAPL in the Lower Aquifer, it is unlikely that ARARs could be met within a reasonable timeframe. *Remedial Action Alternatives* – The remedy for the Lower Aquifer consists of institutional controls prohibiting installation of new water supply wells and groundwater monitoring.
	Current Status/Activities: An alternate water supply has been provided to residents whose domestic wells were influenced or potentially influenced by off-site migration of the contaminant plumes in the Upper Aquifer. According to the 2010 5-year review, as a result of drought conditions, some residents have installed new wells or are using sealed wells. ICs that prohibit the installation of new water supply wells are in place, but some of the affected area is not within the City of Libby, and is not subject to the well drilling restriction. A P&T system consisting of an oil/water separator, biological treatment and an oxygen injection system have been used to address contamination in the Upper Aquifer; however the oxygen injection system was discontinued in 2003. An additional investigation continues to evaluate the effectiveness of the remedial strategy in the Upper Aquifer and to better define the extent of the Controlled Groundwater Area because it appears groundwater P&T with biological treatment may not be remediating the source zone and PCP plume. Land treatment units were used to address contaminated soil at the site. Both the soil and groundwater cleanup levels have become more stringent, which has led to doubts in the performance of both media's selected remedy. The VI pathway and presence of 1,4-dioxane in groundwater warrant additional data collection.

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General Site Information	TI-Relevant Information
Site Name: California Gulch *State:* CO *OUs:* 12 *Decision Doc. (Type & Date):* ROD, 9/22/09 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, 9/22/09, www.epa.gov/superfund/sites/rods/fulltext/r2009080003087.pdf; (2) Site summary, www.epa.gov/region8/superfund/co/calgulch/index.html	***TI Decision:*** ARARs waived are MCLs for cadmium and lead in the shallow aquifer. There are no current exceedances of the arsenic MCL.
	Rationale: TI waiver for lead and cadmium in the shallow aquifer is necessary because of (1) the amount of waste remaining in place at the site, (2) the free exchange of metal-impacted surface water and alluvial groundwater, and (3) the presence of widespread disturbed and saturated alluvium in Lower California Gulch (and elsewhere in the Site) acting as a low-grade reservoir of metals with the potential to desorb or otherwise be mobilized into alluvial groundwater.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue. *COCs* – Metals (cadmium, lead, arsenic) *Concentration* – Table 6-1 is not provided in copy of ROD. *Geology* – The 1994 CD restricts OU12 to the shallow alluvial aquifer not to exceed a depth of 250 feet or contact with bedrock, whichever is the lesser depth below the ground surface. The alluvial aquifer is largely contiguous and primarily under unconfined conditions although perched groundwater can occur locally. Depth to groundwater varies from less than one foot to approximately 250 feet, and saturated thickness ranges from 0 to over 500 feet in the alluvial aquifer above the bedrock contact. Throughout much of the Site, bedrock is overlain by unconsolidated glacial deposits up to 1,000 feet thick derived from various types of lithologies in the Mosquito Range including porphyry, rhyolite, granite, quartzite, dolomite, limestone and sandstone. Sediments are poorly sorted, loose and porous and were transported and deposited by glacial and fluvial processes. *TI Zone* – TI zone applies to the shallow alluvium of Stray Horse, California, and Oregon gulches, as well as a portion of the Arkansas Valley floodplain. ***[please confirm – obtain TI Evaluation report]***
	Evaluation: *Remedial Timeframe Estimate (years)* – Not provided *Remedial Action Alternatives* – The selected remedy includes ICs to restrict the use of alluvial groundwater for human consumption and groundwater monitoring to provide protectiveness.
	Current Status/Activities: According to the site summary (September 2011), EPA has conducted partial deletions for OUs 2, 8, 9, and 10. ICs are either in development or have been implemented at multiple OUs on site.

