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Recommendations from the EPA Ground Water Task Force

A Report by the Ground Water Task Force

December 2007

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

DEC 21 2007

MEMORANDUM

SUBJECT: Recommendations from the EPA Ground Water Task Force

FROM: Susan Parker Bodine,
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TO: OSWER Office and Staff Directors
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The attached report, "Recommendations from the EPA Ground Water Task Force," is a result of a three-year effort, which was established under OSWER's One Cleanup Program. This group was asked to identify and prioritize ground water issues that will benefit multiple cleanup and protection programs, and to recommend potential activities for EPA to consider in its planning. The Task Force was staffed by senior representatives from EPA program offices that have a role in cleaning up or protecting ground water resources and included OSWER programs, OW, OECA, OAR, and OPPTS. Other participants included the EPA Ground Water Forum, ORD, lead RCRA and Superfund regions, and the states of Georgia, Nebraska, and New York. I would like to thank the Task Force members for preparing this thoughtful report as well as your offices for the support that you have provided to the Task Force.

OSWER is currently working on the following projects in response to recommendations included in this report: an update to the 1993 guidance on technical impracticability; new guidance on data needs and procedures for tracing dense non-aqueous phase liquid (DNAPL) source zone cleanup efforts; a DNAPL web-based resource center; and approaches for drinking water and cleanup program collaboration at Source Water Areas delineated by the states. OSWER will consider additional recommendations and ideas in this report when designing future projects to promote both ground water protection and ground water cleanup.

Questions concerning aspects of this report pertaining to DNAPLs should be directed to either Matthew Charsky (charsky.matthew@epa.gov) or Linda Fiedler (fiedler.linda@epa.gov) of OSWER's Superfund program, and questions concerning aspects of the report pertaining to ground water use, value and vulnerability should be directed to Guy Tomassoni (tomassoni.guy@epa.gov) of OSWER's Center for Program Analysis.

Attachment

A Special Acknowledgement

A special thanks and recognition goes to Kenneth Lovelace who served as the Chair of the Ground Water Task Force that produced this report. Ken was an expert and advocate of ground water protection and remediation, and friend to many who miss him.

Acknowledgments

This report would not have been possible without the contribution of the many individuals listed below who participated in EPA's Ground Water Task Force. The Task Force was organized by the Office of Solid Waste and Emergency Response, and chaired by Kenneth Lovelace formerly of EPA's Office of Superfund Remediation and Technology Innovation. These names and affiliations of individual Task Force members listed below were accurate at the time the Task Force was convening, and may not reflect their current positions.

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Disclaimer

This report is a work product of the Ground Water Task Force. The report is intended to provide information to EPA management, program staff, and other stakeholders for their consideration and to inform and encourage discussion on the topic. The statements in this document do not constitute official Agency policy, do not represent an Agency-wide position, and are not binding on EPA or any other party.

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Table of Contents

Acronyms and Abbreviations 1

Executive Summary 3

DNAPL Source Zone 3

Ground Water Use, Value, and Vulnerability (UVV) 4

Introduction 7

Purpose of Ground Water Task Force 7

Methodology for Developing Recommendations 9

Stakeholder Input on DNAPL Paper and Options 11

Comments on Options Presented in DNAPL Paper 11

Option 1: Develop a fact sheet describing the potential benefits of DNAPL mass removal from the source zone, as well as the potential disadvantages. 11

Option 2: Develop a fact sheet describing program flexibilities and alternative cleanup goals that may be applied to the DNAPL source zone other than attainment of Maximum Contaminant Levels (MCLs). 11

Program flexibilities (e.g., technical impracticability decisions, containment zones, or similar alternatives) would be those allowed under federal or state cleanup programs.

The alternative goals would typically apply only to the DNAPL source zone rather than the entire plume, in accordance with existing policy.

Option 3: Develop a supplemental EPA guidance on technical impracticability (TI) that clarifies some or all of the following questions for Superfund and other EPA cleanup programs:(see page 11 for questions) 11

Option 4: Develop a policy memorandum re-emphasizing the existing EPA policy that program flexibilities are to be used for DNAPL source zones as a means of setting cleanup goals that are achievable in a reasonable time frame. 12

Such program flexibilities may include TI determinations, containment zones, ground water classification exemptions, or similar flexibilities that are available at a particular site from either the federal or state cleanup program overseeing the cleanup at that site.

The memorandum would reiterate EPA's current policy that cleanup goals for DNAPL source zones should not include restoration of ground water to drinking water standards, if this goal cannot be achieved in a "reasonable time frame" based on site conditions.

Option 5: Develop guidance on recommended methods and approaches for delineating the extent of the DNAPL source zone. 12

Option 6: Develop guidance providing a qualitative approach for determining when source depletion technologies should or should not be implemented. 13

Option 7: Develop guidance on performance measures for the effectiveness of DNAPL mass removal, and on how to determine when active DNAPL removal efforts should be discontinued. ……13

Such measures could include trend analysis for mass removal rates, mass flux data, or other parameters for gauging remedy performance.

Option 8: Develop guidance describing improved methods for comparing long-term remedies. ……13

The guidance would allow a more realistic accounting of the costs and other disadvantages of long-term custodial care. This would include long-term costs of maintaining containment systems, equipment replacement, monitoring and enforcing institutional controls, and site monitoring.

Additional Options Suggested by Commenters on the DNAPL Paper ……13

General Themes in Comments on DNAPL Paper ……15

Stakeholder Input on Ground Water Use, Value, and Vulnerability as Factors in Setting Cleanup Goals Paper and Options ……17

Comments on Ground Water Use, Value, and Vulnerability Paper Options ……17

Option 1: Develop a series of educational fact sheets and Internet training seminars. ……17

Material would be, targeted primarily to government officials and members of the regulated community to raise awareness of ground water UVV; interconnection between ground water and surface water systems and health impacts from contaminants most commonly found in ground water.

This effort would include summaries of the findings from the 2004 Ground Water Report to Congress.

Option 2: Conduct research on the impacts on other developed nations that have resulted from either the presence or lack of strong ground water protection programs. ……18

Option 3: Develop summaries of how individual EPA and state cleanup programs consider ground water UVV in setting cleanup goals (e.g., ground water classification and classification exception systems, ground water management zone-type approaches). ……18

These summaries would be written with Internet links to more detailed resources. EPA would provide access to these summaries via its One Cleanup Program website. This option could also involve low-cost Internet training to raise awareness of the range of approaches being used by EPA and states.

Option 4: Takes option 3 one step further by developing an EPA policy memo that explains how EPA cleanup programs acknowledge the various approaches used by states in setting ground water cleanup goals based on ground water UVV. ……18

For example, the policy statement would clarify how state ground water management zone policy could influence goals established under EPA's cleanup programs. Internet training could also be used to increase awareness and understanding of the policy statement.

Option 5: Using information from federal and state cleanup programs, develop a general framework that describes how to prioritize sites according to problem severity and ground water UVV. ……..19

This framework would clearly describe how ground water UVV as well as specific problem magnitude (e.g., risk) can be used to prioritize sites and influence remedial decisions.

This framework would describe how a prioritization system directed at site-specific ground water problems can work within statewide general classification systems and how, for example, ground water management zone policy could influence goals established under EPA's cleanup programs.

Option 6: Use defined Source Water Assessment Program (SWAP) areas (required by the 1996 amendments to the Safe Drinking Water Act) to promote consistency in ground water cleanup decision making. ……19

The option would involve establishing a means to encourage stakeholders to become more aware of and involved with various ground water cleanups taking place within or near an individual Source Water Assessment Area.

The objective would be that cleanups could be selected to maximize efficiencies and benefits within a particular source water area.