General Site Information	TI-Relevant Information
Site Name: Anaconda Co. Smelter *State:* MT; *OU:* 4 *Decision Doc. (Type & Date):* ROD Amendment, 9/29/11 *Stage:* Post-Construction *Media:* Groundwater and surface water *References:* (1) ROD Amendment, OU 4, 9/29/11, www.epa.gov/region8/superfund/mt/anaconda/Anaconda_OU4RODAmendment0911.pdf; (2) Site Summary, November 2011, www.epa.gov/region8/superfund/mt/anaconda/index.html; (3) Five-year review, 9/30/10, www.epa.gov/superfund/sites/fiveyear/f2010080003610.pdf	***TI Decision:*** Human health standard (10 µg/L) is being waived for arsenic in groundwater and surface waters, which has resulted in new and expanded TI zones for this site. ***Rationale:*** In addition to the expansion of the bedrock aquifer TI zone boundaries, a waiver of the arsenic human health standard have been identified for alluvial aquifers in the North Opportunity and South Opportunity areas. Although this ROD Amendment requires more source control measures (e.g., removal of miscellaneous wastes and reclamation of contaminated soils) than the 1998 Selected Remedy, TI evaluations have concluded that the human health arsenic standard will not be achieved within a reasonable period of time within the areas. A domestic well monitoring and replacement plan has been developed to ensure that domestic well users within or adjacent to these TI zones will have drinking water that, at a minimum, meets human health standards. The arsenic human health standard for surface water is waived to the chronic and acute aquatic life federal and state standards of 150 and 340 µg/L, respectively, within the surface water TI zone. These surface waters have been impacted by groundwater discharges from the bedrock TI zone. **North Opportunity Area** – The arsenic standard is waived for the uppermost portion of the shallow unconfined alluvial aquifer within the North Opportunity Ground Water/Surface Water Area of Concern, where shallow groundwater interacts with arsenic-contaminated soils. The source of arsenic contamination in groundwater is the combination of contaminated soil and saturated conditions. The restrictions on RAs due to its wetland characteristics limit any actions that will significantly disturb the soil or hydrologic conditions. Additionally, the geochemical conditions necessary for natural attenuation are not present. Since no actions are available which will remove the source or disrupt the transport pathway, any groundwater within or entering the North Opportunity AOC will remain or become contaminated with arsenic. Even if groundwater is withdrawn for treatment, the recharge water will become contaminated. The North Opportunity TI Zone extends from the edge of the valley bottom along the north side of Lost Creek to Warm Springs Creek on the south and from the 5000 foot elevation contour on the west to the OU 4 boundary on the east. The downgradient/downstream limits of the TI Zone extend to the OU boundary where the surface and groundwater flow into the Clark Fork River OU. The TI Zone applies to all surface water within the TI Zone. The TI zone also applies to groundwater within 10 feet of the water table. On this basis, the North Opportunity TI Analysis concludes that it is technically impracticable from an engineering perspective to reduce arsenic concentrations below 10 µg/L in groundwater within the North Opportunity AOC. The TI zone generally extends from the Anaconda Airport to the Clark Fork River OU boundary and from Warm Springs Creek to Lost Creek. **South Opportunity Area –** The arsenic human health standard is waived for certain surface water and groundwater within the South Opportunity Area of Concern. None of the alternatives evaluated is capable of achieving the human health standard for arsenic with certainty. The source of arsenic contamination in groundwater is the combination of contaminated soil and saturated conditions. The previous RAs of reducing irrigation and allowing natural attenuation to work for eleven years has not resulted in significant progress toward meeting the groundwater ARAR. Additional RAs which would control the source through removal action or changing the hydrologic conditions are difficult to implement because much of the area of concern is a jurisdictional wetland. Additionally, the geochemical conditions necessary for natural attenuation are not present. Since no actions are available which will entirely remove the source or disrupt the transport pathway, any groundwater within or entering the South Opportunity Area of Concern will remain or become contaminated with arsenic. Even if groundwater is withdrawn for treatment, the recharge water will become contaminated. Because the contaminated South Opportunity TI zone groundwater discharges to surface water (Willow Creek), movement of the plume is hydraulically controlled. The source of arsenic in surface water is gains from groundwater via small tributaries and drain tiles, and upstream source within the bedrock TI zone. It has been determined to be technically impracticable to remediate the groundwater to the arsenic human health standard throughout the South Opportunity Area of Concern, and a previous determination has concluded that it is technically impracticable to remediate the upstream source. The TI zone generally includes the valley bottom land located within an area bounded by Mill Creek or Highway 1 to the north, the Streamside

General Site Information	TI-Relevant Information
	Tailings OU to the east, the Silver Bow County line to the south, and uplands associated with the Mount Haggin WMA (also the bedrock TI zone) to the west. Downgradient movement of the plume is hydraulically controlled by discharge into surface water either along Willow Creek or drain tiles. Because of the connection between the extent of wetlands and groundwater contamination, wetlands on the north side of Highway 1 are included in the TI zone. The surface water TI zone includes all surface water within the groundwater TI zone plus all surface water exiting the bedrock TI zone to the confluence of Mill Creek and Willow Creek. **Bedrock Aquifer -** Additional data collected for the bedrock aquifer have resulted in an expansion of its TI zone. The primary changes to all three previous TI Zones include: -The bedrock aquifer beneath the alluvial aquifer in the valleys has been added to the bedrock TI zone resulting in merging of the previous three TI zones into a single bedrock TI zone; -The California Creek area has been added based on new spring and surface water data; -The area from Lost Creek to Modesty Creek has been added based on surface water data and limited spring data; -The western boundary near Anaconda has been expanded slightly based on data collected from domestic wells; and -Boundaries with waste management areas are adjusted based on changes to the WMA boundaries The bedrock TI zone now includes 63,515 acres or 99 square miles, approximately double the area delineated in the ROD. The depth of the bedrock TI zone remains unchanged at 250 feet below ground surface. **Spring-fed Tributaries –** The Montana surface water human health standard and federal MCL for arsenic are waived in the spring-fed tributaries. These spring-fed tributaries are discharges of bedrock groundwater, which has already been addressed under the bedrock TI evaluation. Since the groundwater source will not be mitigated, surface water in spring-fed tributaries will remain impacted by arsenic within the reaches affected by gaining groundwater. It was determined to be technically impracticable from an engineering perspective to reduce arsenic concentration in spring-fed tributaries of Willow, Mill, California, and Modesty Creeks as well as intermittent flow tributaries below 10 µg/L in surface water within the bedrock TI zone. The TI waiver addresses all surface water bodies with the Bedrock Aquifer TI Zones and extends to the mouths of these surface water bodies or the downstream end of the OU.