Option 7: Promote and provide funding assistance for regular meetings within an individual state or watershed that brings together the various programs and stakeholders involved with ground water cleanup and protection. 19

One of the objectives of these meetings would be to help prioritize cleanup actions based on factors, such as magnitude and extent of ground water contamination, as well as ground water UVV.

Additional Options Suggested by Commenters on the Ground Water Use, Value, and Vulnerability Paper 19

General Themes In Comments on Ground Water UVV Paper……20

Task Force Recommendations.....23

Recommendations Concerning DNAPL Issues.....23

Recommendation 1. Develop guidance on how to acknowledge technical limitations posed by DNAPLs in EPA cleanup decisions. ……..23

This would include updated guidance on the use of technical impracticability (TI) decisions in the Superfund program.

The guidance should also discuss mechanisms for acknowledging technical limitations posed by site complexities other than DNAPLs.

Ground Water Use, Value, and Vulnerability Recommendations 26

Recommendation A. Develop a new web-based resource center for information related to the potential role of ground water UVV in cleanup decisions. ……...26

The resource center would address items such as:

- *interconnection between ground water and surface-water systems;*
- *importance of ground water to ecosystems;*
- *health impacts from contaminants most commonly found in ground water;*

- *potential for drinking water shortages and their effects on current ground water use classifications;*
- *federal protection policies, and exemplary state policies*

Recommendation B. Request that the U.S. Census Bureau update the 1990 census information on sources of drinking water, and develop tools to facilitate access to this information. 27

Recommendation C. Develop approaches for using source water areas (SWA), delineated by state drinking water programs, to promote collaboration among cleanup programs, drinking water programs, and stakeholders concerned with cleanup and protection of ground water resources. 28

Summary 29

Attachment A. Discussion Paper: Cleanup Goals Appropriate for DNAPL Source Zones A-1

Attachment B. Discussion Paper: Ground Water Use, Value, and Vulnerability as Factors in Setting Cleanup Goals B-1

Attachment C. GWTF Web Page C-1

Attachment D. Individuals and Organizations that Submitted Comments on One or Both Discussion Papers D-1

Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirements
ASTSWMO	Association of State and Territorial Solid Waste Management Officials
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	Environmental Protection Agency
GWTF	Ground Water Task Force
MCL	Maximum Contaminant Level
MOU	Memorandum of Understanding
NCP	Superfund National Oil and Hazardous Substances Pollution Contingency Plan
NGWA	National Ground Water Association
OSWER	Office of Solid Waste and Emergency Response
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
SWA	Source Water Area
TI	Technical Impracticability
UST	Underground Storage Tank
UVV	Use, Value, and Vulnerability

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Executive Summary

In recognizing the importance of ground water to the nation's drinking water supply and its critical role in maintaining the health of ecosystems, EPA established the Ground Water Task Force (GWTF) in the fall of 2002 as part of the Agency's One Cleanup Program. The mission of the task force was to identify and prioritize ground water issues that will benefit multiple cleanup programs (e.g., RCRA, Superfund, Brownfields, Underground Storage Tanks, etc.), and make recommendations to EPA senior management on the best course of action. The GWTF was staffed by senior representatives from various EPA program offices (cleanup and non-cleanup), and representatives from the Ground Water Forum, lead RCRA and Superfund regions, and some state cleanup programs.

Task force members identified two topic areas for initial evaluation and developed "discussion papers" for each area. The papers are: "Cleanup Goals Appropriate for DNAPL[1] Source Zones" and "Ground Water Use, Value, and Vulnerability as Factors in Setting Cleanup Goals" (UVV). EPA undertook an extensive outreach effort to obtain the views of the general public, environmental advocacy groups as well as state officials, tribal leaders, and industry. The papers provide a series of problem statements that reflect the views of EPA as well as various stakeholder groups who responded and proposed options (not necessarily mutually exclusive)that may be used to address the problem statements. The task force reviewed cleanup policies associated with these topic areas, but did not review overall Agency policies concerning the cleanup of contaminated ground water.

The task force placed the papers on the GWTF webpage on May 10, 2004 and solicited comments on the options. The task force also invited commenters to submit any other suggestions they might have on the two issues. To advertise the solicitation of comments, notices were placed in several newsletters, two EPA internet seminars were held to explain the papers, and direct email requests were sent to over 100 stakeholder groups. Comments were received from industry, government agencies, and environmental consultants. No comments were received from environmental advocacy groups.[2] The task force considered the comments received in light of the original options, evaluated additional suggestions, and developed the following series of recommendations for consideration by senior EPA management.

DNAPL Source Zone

The decision-making process involved in determining cleanup goals appropriate for a DNAPL source zone, and whether remediation efforts should be undertaken to remove or treat the DNAPL source zone was a common theme in the comments received. Most task force members agreed that the current Superfund guidance on technical impracticability (TI) should be

[1] A nonaqueous phase liquid (NAPL) is a chemical compound that is a liquid in its pure form, does not readily mix with water, but does slowly dissolve in water. A dense nonaqueous phase liquid (DNAPL) sinks in water, while a light nonaqueous phase liquid (LNAPL) floats on water. When released to the environment, DNAPLs and LNAPLs are sources of contamination to ground water.

[2] These papers are included in this report as Attachments A and B. Comments can be viewed from the Ground Water Task Force website at: http://gwtf.clu-in.org/papers/.

updated. Also, there was support for identifying mechanisms for acknowledging complex site conditions that would be useful in the decision-making process for cleanup programs other than Superfund.

> *Recommendation.* Develop guidance on how to acknowledge technical limitations posed by DNAPLs in EPA cleanup decisions, including updated guidance on the use of technical impracticability (TI) decisions in the Superfund program. The guidance should also discuss mechanisms for acknowledging technical limitations posed by site complexities other than DNAPLs.

While not a universal opinion, there was common concern that several of the options could not be implemented because of a lack of scientific consensus, and industry commenters in particular made the point that the benefits of source reduction had not been conclusively demonstrated. The task force agreed that there is a need to better assess and document results achieved by DNAPL source reduction efforts.

> *Recommendation.* Develop recommended data needs and procedures for documenting and tracking DNAPL source zone cleanup efforts so that technology performance can be adequately assessed. Procedures are needed to better assess field research and testing (conducted by EPA and others) to develop promising technologies for remediation and characterization of DNAPL source zones.

Several of the options involved educational and informational activities, and analysis of the comments showed a need for better access to the research, guidance, and policy documents that are currently available on DNAPL issues. Such access could be provided through a website and would be a useful source of information for EPA and state site managers, cleanup contractors, community groups, and other stakeholders. There is no current EPA website specific to DNAPLs that serves this purpose.

> *Recommendation.* Develop a web-based resource center for information related to cleanup and characterization of sites with DNAPLs, including links to existing policy, guidance, technology descriptions, and case studies.

The GWTF believes that implementation of these recommendations will greatly aid practitioners in making decisions on the cleanup of DNAPL source zones. Updated guidance on ways to acknowledge complex site conditions in cleanup decisions (e.g., TI decisions in Superfund) combined with an EPA website that provides current information on remediation technologies and EPA guidance related to DNAPLs will provide tools to help meet near-term needs of cleanup programs. In addition, continuing to support technology demonstrations, while providing a mechanism for properly evaluating field application of DNAPL source cleanups, will develop the scientific basis for evaluating the likely benefits of source cleanups, and provide the basis for future Agency guidance.

Ground Water Use, Value, and Vulnerability (UVV)

One key factor in determining human health risk from contaminated ground water is whether an aquifer is currently used as a drinking water supply, or is expected to be used in the future as a source of drinking water. Also, the economic and/or ecological value of an aquifer, or the relative vulnerability of an aquifer to contamination may be considered in setting cleanup goals. Consideration of ground water use, value, and vulnerability may be helpful in other

remedy decisions, such as desired cleanup time frame or priority of cleanup compared to other sites.