	Conditions: *NAPL (suspected or observed)* – NAPL is not an issue at this site. *COCs* –Arsenic *Concentration* – In Willow Creek (South Opportunity area), arsenic concentrations ranged from 11 to 164 µg/L in the mainstream and from 28 to 307 µg/L in small tributaries. Arsenic concentrations at the top of the aquifer approach 150 µg/L over a large area of South Opportunity. Additional recent data was not available in the documents reviewed. *Geology* – Fractured bedrock *TI Zone* – TI waiver applies to the shallow groundwater at the North and South Opportunity areas (from the water table to 10 feet below the water table), expands upon the existing TI zone in the bedrock aquifer, and includes surface waters within the TI zones.
	Evaluation: *Remedial Timeframe Estimate (years)* – Not provided in the ROD Amendment. *Remedial Action Alternatives* – ICs were selected to minimize exposure to groundwater and surface waters located within the TI zones. A domestic well monitoring and replacement program will be implemented to ensure that nearby residents are provided appropriate drinking water. Long-term monitoring was also selected. Additional source removal was also selected for the South Opportunity area.
	Current Status/Activities: According to the 2010 5-year review, site-wide activities such as ICs, monitoring and maintenance, and groundwater and surface water remedies are ongoing. Construction is also ongoing at 3 areas (OU 4, 7, and 16).

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 9: 9 sites
Site Name: Westinghouse Electric Corp (Sunnyvale Plant) *State:* CA; *OU:* 1 *Decision Doc. (Type & Date):* ROD, 10/16/91 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU1, 10/16/91, www.epa.gov/superfund/sites/rods/fulltext/r0992079.pdf; (2) Five-year review, 2006, www.epa.gov/superfund/sites/fiveyear/f2006090001097.pdf; (3) Five-year review, 9/29/11, www.epa.gov/superfund/sites/fiveyear/f2011090004165.pdf	***TI Decision:*** MCLs are being waived for PCBs.
	Rationale: A TI waiver is justified based on the following: (1) the presence of spatially discontinuous DNAPL PCB in significant amounts; (2) the heterogeneity of the subsurface combined with low permeabilities; and (3) the characteristics of PCBs, including low solubility, high tendency to partition onto organic materials, and high viscosity.
	Conditions: *NAPL (suspected or observed)* – DNAPL has been observed in the A and B aquifers and at the A/B aquitard. *COCs* – PCBs *Concentration* – Concentration of PCBs in the A aquifer was not available. *Geology* – Low permeability soils *TI Zone* – TI Zone includes aquifer A in the source area.
	Evaluation: *Remedial Timeframe Estimate (years)* – An assessment was not done. *Remedial Action Alternatives* – The selected remedy includes P&T for restoration of other contaminants and for containment of PCBs in the source area, ICs, and monitoring. Source removal and incineration were also selected.
	Current Status/Activities: According to the 2011 5-year review, P&T continues and ICs have not been implemented yet.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Schofield Barracks *State:* HI; *OU:* 2 Decision Doc. (Type & Date): *ROD, 2/7/97* *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 2/7/97, www.epa.gov/superfund/sites/rods/fulltext/r0997032.pdf; (2) Justification for TI Waiver, 2/7/97; (3) Five-year review, 2002, www.epa.gov/superfund/sites/fiveyear/f02-09007.pdf; (4) Site summary, www.yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba325236842882574 2600743733/1818fba2414310dc882 57007005e9452!OpenDocument	***TI Decision:*** MCLs are waived for carbon tetrachloride and TCE.
	Rationale: The Justification for TI Waiver states "Remediating the aquifer to MCLs is not feasible because of the depth (500 to 700 feet), thickness (greater than 2,000 feet), and fractured lava characteristics of the aquifer, and the large size and age of the plume. The plume is contained through a combination of P&T of 4 mgd at supply wells, geologic barriers, and natural attenuation. Treatment at the source is not possible because of the geology of the site and the nature of DNAPLs. The geology at the site is complex fractured basalt and there is extreme heterogeneity. Additionally, the high transmissivity (about 900,000 feet/day) and the associated high volume of water flowing through the system would require tremendous P&T capacity to contain the plume estimated at 150 mgd (based on FEMWATER modeling). A P&T system of this capacity would cost about $350 million. The plume migrating off-base has concentrations less than 15 ppb, which poses a risk of $1x10^{-5}$ to 10^{-6}; therefore, removal of residual DNAPL would not provide a significant reduction in risk. Risk is controlled through wellhead treatment (air stripping) for VOCs at all affected water supply wells.
	Conditions: *NAPL (suspected or observed)* – Residual DNAPL is likely present. *COCs* – Carbon tetrachloride and TCE *Concentration* – Influent concentrations at the production wells were observed at 8.2 µg/L for carbon tetrachloride and 25 µg/L for TCE. *Geology* – The geology at the site is complex fractured basalt and there is extreme heterogeneity with a high transmissivity (about 900,000 ft/day). *TI Zone* – The entire plume above MCLs; however the extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Hundreds of years *Remedial Action Alternatives* – Several were evaluated including P&T and *in situ* treatment. The TI zone is too large to remediate and there is not enough power on the island to operate the required number of pumps.