Most of the options presented in the UVV paper contain an element of information transfer and education, and several of the comments received emphasized the importance of education in understanding the importance of the use, value, and vulnerability of surface and ground waters in making cleanup decisions. The GWTF concluded that information on ground water UVV and its potential role in cleanup decisions should be more readily available to government officials (particularly cleanup managers) and interested members of the public. Furthermore, an information and education effort could help address many of the issues identified in the GWTF option paper (e.g., educate interested stakeholders about the many state approaches used to account for ground water UVV in site-specific cleanup decisions). Educational tools would address the importance of protecting ground waters that currently support ecosystems, and ground waters that may be needed as a future source of drinking water whether they are currently considered suitable for drinking water or not.

> *Recommendation.* Develop a new web-based resource center for information related to the potential role of ground water UVV in cleanup decisions. The resource center would address items, such as the interconnection between ground water and surface-water systems; health impacts from contaminants most commonly found in ground water; federal protection policies, and exemplary state policies.

Most states, through the source water assessment program, have identified aquifers that supply public drinking water wells; however, information on private drinking water wells in a given area is sometimes inaccurate, difficult to obtain, or unavailable. In the 1990 Census, the U.S. Census Bureau collected information on the source of drinking water to a household—private well or public supply. This question was included in the "long form" of the 1990 Census, but was omitted from the long form in the 2000 Census.[3] The task force agreed that the information collected by the Census Bureau in 1990 was a valuable source of information on sources of drinking water, because location-specific information was collected for all 50 states, and this is the only national data base with information concerning private wells. The task force agreed that easily accessible information on drinking water sources would be very helpful to EPA programs involved with protection and cleanup of ground water. It would be most helpful if the Census Bureau would reinstate the question on source of drinking water.

> *Recommendation.* Request that the U.S. Census Bureau update the 1990 census information on sources of drinking water, and develop tools to facilitate access to this information.

Option 6 in the UVV paper involved source water areas (SWAs) delineated by state drinking water programs. Ground water source areas are portions of an aquifer that supply drinking water to public wells.[4] This option suggested that mechanisms to facilitate collaboration

[3] For the 2010 Census, the long form is being replaced by the ongoing American Community Survey (ACS), which also does not have questions concerning source of drinking water.

[4] Delineation of the source water is typically based on estimated travel time for water in the aquifer to reach the public supply well (e.g., 10 years). A more simplified approach used by some states is to delineate the source based on a radial distance from the well. See http://cfpub.epa.gov/safewater/sourcewater/ for more information about source water, source water assessments, and source water protection.

among ground water cleanup and protection programs within specific (i.e., "pilot") source water areas should be explored. This option was well received by both the regulated community and government commenters. It would promote consistency in ground water cleanup decision making and encourage stakeholders to become more aware of and involved with various ground water cleanups taking place within or near an individual Source Water Assessment Area. A further objective would be to maximize efficiencies and benefits within a particular source area.

> *Recommendation.* Develop approaches for using source water areas (SWA) delineated by state drinking water programs to promote collaboration among cleanup programs, drinking water programs, and stakeholders concerned with cleanup and protection of ground water resources.

By implementing these recommendations on ground water use, value, and vulnerability, the GWTF believes the Agency will attain more consistency within its ground water cleanup programs and promote a better understanding among all stakeholders of the role that evaluation of aquifer use, value, and vulnerability plays in making cleanup decisions. The recommendations reflect the fact that other than educational efforts, which are represented in the recommendations, there was little consensus among stakeholders on how these issues should be approached. The regulated community for the most part advocated a risk-based present use approach, while the government commenters preferred to evaluate an aquifer for its present and future uses as well as how it fits into the overall ecosystem.

Introduction

The Ground Water Task Force (GWTF) was established in the fall of 2002 as part of the Environmental Protection Agency's (EPA) One Cleanup Program. The One Cleanup Program is a long term effort designed to improve the planning and quality of EPA cleanup programs dealing with brownfields, federal facilities, leaking underground storage tanks, Resource Conservation and Recovery Act (RCRA) Corrective Action and Superfund. The Office of Solid Waste and Emergency Response (OSWER) established the One Cleanup Program in 2002 in response to issues raised by the regulated community, other governmental agencies, and citizens impacted by contaminated properties. The One Cleanup Program's goal is to improve the coordination, speed, and effectiveness of cleanups at the nation's contaminated sites without new legislation or program restructuring. It represents EPA's vision for how different cleanup programs at all levels of government can work together to meet this goal—and ensure that resources, activities, and results are effectively coordinated and communicated to the public. More information concerning the One Cleanup Program can be obtained from the Agency's website (http://www.epa.gov/oswer/onecleanupprogram/).

The One Cleanup Program encourages coordination among EPA programs and state, tribal, local, and other federal agency programs and stakeholders that lead to:

- More consistent and effective cleanups among cleanup programs
- Clearer and more useful information about cleanups
- Better cross-program performance measures

The results of the One Cleanup Program are evaluated on a regular basis and considered in annual planning processes.

Purpose of Ground Water Task Force

The GWTF served as the main technical, policy, communication, and networking resource for OSWER on ground water issues. As such, it promoted cross-program (state and federal) coordination and communication on technical and policy issues related to the cleanup of contaminated ground water. The GWTF sought to identify, prioritize, and solve and/or provide guidance on ground water issues and projects that will benefit multiple cleanup programs. It was staffed by senior representatives from various EPA program offices (both cleanup and non-cleanup), and representatives from the Ground Water Forum, lead RCRA and Superfund regions, and the states.

Ground water is an essential national resource—over half of the U.S. population relies on it for drinking water.[5] Unfortunately many of the nation's contaminated sites impact ground water, and ground water contamination is usually very difficult to characterize and clean up, often requiring decades of treatment and monitoring. Consequently, almost every cleanup program devotes a significant level of attention and resources to ground water issues.

[5] "Safe Drinking Water Act, Section 1429 Ground Water Report to Congress," October 1999, Office of Water Publication EPA-816-R-99-016.

While each ground water contamination problem is uniquely complex, there are many common issues related to the management and cleanup of these problems. Thus, it is important that the nation's cleanup programs share their knowledge and work together to ensure consistent, effective, efficient, and protective ground water cleanups. The GWTF created a website (http://gwtf.cluin.org) to aid in outreach efforts. The website contains a ground water resource center that has hyperlinks to various Agency policy and guidance documents, ground water characterization and monitoring guidance and modeling documents from across government agencies, treatment technology descriptions and guidance, and hyperlinks to information on dense non-aqueous phase liquids (DNAPLs). Also on the website are examples of various ground water cleanup approaches and "success stories" from the RCRA and Superfund programs.

GWTF members identified two high priority areas to focus on and have developed a "discussion paper" for each of them: "Cleanup Goals Appropriate for DNAPL Source Zones" and "Ground Water Use, Value and Vulnerability as Factors in Setting Cleanup Goals" (Attachments A and B). Both discussion papers were written to improve the processes for setting cleanup goals at ground water contamination sites.

These papers outline the background of the issues involved in DNAPL cleanup decisions and in assessing ground water use, value, and vulnerability to aid in making cleanup decisions. They lay out a series of problem statements that were designed to reflect the views of various stakeholders (e.g., state and federal project managers, the public, industry, and environmental advocacy groups). They also contain a series of potential options (not necessarily mutually exclusive options)that EPA could undertake to address some or all of the issues raised in the problem statements.

Methodology for Developing Recommendations

Two GWTF subgroups developed the papers, which were reviewed and revised before being sent to OSWER office directors, and regional division directors, for any major comments. After these comments were addressed, the papers were posted on the GWTF website on May 10, 2004. The website announcement invited public comments on the options and invited the submission of additional problem statements as well as other options for the GWTF to use to refine the recommendation choices.

The specific means by which the GWTF solicited comments on the papers included the following:

- *RCRA Corrective Action National Meeting, May 11, 2004.* Presentations on the options papers were given during a two-hour session that was held at the end of the RCRA Corrective Action National Meeting. The session was well attended (100+) by a broad range of interest group representatives.

- *Ground Water News and Views.* A short article on the GWTF and the options papers was written for the National Ground Water Association's (NGWA) June issue of Ground Water News and Views (Lovelace, K. EPA Task Force Seeks Comment from NGWA, Ground Water News and Views, Volume 1, Issue 1, June 2004). This on-line publication reaches ground water professionals from industry, government, and consulting. The NGWA also sent a direct request for comment to its members.

- *TechDirect Newsletter.* A one-paragraph description of GWTF activities and the options papers was placed in EPA's TechDirect email newsletter (June 2004, message 88), which at that time had over 20,000 subscribers.

- *Internet Seminar.* Two Internet seminars were held June 8 and June 23, 2004 to discuss the GWTF and the options papers. The seminars were announced in TechDirect (see above) and attracted over 100 attendees each.

- *Direct Email Notices.* Direct email notices requesting review of the options papers were sent to EPA Superfund regional branch chiefs, EPA Ground Water Forum, EPA Engineering Forum, EPA Federal Facilities Forum, and EPA Office Directors for programs represented on the GWTF. The Association of State and Territorial Solid Waste Management Officials (ASTSWMO) forwarded their email notice to their state remediation managers for RCRA, Superfund, Federal Facilities, and Underground Storage Tank programs. Emails were sent directly to cleanup program managers in other federal agencies (forwarded by the Federal Facilities Restoration and Reuse Office). Direct email notices were also sent to over 100 stakeholder groups, including trade associations (industries and their attorneys), associations of waste management officials, water pollution prevention officials, drinking water supply associations, state or tribal environmental officials, public interest groups, environmental groups, and other stakeholder groups having a national perspective on issues related to cleanup and protection of contaminated ground water.

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Stakeholder Input on DNAPL Paper and Options

This section summarizes review comments on the options provided in the DNAPL paper, lists new options recommended by reviewers, summarizes general comment themes that did not specifically address the original options, and presents the recommendations of the GWTF.

* * * * *

Comments on Options Presented in DNAPL Paper

The final deadline for submitting comments was September 24, 2004. As of that date, 37 comments on the DNAPL options paper had been received. Of the 37 comments, 20 came from government agencies (6 states and 14 federal headquarters and regional offices), and 17 came from the private sector/regulated community (6 industry associations or companies, 8 consultants, and 3 federal facilities). No comments were received from environmental advocacy groups or from public interest groups. Comments from non-EPA reviewers are available on the task force website at: http://gwtf.cluin.org.

The DNAPL paper evaluated eight problem statements and offered eight potential options that might be adopted to help solve them, and commenters were invited to propose additional options.
The options were intended to address at least one problem statement, but they may address several.

Option 1: Develop a fact sheet describing the potential benefits of DNAPL mass removal from the source zone, as well as the potential disadvantages.

Private sector/regulated community: These commenters thought that this option was unnecessary since it would be repetitive of what is already available and even if it were completed, it would not affect decision making, which is done on a site by site basis.

Government agencies: These commenters thought that such a fact sheet might be useful, but did not indicate strong support for it.

Option 2: Develop a fact sheet describing program flexibilities and alternative cleanup goals that may be applied to the DNAPL source zone other than attainment of Maximum Contaminant Levels (MCLs). Program flexibilities (e.g., technical impracticability decisions, containment zones, or similar alternatives) would be those allowed under federal or state cleanup programs. The alternative goals would typically apply only to the DNAPL source zone rather than the entire plume, in accordance with existing policy.

Private sector/regulated community: Comments were generally favorable, and in some cases commenters wanted the scope expanded.

Government agencies: Commenters discussed technical issues related to this option and in general did not think it would be particularly useful.

Option 3: Develop a supplemental EPA guidance on technical impracticability (TI)[6]

[6] Technical impracticability (TI) for contaminated ground water refers to a situation where a remedy is not expected to achieve ground water cleanup levels that would

that clarifies some or all of the following questions for Superfund and other EPA cleanup programs:

- Circumstances that would warrant revisiting a TI decision
- Content and/or format of a TI evaluation report
- How the TI decision process can be used to encourage delineation of DNAPL source zones
- When a simplified (or streamlined) TI decision process can be applied to operating remedies
- How the TI decision process can be used to encourage use of innovative source removal technologies

General: There was general agreement that the current guidance is dated, and most of the commenters supported the development of supplemental TI guidance; however, opinions differed on what it should cover.

Government agencies: While not opposing a guidance update, multiple state commenters pointed out that TI as a concept is not always well received in states with antidegradation policies and is often perceived as a no-action option by the public.

Option 4: Develop a policy memorandum re-emphasizing the existing EPA policy that program flexibilities are to be used for DNAPL source zones as a means of setting cleanup goals that are achievable in a reasonable time frame. Such program flexibilities may include TI determinations, containment zones, ground water classification exemptions, or similar flexibilities that are available at a particular site from either the federal or state cleanup program overseeing the cleanup at that site. The memorandum would reiterate EPA's current policy that cleanup goals for DNAPL source zones should not include restoration of ground water to drinking water standards, if this goal cannot be achieved in a "reasonable time frame" based on site conditions.

General: A number of commenters did not express an opinion on implementing this option, but did provide technical observations.

Private sector/regulated community: Option 4 was generally supported (with caveats) by those commenting.

Government agencies: There were few direct government comments, and they were generally not supportive of the recommendation

Option 5: Develop guidance on recommended methods and approaches for delineating the extent of the DNAPL source zone.

General: Option 5 had no clear trends among commenter groups or commenters. Some thought a delineation guidance would be useful and should include topics, such as how much delineation is necessary. Others thought that there are a sufficient number of guidance documents already available to develop an appropriate

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normally be required, because achieving such levels is not practicable from an engineering perspective. This definition for TI was included in the Superfund statute. EPA's "Guidance for Evaluating the Technical Impracticability of Ground Water Restoration" was completed in 1993. A TI determination is part of a site-specific remedy decision and is made by the lead decision-maker for the site (e.g., EPA or state). The supporting rationale for such a decision is provided in the decision document (e.g., a Superfund Record of Decision). The term "engineering perspective" refers to factors, such as feasibility, reliability, scale or magnitude of a project.

approach for any given site. Still others did not think that source zone delineation is an issue.

Option 6: Develop guidance providing a qualitative approach for determining when source depletion technologies should or should not be implemented. This guidance would attempt to identify types of site conditions where:

- MCLs are potentially achievable in the DNAPL source zone
- MCLs are not likely to be achieved
- Benefits of source depletion efforts tend to outweigh disadvantages
- Source depletions should be included as a remediation goal (regardless of whether or not MCLs are likely to be achieved within the DNAPL source zone

Private sector/regulated community: Though potential difficulties were acknowledged, this option was generally supported.

Government agencies: The states that commented on it were not supportive and thought the information needed to accomplish it is not available. EPA comments tended to be technical in nature and neutral on whether or not to move forward with this option.

Option 7: Develop guidance on performance measures for the effectiveness of DNAPL mass removal, and on how to determine when active DNAPL removal efforts should be discontinued. Such measures could include trend analysis for mass removal rates, mass flux data, or other parameters for gauging remedy performance.