	Current Status/Activities: Based on the site summary and the 2002 5-year review report, well-head treatment was added to nearby production wells, and ICs (land and groundwater use restrictions) are in place at OU4 (ICs were not mentioned for OU2).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Tucson International Airport Area *State:* AZ; *OU:* 2 Decision Doc. (Type & Date): *ROD, 9/30/97* *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU2, 9/30/97, www.epa.gov/superfund/sites/rods/fulltext/r0997137.pdf; (2) Final FS, Appendix B, June 1997; (3) Site summary, www.yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/edd9fbc1531a93b788257007005e9467!OpenDocument	***TI Decision:*** MCLs are being waived for contaminants in the TI Zone, including TCE; PCE; 1,1-DCE; benzene; chloroform; 1,2-DCP; and methylene chloride.
	Rationale: A TI waiver is justified for the Airport Property area of the site because the VOCs are present in low permeability clays and there are significant heterogeneous conditions within the vadose and shallow groundwater zones, making contaminant removal difficult. In addition, there are no remedial technologies available to remove all trapped DNAPL. There is indirect evidence of DNAPL at depths greater than 110 feet bgs in the gravel unit. Complete restoration of the TI Zone is unlikely because remedial technologies can only reduce the DNAPL mass, not eliminate it.
	Conditions: *NAPL (suspected or observed)* – DNAPL is likely present as TCE, which has been detected at concentrations almost 10 times greater than its solubility limit. *COCs* – 8 VOCs, 2 metals, nitrate, and di(2-ethylhexyl)phthalate *Concentration* – Maximum TCE concentration was 74,000 µg/L in the shallow groundwater. *Geology* – Clays, gravel *TI Zone* – The TI Zone covers 2 acres and includes the shallow groundwater zone extending to 180 feet bgs (5 feet below the Unit 4 gravel subunit). The Regional Aquifer is not included.
	Evaluation: *Remedial Timeframe Estimate (years)* – Assessment not done. *Remedial Action Alternatives* – The selected remedy includes P&T to restore groundwater outside the TI Zone and to contain contamination within the TI Zone, and ICs (groundwater use restrictions). SVE, removal, and on-site containment were selected for site soils.
	Current Status/Activities: Based on the site summary, P&T construction at this area began in early 2007.

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Del Norte Pesticide Storage *State:* CA; *OU:* 1 Decision Doc. (Type & Date): *ROD Amendment, 8/29/00* *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU1, 8/29/00, www.epa.gov/superfund/sites/rods/fulltext/a0900113.pdf; (2) Site summary, yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/17e2c218855f66ce88257007005e9406!OpenDocument	***TI Decision:*** The MCL for 1,2-DCP (5 µg/L) is being waived due to TI. This Amendment changed the cleanup goal from 10 µg/L to 5 µg/L for 1,2-DCP and then waived the newly identified cleanup goal.
	Rationale: Following source removal actions in 1987 and P&T operation from 1990 to 1994, 1,2-DCP concentrations decreased (from 2,000 µg/L) to asymptotic levels (15-40 µg/L). The P&T system has been shut off since 1997 and concentrations continue to decline very slowly (at the same rate as when the system was operating prior to shut down). Air sparging was added in 1994 but no discernable changes to concentrations were observed. It was determined that the cleanup levels of 1,2-DCP cannot be reached through engineering means or natural attenuation. It is not known if the source of the 1,2-DCP is a NAPL or not.
	Conditions: *NAPL (suspected or observed)* – NAPL - residual 1,2-DCP is acting as a NAPL. *COCs* – 1,2-DCP *Concentration* – 1,2-DCP concentrations decreased from approximately 2,000 to 600 µg/L following the source removal action. *Geology* – Low permeability soils, sea terrace, fluctuating water table. *TI Zone* – Area of TI Zone applies to the current areal and vertical extent of the contaminant plume with concentrations above 5 µg/L (approx. 5,000 square feet) and to the depth of the uppermost aquifer (30 feet bgs).
	Evaluation: *Remedial Timeframe Estimate (years)* – Assessment not done. *Remedial Action Alternatives* – Evaluated removal, P&T, and air sparging.
	Current Status/Activities: Based on the site summary, P&T is shutdown. The site was deleted from the NPL in 2002. EPA continues to conduct five year reviews using results of semi-annual and annual groundwater monitoring. Data indicate that concentrations are slowly approaching the 5 µg/L level.

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(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: J.H. Baxter & Co. *State:* CA; *OU:* 1 Decision Doc. (Type & Date): ROD Amendment, 3/27/98 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU1, 3/27/98, www.epa.gov/superfund/sites/rods/fulltext/a0998033.pdf; (2) Final Focused FS and Evaluation of TI, May 1997; (3) Five-year review, 2005, www.epa.gov/superfund/sites/fiveyear/f05-09017.pdf ; (4) Five-year review, 9/30/10, www.epa.gov/superfund/sites/fiveyear/f2010090003624.pdf	***TI Decision:*** Cleanup standards that are being waived include (in µg/L): arsenic–5; chromium–8; copper–11; zinc–90; benzene–1; pentachlorophenol–1; tetrachlorophenol–1,100; carcinogenic PAHs–5; non-carcinogenic PAHs–5; and dioxins–0.000025.
	Rationale: A number of alternatives were evaluated; however, even if only 5 percent of the DNAPL-contaminated soil remains after complete excavation or *in situ* treatments, achievement of cleanup goals for non-chlorinated PAHs would take at least 3,000 and 400 years, respectively (and achievement of cleanup goals for chlorinated PAHs would take even longer). The lower aquifer is not currently impacted by DNAPL and it is likely that the aquitard separating the two aquifers will continue to protect the lower aquifer. No groundwater remediation will be conducted for the DNAPL zone, because although it is technically feasible to address the non-PAH contaminants in the upper aquifer, the PAHs remaining in the aquifer would still result in an unacceptable risk.
	Conditions: *NAPL (suspected or observed)* – Free-phase and residual DNAPL have been observed. *COCs* – 4 metals; benzene; 2 organic pesticides; carcinogenic PAHs; non-carcinogenic PAHs; dioxins *Concentration* – Maximum concentrations prior to the ROD (1990) in ppb: arsenic–1,740; chromium–122; copper–37,100; zinc–23,000; pentachlorophenol–210; carcinogenic PAHs–6,000; non-carcinogenic PAHs–251,800; benzene–170; dioxins–13. *Geology* – Two aquifers separated by an aquitard. *TI Zone* – TI Zone includes the area interpreted to contain DNAPLs with a vertical extent from the water table of the upper aquifer down to the aquitard. The lower aquifer is not included.
	Evaluation: *Remedial Timeframe Estimate (years)* – At least 3,000 years *Remedial Action Alternatives* – The amended remedy includes a slurry wall for groundwater containment (along with pumping inside the wall to create an inward gradient), source containment and treatment, and ICs. Groundwater contamination outside of the DNAPL zone will be addressed by P&T.
	Current Status/Activities: According to the 2010 5-year review, the slurry wall and associated extraction system were installed in 1999 and continue to function. ICs (restrictive covenants) have been filed with the country recorder to limit site access, restrict land and groundwater use, provide notices, and prohibit activities that could cause potential threat to human health or the environment.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Del Amo *State:* CA; *OU:* 3 Decision Doc. (Type & Date): *ROD, 3/30/99* *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU3, 3/30/99, www.epa.gov/superfund/sites/rods/fulltext/r0999035.pdf; (2) Five-year review, 2005, www.epa.gov/superfund/sites/rods/fulltext/r0999035.pdf	***TI Decision:*** *In situ* groundwater standards, the lower of either Federal or state MCLs, are being waived for all contaminants within the TI Zone; primary COCs in this area include TCE (5 ppb), chlorobenzene (70 ppb) and benzene (1 ppb).
	Rationale: Due to the presence of LNAPL and DNAPL, it would be technically impracticable to restore groundwater at the source because there are no remedial technologies that can remove all of the contamination. These areas will be contained by pumping, injection, and MNA, and ICs will prevent exposure. DNAPL is present at depths potentially exceeding 130 feet bgs and occurs in discontinuous thin layers that reside atop the heterogeneously distributed fine-grained sediments. The majority of DNAPL is below the water table. LNAPL is smeared in the aquifer due to the rise and fall of the water table. The dissolved contamination in the TI Zones is not being restored but will only be contained because (1) NAPL removal is not technically practicable, (2) restoration could never be complete due to the continuing migration of benzene from the LNAPL, (3) extraction wells in the fine-grained units would have extremely small radii of influence, and (4) extraction may cause adverse migration of contaminants.
	Conditions: *NAPL (suspected or observed)* – DNAPL and LNAPL are present. *COCs* – all contaminants within the TI zone, mainly TCE, chlorobenzene, and benzene *Concentration* – Maximum concentrations: benzene exceeded 100,000 µg/L; TCE at 9,400 µg/L, and chlorobenzene up to 38,000 µg/L. *Geology* – Heterogeneously distributed fine-grained sediments. *TI Zone* – TI Zones were determined based on contaminant plumes. The chlorobenzene (DNAPL) plume vertically includes the Bellflower Aquitard and Gage Aquifer and horizontally, the zone is larger than the plume to allow for a buffer between the plume and extraction well. The TCE and benzene plumes (LNAPL) are commingled in the UBF and MBFB units and are vertically delineated by the current benzene plume (greater than 1 ppb). The TI Zone for benzene and TCE in the MBFC sand unit is based on the benzene plume in the unit above (the MBFB sand) because there is little separation between the two layers.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – According to the ROD, NAPL areas will be contained by pumping, injection, and MNA, and ICs will prevent exposure. The areas of dissolved contamination outside the TI Zones will be restored by P&T.
	Current Status/Activities: The 2005 5-year review was for OU2 (not groundwater) and it is unclear if groundwater ICs have been implemented. This TI waiver applies at two sites (Del Amo and Montrose Chemical).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Koppers Co. Inc. (Oroville Plant) *State:* CA; *OU:* 1 Decision Doc. (Type & Date): *ROD Amendment, 9/23/99* *Stage:* Post-construction *Media:* Groundwater *References:* (1) ROD Amendment, OU1, 9/23/99, www.epa.gov/superfund/sites/rods/fulltext/a0999094.pdf; (2) Site summary, www.yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/028690d5578028d888257007005e941d!OpenDocument	***TI Decision:*** Remedial standards for dioxin (5.3×10^{-7} ppb) and total cPAHs (0.007 ppb) and the federal MCL for PCP (1 ppb) are being waived in the TI Zone.