Private sector/regulated community: Option 7 had strong support from the private sector/ regulated community. Dissenters either believed it was premature to write a guidance, given the state of the art, or existing guidance already addresses this issue.

Government agencies: EPA comments tended to be technical in nature and neutral on whether or not to move forward with this option. The Interstate Technology Regulatory Council (ITRC, a state workgroup) has developed a technical guide on this issue.

Option 8: Develop guidance describing improved methods for comparing long-term remedies. The guidance would allow a more realistic accounting of the costs and other disadvantages of long-term custodial care. This would include long-term costs of maintaining containment systems, equipment replacement, monitoring and enforcing institutional controls, and site monitoring.

Private sector/regulated community: Most of the comments on this option were from the private sector/regulated community and either supported developing the guidance or provided technical input that was neutral on implementation. The dissenting comments questioned its usefulness.

Government agencies: EPA comments tended to be technical in nature and neutral on whether or not to move forward with this option.

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Additional Options Suggested by Commenters on the DNAPL Paper

In addition to thoughts on the options presented in the DNAPL paper, many commenters offered other ideas for EPA to consider. Some of these suggestions were unclear or overly broad (e.g., EPA should change its entire approach to cleanup). From these suggestions, the task force

found that the following nine were worthy of further consideration.

1. *All Records of Decision (RODs) should have required language to indicate whether DNAPLs are present at a ground water remedy site and whether remedial actions will have significant benefit based on conditions at the site. Ground water RODs with pump and treat as the selected remedy should be subjected to external scientific peer review.*

2. *Set up a system of rewarding mass removal of DNAPL regardless of the fraction of total mass that it represents. This suggestion pertains to Problem Statements 1 & 2, in particular. Site owners and regulators are more likely to collaborate if success can be envisioned. A quantitative value can be attached to a pound of DNAPL removed from the subsurface environment with a simple economic analysis. Each site's regulator and owner would be tasked with achieving a covenant as to how the value of the DNAPL removed would be applied to offsetting the present or future cost of compliance. Examples of these offsets include monitoring reduction and reporting relief.*

3. *EPA should standardize the use of indicators that identify decreasing effectiveness of pump-and-treat systems (e.g., declining mass removal rates) and provide an agreed upon metric for determining when further reductions are not technically feasible.*

4. *EPA should compile a comprehensive DNAPL annotated bibliography (for Internet access) of references, research, organizations (e.g., academic, industry, and government), and their respective web links/addresses.*

5. *EPA should establish a more consistent framework for setting site-specific goals for ground water remediation. Such a framework should take into account the priority of public health protection, use, and value of the ground water unit in question, and a realistic approach to ground water remediation.*

6. *EPA should produce a guidance that provides site owners and regulators/site managers with more information with which to make decisions (e.g., DNAPL source zone definition, mass flux, risks impacted, site cleanup difficulty ranking, aquifer value and vulnerability, site value). This type of site information must be developed first before a decision is made about whether a TI is appropriate or not.*

7. *EPA should develop new guidance explicitly on how to assess the remedy for DNAPL sites under the remedy selection criteria provided in the Superfund National Oil and Hazardous Substances Pollution Contingency Plan (NCP).*[7]

8. *EPA should fund the research areas suggested in the Kavanaugh-Rao report. (M. Kavanaugh and S. Rao, co-chairs, 2004. The DNAPL Remediation Challenge: Is There a Case for Source Depletion? EPA/600/R-03/143. Office of Research and Development, EPA.)*

9. *EPA should sponsor a team of experts that will go to a variety of sites across the country that have undergone or are about to undergo a source depletion remediation. The EPA experts (along*

[7] National Oil and Hazardous Substances Pollution Contingency Plan (NCP); Final Rule, Federal Register 55, no. 46:8706 and 8733-34, March 8, 1990. The NCP provides the regulatory framework for the Superfund program.

with those from other agencies or from industry, as appropriate for a particular site) will determine if site conditions are properly characterized and will ensure that performance monitoring instrumentation is in place to determine the short- and long-term effects of the source depletion. The ensuing data set will provide hard evidence that is acceptable to both sides (EPA/states and industry) on the benefits, if any, of source depletion in different hydrogeologic settings.

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General Themes in Comments on DNAPL Paper

In addition to specific comments on the options themselves there were several overarching themes within the comments submitted for the DNAPL paper by the different groups.

Private sector/regulated community

Commenters from the regulated community felt that EPA could exercise a great deal of flexibility in setting goals for the cleanup of DNAPL sites, but rarely did.

There was some concern about an overly rigid interpretation or lack of consideration of what constitutes a "reasonable time frame" for achieving cleanup goals.

It was suggested that EPA change its overall approach to site cleanup and adopt a risk- based one, limiting the interpretation of "risk-based" to current use and exposure of a contaminated resource (e.g., ground water) and excluding future uses for purposes of setting current cleanup goals.

Many commenters also cited as an issue a lack of data to support source removal decisions.

There was far more uncertainty in predicting the success and cost of source removal technologies, which some felt are experimental, than with more proven technological approaches, such as containment.

In addition, they believe that given the current state of knowledge, the benefits of source removal are at best conjectural.

Government agencies

There was considerable support for keeping MCLs as the cleanup goals for source zones for the following reasons: they encourage source zone cleanup; they encourage development of innovative technologies; and they may, by forcing source zone depletion actions, allow MCLs to be achieved at the property line.

Several commenters voiced the opinion that waiving stringent goals, such as MCLs undervalued the resource in order to justify short-term cost savings that may very well result in higher costs in the future.

A state commenter, taking a different tack, said that several states had embraced risk-based corrective action (RBCA) and were applying it to set cleanup goals at DNAPL sites.

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Stakeholder Input on Ground Water Use, Value, and Vulnerability as Factors in Setting Cleanup Goals Paper and Options

This section summarizes review comments on the options provided in the UVV paper, lists new options recommended by reviewers, summarizes general comment themes that did not specifically address the original options, and presents the GWTF's recommendations.

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Comments on Ground Water Use, Value, and Vulnerability Paper Options

The final deadline for submitting comments was September 24, 2004. As of that date, 33 comments on the UVV options paper had been received. Of the 33 comments, 24 were from government agencies (9 states and 15 federal headquarters and regional offices), and 9 were from the private sector/regulated community (5 industry associations or companies, 3 consultants, and 1 federal facility). No comments were received from environmental advocacy groups or public interest groups. Comments from non-EPA reviewers are available on the task force website at: http://gwtf.cluin.org.

The UVV paper evaluated four problem statements and offered seven potential options that might be adopted to help solve them. Although the options were intended to address at least one problem statement, overlap exists. The paper invited commenters to propose additional options if they so desired.

Option 1: Develop a series of educational fact sheets and Internet training seminars, targeted primarily to government officials and members of the regulated community to raise awareness of ground water UVV; interconnection between ground water and surface water systems; and health impacts from contaminants most commonly found in ground water. This effort would include summaries of the findings from the upcoming Ground Water Report to Congress.

General: This option received a moderate number of direct comments, but many more commenters supported the need for educational efforts in a variety of areas.

Private section/regulated community: Positive commenters supported the option in general with specific suggestions on how it could be implemented. One commenter, however, thought that it would not provide much information beyond what is already available.

Government agencies: There were both positive and negative government agency comments. The positive comments generally identified specific issues the commenters thought should be addressed with education efforts, while the negative commenters generally thought other options would be more effective. Some thought that the description of this option did not adequately emphasize educating people on the need to protect ground waters that currently support ecosystems

and ground waters that may be needed as a future source of drinking water.

Option 2: Conduct research on the impacts on other developed nations that have resulted from either the presence or lack of strong ground water protection programs.