	Rationale: The nature and extent of DNAPL at the site has become better defined than at the time of the RI, and technical issues regarding DNAPL are better understood than during the FS and original ROD (1989). The ROD Amendment changes the goal for groundwater from within the 4-acre TI Zone from restoration to containment. A TI waiver is justified based on the following: (1) surface and near surface soil contamination have been remediated and the DNAPL has been contained; (2) it is not technically feasible to meet the cleanup standards within the TI Zone; (3) deed restrictions can provide adequate protection; (4) contaminants will be monitored inside the TI zone; and (5) operation of P&T will be resumed as a contingent remedy if contaminants migrate outside the TI Zone. Groundwater is approximately 30 feet bgs with an estimated volume of 67 million gallons in the TI Zone. The DNAPL likely resides on three clay layers separating the different aquifers, and based on RI data, more than 1 million gallons of free creosote may be present at these layers.
	Conditions: *NAPL (suspected or observed)* – DNAPL is not expected to still be in the mobile phase but rather as residual contamination on each of the 3 clay layers. *COCs* – Dioxin, total cPAHs, PCP *Concentration* – In 1998, total cPAH concentrations ranged from ND to 6,980 ppb in the TI zone. *Geology* – Clay layers separate each of the aquifers. *TI Zone* – TI Zone covers 4 acres of 200-acre site and includes all aquifers.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – The amended remedy includes continued operation of the existing P&T system to restore groundwater outside the TI Zone, coupled with enhanced *in situ* bioremediation to address PCP. MNA is designated as a contingent remedy outside the TI Zone. Source removal activities were conducted followed by on-site consolidation/landfilling.
	Current Status/Activities: The site summary indicates ICs (land and groundwater use restrictions) have been implemented, and on-site P&T and monitoring (on-site and off-site) continue.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Montrose Chemical Corp. *State:* CA; *OU:* 3 Decision Doc. (Type & Date): *ROD, 3/30/99* *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OU3, 3/30/99, www.epa.gov/superfund/sites/rods/fulltext/r0999035.pdf; (2) Five-year review, 2005	***TI Decision:*** *In situ* groundwater standards, the lower of either Federal or state MCLs, are being waived for all contaminants within the TI Zone, mainly TCE (5 ppb), chlorobenzene (70 ppb) and benzene (1 ppb).
	Rationale: Due to the presence of LNAPL and DNAPL, it was determined that it would be technically impracticable to restore groundwater at the source zones because at the time the ROD was written there were no remedial technologies that could remove all of the contamination. These areas will be contained by pumping and MNA, and ICs will prevent exposure. DNAPL is present at depths potentially exceeding 130 feet bgs and occurs in discontinuous thin layers that reside atop the heterogeneously distributed fine-grained sediments. The majority of DNAPL is below the water table. LNAPL is smeared in the aquifer due to the rise and fall of the water table. The dissolved contamination in the TI Zones is not being restored but will only be contained because (1) NAPL removal is not technically practicable; (2) restoration could never be complete due to the continuing migration of benzene from the LNAPL; (3) extraction wells in the fine-grained units would have extremely small radii of influence; and (4) extraction may cause adverse migration of contaminants.
	Conditions: *NAPL (suspected or observed)* – DNAPL and LNAPL are present. *COCs* – TCE, chlorobenzene, and benzene *Concentration* – Maximum concentrations: benzene exceeded 100,000 µg/L; TCE at 9,400 µg/L, and chlorobenzene up to 38,000 µg/L. *Geology* – Heterogeneously distributed fine-grained sediments. *TI Zone* – TI Zones were determined based on contaminant plumes. The chlorobenzene (DNAPL) plume vertically includes the Bellflower Aquitard and Gage Aquifer and horizontally, the zone is larger than the plume to allow for a buffer between the plume and extraction well. The TCE and benzene plumes (LNAPL) are commingled in the UBF and MBFB units and are vertically delineated by the current benzene plume (greater than 1 ppb). The TI Zone for benzene and TCE in the MBFC sand unit is based on the benzene plume in the unit above (the MBFB sand) because there is little separation between the two layers.
	Evaluation: *Remedial Timeframe Estimate (years)* – Indefinite *Remedial Action Alternatives* – NAPL areas will be contained by pumping and MNA, and ICs will prevent exposure. The areas of dissolved contamination outside the TI zones will be restored by P&T.
	Current Status/Activities: 2005 5-year review was for OU2 (not groundwater) and it is unclear if groundwater ICs have been implemented yet. This TI waiver applies at two sites (Del Amo and Montrose Chemical).

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Edwards Air Force Base *State:* CA; *OUs:* 4 & 9 (Sites 37, 120, 133, and 321) *Decision Doc. (Type & Date):* ROD, 9/24/07 *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD, OUs 4 & 9, 9/24/07, www.yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/cadf7f8d48234c98882574260073d787/23b33b4a7b9ed4828825740a00621d8b!OpenDocument; (2) Site summary, www.yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/130468772dfd94ff88257007005e9413!OpenDocument	***TI Decision:*** ARARs are being waived for contaminants that have primary MCLs, see Table 2.5-1 of ROD. The TI waiver applies only to COCs with a chemical-specific ARAR (primary MCL).
	Rationale: A TI waiver is being invoked due to the technical impracticability, from an engineering perspective, of achieving groundwater restoration and removing DNAPL solvents that are suspected in crystalline, fractured granitic bedrock impacted by dissolved-phase VOCs and other chemicals. Remediation of groundwater is limited at this site due to the following factors: (1) groundwater occurs in a complex system of isolated and heterogeneous fractures within the crystalline granitic bedrock. As a result, aquifer permeability is very low, hindering both groundwater extraction for above ground treatment and the delivery of materials for *in situ* treatment; (2) chlorinated solvents such as PCE and TCE are recalcitrant contaminants when present as DNAPL and have proven difficult (if not impossible) to remove or remediate on a large scale. PCE and TCE are likely present as DNAPL at Site 37 and 133 based on groundwater sampling coupled with known historical contaminant releases; and (3) groundwater at depths in excess of 250 feet bgs (Site 37) and 350 feet bgs (Site 133) is impacted based on analysis of samples from deep wells. Extraction of groundwater for treatment, or distribution of injected materials (e.g. chemicals and/or bacteria) for *in situ* treatment becomes increasingly difficult at greater depths because the fractures become smaller, tighter, and less frequent, further reducing the permeability of the water-bearing intervals. Moreover, installation of deep monitoring wells is challenging and expensive, especially if care is taken not to carry contamination further downward.
	Conditions: *NAPL (suspected or observed)* – DNAPL is suspected in the fractured bedrock *COCs* – 9 chlorinated VOCs, benzene, naphthalene, trichlorofluoroethane (CFC 113), methylene chloride, MTBE, nitrate *Concentration* – Maximum concentrations are provided in Table 2.5-1 of ROD. *Geology* – The crystalline granitic bedrock is overlain in some areas by a thin veneer of unconsolidated material. Multiple aquifers are present. *TI Zone* – TI zone covers 16.4 square miles and corresponds to township, range, and section boundaries as convenient. The zone extends to a depth of 500 ft bgs, which is 175 ft below the maximum depth of contamination.
	Evaluation: *Remedial Timeframe Estimate (years)* **–** Combined PCE and TCE plumes would advance for 300 years before the western lobe would reach equilibrium and 800 years until the eastern lobe would. Estimates for P&T range from 210 to 1,200 years assuming that the entire DNAPL source could be removed (See table 2.5-5 of ROD for additional information). *Remedial Action Alternatives* **–** The selected remedy includes institutional controls restricting groundwater use and long-term groundwater monitoring with a contingency (if contaminants are found to be migrating), along with no action for soil, and institutional and engineering controls for soil vapor. Additional groundwater remedies evaluated in the ROD included P&T for containment and blast fracturing.
	Current Status/Activities: Long-term groundwater monitoring required by the ROD continues to be used for documenting the slowly migrating plumes and the related compliance boundary for vapor intrusion pathway land use controls (VIP LUCs). Occasional vapor sampling in or near buildings is conducted per the VIP LUC requirements. The first 5-year review report is due in September 2012.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
	Region 10: 1 site (2 waivers)
Site Name: Eielson Air Force Base *State:* AK; *OU:* 2 Decision Doc. (Type & Date): *ROD Amendment, 9/28/98* *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD Amendment, OUs 2, 3, 4, 5; 9/28/98, www.epa.gov/superfund/sites/rods/fulltext/a1098185.pdf; (2) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f03-10002.pdf	***TI Decision:*** EPA's established action level for lead in drinking water (15 µg/L) is being waived.
	Rationale: P&T was selected in 1994 to address lead contamination. However, subsequent evaluation has concluded that lead is largely immobile in the subsurface, that the plume is stable and not expanding, and that removal of lead contamination is technically infeasible. Any remaining source of more mobile organic lead will be degraded to the immobile inorganic lead through treatment and removal of petroleum products.
	Conditions: *NAPL (suspected or observed)* – NAPL has been detected as free product in some areas of this OU. *COCs* – Lead *Concentration* – Concentration range for lead at OU2 was 1.3 to 795 µg/L. *Geology* – Glacial outwash plain/thick deposits of mostly high-energy fluvial deposits (sand and gravel with thin discontinuous lenses of silt). *TI Zone* – TI Zone includes a portion of the site and extends from the water table to 30 feet bgs; however the lateral extent of the TI zone is undefined in the references reviewed.
	Evaluation: *Remedial Timeframe Estimate (years)* – Air Force estimated over 100 years if a standard P&T system was to be used. EPA believes this is an optimistic estimate because the immobile form of lead is described as unlikely to be leached from the formation and transported to production wells by a conventional P&T system within a reasonable timeframe. *Remedial Action Alternatives* – The 1998 ROD Amendment selected monitoring and ICs (use restrictions) for groundwater. Bioventing and SVE have been conducted for site soils and passive skimming has removed floating fuel.
	Current Status/Activities: Based on the 2003 5-year review, ICs have been implemented at OU2.