General: While several commenters thought studying selective foreign ground water protection policies might prove useful, the majority of commenters (both private sector/regulated community and government agencies) did not think it would be effective in addressing any of the problems put forth in the paper, especially in times of limited resources.

Option 3: Develop summaries of how individual EPA and state cleanup programs consider ground water UVV in setting cleanup goals (e.g., ground water classification and classification exception systems, ground water management zone-type approaches). These summaries would be written with Internet links to more detailed resources. EPA would provide access to these summaries via its One Cleanup Program website. This option could also involve low-cost Internet training to raise awareness of the range of approaches being used by EPA and states.

Private sector/regulated community: Option 3 was generally opposed by the commenters as not providing an implementable solution. Several commenters, however, thought it would be a useful exercise for discussion and developing guidance and another said they had already performed a similar exercise and it pointed out the many inconsistencies in the various state programs and the need for guidance to correct these inconsistencies.

Government agencies: Several regulatory agencies (both state and federal) were in favor of this effort. One state commenter did not think highlighting differences in state and federal programs was a good idea, though the commenter did support a study that examined state and federal programs with the goal of highlighting strong points. Some thought that this option would negatively impact states that have a conservative approach to protecting ground water resources.

Option 4: Takes option 3 one step further by developing an EPA policy memo that explains how EPA cleanup programs acknowledge the various approaches used by states in setting ground water cleanup goals based on ground water UVV. For example, the policy statement would clarify how state ground water management zone policy could influence goals established under EPA's cleanup programs. Internet training could also be used to increase awareness and understanding of the policy statement.

Private sector/regulated community: Regulated community comments on this option were mixed. Some did not think that this option would lead to any changes that they would favor. Others said that such a policy should be expanded to promote greater use of existing program flexibilities, with more emphasis on "risk-based" cleanup decisions rather than restoration of ground water in every situation.

Government agencies: Government agency comments were also mixed. Some EPA commenters thought that such a policy would be very helpful. Others, mainly state commenters, thought that this option would somehow hinder state efforts to protect resources. Others thought that such a policy should also address the need to protect ground waters that currently support ecosystems and ground waters that may be needed as a future source of drinking water.

Option 5: Using information from federal and state cleanup programs, develop a general framework that describes how to prioritize sites according to problem severity and ground water UVV. This framework would clearly describe how ground water UVV as well as specific problem magnitude (e.g., risk) can be used to prioritize sites and influence remedial decisions. This framework would describe how a prioritization system directed at site-specific ground water problems can work within statewide general classification systems and how, for example, ground water management zone policy could influence goals established under EPA's cleanup programs.

General: This option generated a number of comments that were equally split between support and opposition. On the support side, many commenters thought it would be a good idea to bring UVV concepts into a useable framework to aid in prioritizing site cleanups. Speaking against this option, other commenters thought it would be difficult or unwise to implement, and several pointed out that it seemed to be similar to the Comprehensive State Ground Water Protection Program (CSGWPP) initiative, which has been implemented by only a few states.

Option 6: Use defined Source Water Assessment Program (SWAP) areas (required by the 1996 amendments to the Safe Drinking Water Act) to promote consistency in ground water cleanup decision making. The option would involve establishing a means to encourage stakeholders to become more aware of and involved with various ground water cleanups taking place within or near an individual Source Water Assessment Area. The objective would be that cleanups could be selected to maximize efficiencies and benefits within a particular source water area.

Private sector/regulated community: Commenters were generally in support of this option. One consultant, however, thought it would be difficult to implement.

Government agencies: Government commenters were generally in favor of this option, with one pointing out the necessity of including private well locations in the pool and another cautioning about the uneven quality of the state SWAP designated areas. Some thought that this option ignores the need to protect ground waters that currently support ecosystems and ground waters that may be needed as a future source of drinking water.

Option 7: Promote and provide funding assistance for regular meetings within an individual state or watershed that brings together the various programs and stakeholders involved with ground water cleanup and protection. One of the objectives of these meetings would be to help prioritize cleanup actions based on factors, such as magnitude and extent of ground water contamination, as well as ground water UVV.

General: While Option 7 received some positive comments, the majority of the commenters were against implementing this option, with one pointing out the potential cost of doing this on a nationwide scale.

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Additional Options Suggested by Commenters on the Ground Water Use, Value, and Vulnerability Paper

In addition to thoughts on the options presented in the DNAPL paper, many commenters offered other ideas for EPA to consider. Some of these suggestions were unclear or overly broad (e.g., EPA should change its entire approach to cleanup). From these suggestions, the task force

found that the following twelve were worthy of further consideration.

1. *A study should be done to assess the success of current ground water cleanups in protecting source water protection zones.*

2. *EPA needs to clarify or modify its definition of what constitutes a potential (future) source of drinking water under the Superfund program.*

3. *EPA should develop a guidance that better defines how the ground water classification or valuation established within the current regulatory framework is used in conjunction with other factors to establish a "reasonable time frame" for ground water restoration. A second commenter suggested that EPA develop a guidance document discussing time as a cleanup parameter.*

4. *EPA should provide guidance to the states that would allow more flexibility in interpreting non-degradation rules.*

5. *EPA should develop guidance on determining cleanup levels for non-potable ground water pathways, such as those for irrigation water.*

6. *EPA should conduct a study on how many cleanup sites were caused or exacerbated by shallow injection wells.*

7. *Establish a forum for sharing GIS information on the extent of ground water plumes and source water assessment areas.*

8. *EPA should develop a reliable tracking and mapping system for contaminated areas that can be used by future resource developers.*

9. *EPA should make an effort to get the U.S. Census Bureau to reinstate a question about private well use that was in the 1990 census but not in the 2000 census. These data are very valuable in evaluating the vulnerability of private wells from contaminated sites. Currently the government only tracks public water systems.*

10. *Develop an annotated, web-based bibliography of regulatory and technical resources.*

11. *Develop educational materials for use in public participation programs.*

12. *Develop a national policy statement regarding overall ground water goals for the Agency. This statement should reflect the overall view that 1) no aquifer will be degraded, and 2) any degraded aquifer ultimately needs to be restored to its natural condition.*

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General Themes In Comments on Ground Water Use, Value, and Vulnerability Paper

In addition to specific comments on the options themselves, several overarching themes were identified within the commenter groups.

Private sector/regulated community

State and federal treatment of ground water UVV is a patchwork of regulations and practices.

EPA needs to provide a more consistent framework for setting site-specific goals for ground water remediation. Underlying much of the argument is the concept of the value of ground water, which is very subjective, and there are no commonly acceptable methods for evaluating it.

Any definition of reasonably expected uses needs to be based on economic (e.g., well yield and value of property) and risk-related factors (e.g., water quality and exposure). EPA needs to adopt a risk based

approach to site cleanup. The Agency should limit the interpretation of "risk based" to current use and exposure of a contaminated resource (e.g., ground water) and exclude future uses for purposes of setting current cleanup goals.

There is a need to prioritize site cleanups so that limited resources are targeted towards actions that have the greatest benefit to human health, the environment, or ground water resources.

Government agencies

Commenters thought a goal using "reasonably expected" uses was too vague and the program should keep the statement "return to potential future uses" as its goal.

Too little consideration of future drinking water demands was given in the paper in considering future uses. One commenter suggested the Agency should be involved in evaluating increasing ground water demand in various regions of the country to allow for better decision making.

Most options focus too much on protecting current sources of drinking water and ignore the need to protect ground waters that currently support ecosystems and ground waters that may be needed as a future source of drinking water.

Another commenter gave a real-life example of a brackish aquifer near a city for which drinking water would not have been considered a reasonably expected use, but now it has been designated an aquifer for drinking water and the city is constructing a desalinization plant.