Summary of Technical Impracticability Waivers at Superfund Sites
(91 waivers at 85 sites through FY 2011, as of April 2012)

General Site Information	TI-Relevant Information
Site Name: Eielson Air Force Base, ST58 *State:* AK; *OU:* 4 Decision Doc. (Type & Date): *ROD Amendment, 9/28/98* *Stage:* Pre-construction *Media:* Groundwater *References:* (1) ROD Amendment, OUs 2, 3, 4, 5; 9/28/98, www.epa.gov/superfund/sites/rods/fulltext/a1098186.pdf; (2) Five-year review, 2003, www.epa.gov/superfund/sites/fiveyear/f03-10002.pdf	***TI Decision:*** EPA's established action level for lead in drinking water (15 µg/L) is being waived.
	Rationale: The original remedy was monitoring and ICs for groundwater (and bioventing for soils and fuels). Subsequent investigations have shown that bioventing is no longer necessary because contamination has been reduced in soils as a result of removal actions. In addition, it has been determined that (1) the organic lead originally contained in the fuel has degraded to an immobile, stable inorganic lead; (2) any remaining organic fuel will be converted to its immobile phase; and (3) lead is also not migrating. Modeling estimated restoration in about 100 years.
	Conditions: *NAPL (suspected or observed)* – No floating product has been observed at ST58. *COCs* – Lead *Concentration* – Concentration range for lead at ST58 was 35 to 180 µg/L. *Geology* – Glacial outwash plain/thick deposits of mostly high-energy fluvial deposits (sand and gravel with thin discontinuous lenses of silt). *TI Zone* – TI Zone includes a portion of the site and extends from water table to 30 feet bgs; however the lateral extent of the TI zone is undefined in the references reviewed.
	Evaluation: ***Remedial*** *Timeframe Estimate (years)* – 100 years *Remedial Action Alternatives* – The Air Force considered a standard P&T system and excavation of the soil/aquifer matrix, which serves as the source area for slow leaching of lead into groundwater. Both are described as technically impracticable.
	Current Status/Activities: Based on the 2003 5-year review, ICs (groundwater use restrictions) have been implemented at ST58.

APPENDIX B:

List of Acronyms

ACL – Alternative concentration limit
ARAR – Applicable or relevant and appropriate requirements
AWQS – Ambient water quality standard
BAT – Best available technology
bgs – Below ground surface
BEHP – Bis(2-ethylhexyl)phthalate
BTEX – Benzene, toluene, ethylbenzene, xylenes
CFC – Chlorofluorocarbon
COC – Contaminant of concern
COPC – Contaminant of potential concern
CROW – Contained recovery of oil waste
DCA – Dichloroethane
DCB – Dichlorobenzene
DCE – Dichloroethene
DCP – Dichloropropane
DNAPL – Dense non-aqueous phase liquid
EPA – Environmental Protection Agency
ES – Entomology Shop
ESD – Explanation of Significant Differences
FEMWATER – Finite Element Model for Groundwater
FS – Feasibility study
ft – Foot/feet
gpm – Gallon per minute
GWQS – Groundwater quality standard
IAC – Indiana Administrative Code
IC – Institutional control
ICS – Illinois Central Spring
JEBS – Jet Engine Build-Up Shop
LNAPL – Light non-aqueous phase liquid
LTRA – Long-term response action
MBFB – Middle Bellflower “B” Sand
MBFC – Middle Bellflower “C” Sand
MCL – Maximum contaminant level
MCLG – Maximum contaminant level goal
MEG – Maximum exposure guideline
mg/kg – Milligram per kilogram
mg/L – Milligram per liter
mgd – Million gallons per day
MNA – Monitored natural attenuation
MTBE – Methyl tertiary butyl ether
NAPL – Non-aqueous phase liquid
ND – Not detected
ng/L – Nanogram per liter
NHBB – New Hampshire Ball Bearings, Inc.
NJDEP – New Jersey Department of Environmental Protection
NPDES – National Pollutant Discharge Elimination System
NPL – National Priorities List
OU – Operable unit
P&T – Pump and treat
PADEP – Pennsylvania Department of Environmental Protection
PAH – Polyaromatic hydrocarbon
PCA – Tetrachloroethane
PCB – Polychlorinated biphenyl
PCE – Tetrachloroethene
PCP – Pentachlorophenol
ppb – Part per billion
ppm – Part per million
PQL – Practical quantitation limit
PRB – Permeable reactive barrier
PRG – Preliminary remedial goal
RI – Remedial Investigation
ROD – Record of Decision
SDWA – Safe Drinking Water Act
SVE – Soil vapor extraction
SVOC – Semivolatile organic compound
TCA – Trichloroethane
TCB – Trichlorobenzene
TCDD – Tetrachlorodibenzodioxin
TCE – Trichloroethene
TDS – Total dissolved solids
TI – Technical Impracticability
TP – Trichlorophenol
TWA – Transformer work area
UBF – Upper Bellflower
µg/L – Microgram per liter
USGS – U.S. Geological Survey
UXO – Unexploded ordnance
VEB – Vertical engineered barrier
VER – Vacuum enhanced recovery
VI – Vapor intrusion
VOC – Volatile organic compound