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Task Force Recommendations

As discussed in the stakeholder comments sections, a range of potential options was included in each of the two discussion papers prepared by the task force. In its deliberations, the task force considered the information presented in the discussion papers, comments received on the options presented in each paper, additional options suggested by commenters, and the general themes of comments from various stakeholders.

In developing its recommendations the task force divided its work into two subgroups, one for each discussion paper. Initially the subgroups looked for ways to consider all of the input received on the papers in developing recommendations. Each subgroup decided that recommendations would not necessarily be based solely on the paper options, but could include options suggested by commenters. Furthermore, when deemed appropriate, a single recommendation might combine several options from the papers. In later discussions each subgroup member was asked to list their top two or three recommendations, based on previous deliberations and their understanding of the issues. These results were tabulated and discussed. The discussions led to the task force making three recommendations for each paper that were tailored to allow some flexibility during implementation. Thus, the task force considered input from multiple EPA programs and stakeholders and followed a consensus approach in developing its recommendations.

The task force did not attempt to review overall cleanup approaches or policies of individual EPA cleanup programs, except as necessary to provide background for issues presented in the two options papers. Deliberations of the task force focused on issues and potential options presented in the papers. The task force operated under the assumption that the existing statutory and regulatory framework governing EPA cleanup programs would not change.

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Recommendations Concerning DNAPL Issues

The GWTF developed the following recommendations to address issues identified in the DNAPL paper. The recommendations fall under three broad headings: policy/guidance, technology research and development, and information resources.

Policy/Guidance

Recommendation 1. Develop guidance on how to acknowledge technical limitations posed by DNAPLs in EPA cleanup decisions, including updated guidance on the use of technical impracticability (TI) decisions in the Superfund program. The guidance should also discuss mechanisms for acknowledging technical limitations posed by site complexities other than DNAPLs.

Goal: Prepare guidance on mechanisms for setting cleanup goals that acknowledge the presence of DNAPL sources and other types of site complexities. Answer questions that have arisen concerning the use of TI decisions in Superfund and RCRA Corrective Action programs, especially those concerning the decision process.

Rationale: The following issues or questions concerning TI decisions were identified in the DNAPL discussion paper:

- Factors indicating that a TI decision is warranted

- Circumstances that would warrant revisiting a TI decision
- Content and/or format of a TI evaluation report
- Whether a simplified (or streamlined) TI decision process can be applied to operating remedies
- Whether the TI decision process can be used to encourage use of innovative technologies
- Mechanisms other than TI for recognizing site complexities or technology limitations and adjusting cleanup goals in Superfund and other cleanup programs

Addressing these and other questions will help clarify EPA expectations concerning use of TI decisions and dispel many misconceptions that were mentioned by reviewers and GWTF members. Although state reviewers indicated a general dislike for TI decisions, the GWTF concluded that many of these concerns can be addressed by updated guidance.

TI decisions are an important component of the Superfund program because statutory provisions concerning "applicable or relevant and appropriate requirements" (ARARs) and ARAR waivers are unique to the Superfund program. Cleanups conducted under Superfund are required to meet ARARs or waive them using one of the waiver provisions specified in the statute (such as, TI).

Next Steps: Form a cross-program workgroup to scope out and complete this guidance project. For example, the guidance workgroup would determine:

- Topics to be addressed in the updated guidance
- Whether it is better to complete a single document or multiple fact sheets
- Whether guidance should be expanded to include applicability of TI decisions to other types of source areas, such as LNAPLs or metals
- Mechanisms other than TI for setting cleanup goals different from drinking water standards
- Project schedule
- Other issues concerning this project

<u>Technology Research and Development</u>

Recommendation 2. Develop recommended data needs and procedures for documenting and tracking DNAPL source zone cleanup efforts so that technology performance can be adequately assessed. Procedures are needed to better assess field research and testing (conducted by EPA and others) to develop promising technologies for remediation and characterization of DNAPL source zones.

Goal: Provide a scientific basis to determine whether DNAPL source depletion is a reasonable cleanup goal. Improve our understanding of the capabilities of source reduction technologies and long-term impacts of DNAPL source depletion on the dissolved contaminant plume (benefits and detriments).

Rationale: Compilation of improved data sets from multiple sites are needed to provide the scientific basis for future EPA guidance concerning cleanup of DNAPL source zones. One of the findings of a recent EPA-sponsored expert panel report was that even though numerous field trials (pilot tests and full-scale remedies) of DNAPL recovery technologies have been

completed, documentation of the tests has often been insufficient to quantify the degree of source reduction achieved or to assess the long-term effects on the dissolved contaminant plume. The expert panel also concluded that improved data sets from a variety of hydrogeologic settings should be compiled to provide insight on the types of benefits that may be achieved by partial depletion of DNAPL sources, including long-term effects on ground water quality. The panel also recommended that such data sets be independently reviewed.

Additional field research and testing (with well defined monitoring methods) is needed to further advance promising technologies for remediation and characterization of DNAPL source zones, and to better understand the effectiveness and appropriate application of these technologies at contaminated sites. Improved mechanisms for documentation and review of test results will increase the value of field research and testing for cleanup programs. Continued research and improved data sets are needed to provide the scientific basis for EPA guidance development on the remediation of DNAPL source zones. Comments from reviewers and from GWTF members indicate that guidance to assist site managers in determining the types of sites where DNAPL source depletion technologies should be implemented is badly needed.

Next Steps: Form a team or similar body of EPA technical experts to make recommendations on how to instrument and monitor field testing and use of DNAPL source reduction technologies. This advisory body would identify a limited number of sites (e.g., one or two per EPA region) where DNAPL source treatment is to be tested or used as part of a remedy. The team would make recommendations concerning:

- Sites where DNAPL source reduction technologies have been tested previously and further data collection is warranted (e.g., one site per EPA region)
- The types of additional data to be collected (including site characterization and long-term monitoring data)
- Methods for documenting and tracking long-term performance and impacts on the plume
- Independent review of site data sets
- Compilation of data for multiple sites

Because of the complexity and cost of such an approach, partnerships with other federal agencies, universities, or other entities could be considered in establishing such a team (e.g., a "DNAPL technology advisory team").

The purpose of the data collection effort is to accumulate the data sets necessary to develop future EPA guidance on cleanup of DNAPL source zones (e.g., types of sites where source reduction should or should not be attempted, and cleanup goals for the source zone).

<u>Information Resources</u>

Recommendation 3. Develop a web-based resource center for information related to cleanup and characterization of sites with DNAPLs, including links to existing policy, guidance, technology descriptions, and case studies, as well as resources such as fate and transport and chemical property tool calculators.

Goal: A resource center for information concerning cleanup of DNAPL sites, including both technical resources and guidance.

Rationale: There is a need for a website that serves as the starting point for finding information concerning cleanup of DNAPL sites and related information. Such a site would be a useful source of information for EPA and state site managers, cleanup contractors, community groups, and other stakeholders. There is no current EPA website specific to DNAPLs that serves this purpose.

Existing EPA policies and guidance related to cleanup and characterization of sites with DNAPLs would also be linked to this website. Comments from reviewers and from the GWTF indicate that there is still some confusion regarding existing EPA policy, including whether EPA expects DNAPL source zones to be restored to drinking water standards at sites with such sources. Technical guidance on DNAPLs developed by others, such as the Interstate Technology Regulatory Council (ITRC), could also be linked to this website.

Next Steps: Assign a project leader to develop the web resource center. Existing information on cleanup technologies, case studies, and guidance from EPA and non-EPA sources should be identified. The project leader would solicit comments from other programs in making final determinations of information to be linked to the website and the format of the website.

The web resource center could include a list of experts available to answer questions concerning cleanup and characterization of DNAPL sites. This list could include experts on particular technologies, experts on requirements for EPA cleanup programs, and other sources of specific types of information.

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Ground Water Use, Value, and Vulnerability Recommendations

The GWTF found that there is little consensus at this time among stakeholders for recommending any significant shift in current policies to address issues identified in the Ground Water UVV options paper. Therefore, the GWTF developed the following recommendations which focus on providing educational resources and improving coordination among ground water cleanup and protection programs.

Recommendation A. Develop a new web-based resource center for information related to the potential role of ground water UVV in cleanup decisions. The resource center would address items, such as interconnection between ground water and surface-water systems; the importance of ground water to ecosystems; health impacts from contaminants most commonly found in ground water; the potential for drinking water shortages and their effects on current ground water use classifications; federal protection policies, and exemplary state policies.

Goals: Provide a source of information and educational materials that lay a foundation for understanding ground water UVV issues and give examples of how some states have used ground water UVV in making cleanup decisions. An example of a successful outcome of this effort would be that an interested member of the public used materials from the resource center to better understand a proposed remedy where ground water UVV were factors in setting cleanup goals.

Rationale: This recommendation evolved from Option 1, which referred only to educational fact sheets and Internet training seminars. Based on the comments supporting Option 1 and suggestions for other options from commenters, the GWTF broadened Option 1 into a web-based resource center. This recommendation received the broadest support by GWTF members. The GWTF concluded that information on ground water UVV and its potential role in cleanup decisions should be more easily available to government officials (particularly cleanup managers) and interested members of the public. Furthermore, this recommendation could help address many of the issues identified in the GWTF discussion paper (e.g., educate interested stakeholders about many state approaches used to account for ground water UVV in site-specific cleanup decisions). Educational tools would include the importance of protecting ground waters that currently support ecosystems, and ground waters that may be needed as a future source of drinking water. Notably, there were a number of comments, particularly from members of the regulated community, that education alone would not result in needed policy changes.

Next Steps: Form a cross-program workgroup to scope out the project, paying particular attention to resources currently available through EPA's Office of Ground Water and Drinking Water and the EPA Drinking Water Academy.

Recommendation B. Request that the U.S. Census Bureau update the 1990 census information on sources of drinking water[8], and develop tools to facilitate access to this information.

Goal: Successfully convince the U.S. Census Bureau to add a question to the 2010 census pertaining to sources of drinking water, thereby updating information previously collected in 1990. Information on the locations of private wells in all 50 states, would allow ground water cleanup and protection programs to identify areas where ground water is currently used as a source of drinking water for private homes.

Rationale: Information on private wells is not easily accessible and in some cases unavailable from other sources. This recommendation was offered by GWTF members after the issues/options paper was released for public comment; therefore, the GWTF did not receive comments for or against this recommendation. However, the GWTF did receive comments emphasizing growing demand on ground water resources due to population growth and drought conditions in many parts of the country. Members of the GWTF broadly supported this recommendation because only information on public drinking water systems is currently provided to EPA. Additional information on locations of private wells (at the census block group

[8] This information was collected in the 1990 census and earlier but was excluded from the 2000 census. The U.S. Census Bureau web page provides the following explanation as to why the question was removed, "Source of water and method of sewage disposal were not required or mandated items. Although many data users throughout the country found the information extremely useful, there are other sources at the state and local level where such information can be obtained; albeit, not all areas in the country collect these data uniformly or disseminate the information in a manner that is readily accessible to data users."

level) would serve to further inform and educate government officials and other interested stakeholders about the use and value of ground water resources, as well as assist cleanup managers in setting remediation goals that are protective of both public and private uses of these resources.

Next steps: Contact the U.S. Census Bureau to find out why the question on "source of water" was dropped from the 2000 census. Draft a letter from EPA to the U.S. Census Bureau requesting that this question be added to the 2010 census. The letter would explain the value of this information to ground water cleanup and protection programs. In addition, the Agency should develop Internet-based tools to facilitate access to the existing 1990 census data by EPA program staff and the public and conduct training on the availability and utility of the existing data. These activities should be closely coordinated with EPA's Office of Water and Drinking Water.

Recommendation C. Develop approaches for using source water areas (SWA)[9], delineated by state drinking water programs, to promote collaboration among cleanup programs, drinking water programs, and stakeholders concerned with cleanup and protection of ground water resources.

Goals: Increase collaboration among ground water cleanup and protection programs within particular source water areas. Specific examples of desired outcomes are cleanup managers would be able to find out easily if their sites are located in a designated SWA; and site characterization, risk assessments, and other information could be shared among cleanup managers for sites located within a particular SWA. This collaboration would provide an opportunity to agree on common cleanup approaches and standards, where appropriate.

Rationale: Nearly all states have completed delineation of source water areas for all public drinking water systems in their state, including both ground water and surface water systems. Ground water within a source water area is currently used as a source of drinking water for public supply wells. Furthermore, the GWTF supported this recommendation because it recognized that the interconnection of ground water within a source water area makes it possible for a release from one site to affect ground water at another site. For these reasons, this recommendation received broad support from the GWTF and from reviewers. Some commenters pointed out that focusing only on source water areas would ignore ground water supplying private wells; combining this option with the Census recommendation will help to convey EPA's interest in ensuring protection of both public and private drinking water supplies.

Next Steps: Form a cross-program workgroup to scope out options for moving forward. One approach is to develop a memorandum of understanding (MOU), such as that developed between the Office of Water and the Office of Underground Storage Tanks (UST). This MOU would recommend that UST program managers use source water areas as a tool to help prioritize their activities (e.g., inspections, assessments, removals, final cleanups).

[9] See http://cfpub.epa.gov/safewater/sourcewater/protect/swap.html for more information about source water, source water assessments, and source water protection.

Summary

In recognizing the importance of ground water to the nation's drinking water supply and its critical role in maintaining the health of ecosystems, EPA established the Ground Water Task Force (GWTF) in the fall of 2002 as part of the Agency's One Cleanup Program. The mission of the task force was to identify, and prioritize, ground water issues that will benefit multiple cleanup programs; and to make recommendations to EPA senior management on the best course of action.

Task force members identified two topic areas for initial evaluation and developed "options papers" for each area. The papers are: "Cleanup Goals Appropriate for DNAPL Source Zones" and "Ground Water Use, Value and Vulnerability as Factors in Setting Cleanup Goals." The task force reviewed cleanup policies associated with these topic areas, but did not review overall Agency policies concerning cleanup of contaminated ground water.

For DNAPL source zones, the issues are centered around determining cleanup goals appropriate for the source zone, and whether remediation should be undertaken to remove or treat the DNAPL sources. These decisions are difficult because the various outcomes may contain a high degree of uncertainty due to incomplete information regarding the extent of the source zone and the effectiveness of the technologies. The GWTF believed that implementation of the DNAPL recommendations will greatly aid practitioners in making decisions on source zone cleanup. Providing Agency tools such as an updated guidance on ways to acknowledge complex site conditions in cleanup decisions (e.g., TI decisions in Superfund), an EPA website that provides current information on characterization and remediation technologies, and EPA guidance related to DNAPLs, will help meet near term needs of cleanup programs. In addition, continuing to support technology demonstrations, while providing a mechanism for properly evaluating field applications of DNAPL source cleanups, will help expand the scientific basis for evaluation of the likely benefits of source cleanups, and provide the foundation for future Agency guidance.

Ground water use, value and vulnerability issues are more related to consistent application of remedies within a watershed or aquifer system and the philosophic questions of what needs to be protected and why. There was little consensus among stakeholders on how these issues should be approached. The regulated community for the most part advocated a risk based present use approach while the government commenters preferred to evaluate an aquifer for its present and future uses as well as how it fits into the overall ecosystem. However, by implementing the recommendations on ground water use, value, and vulnerability issues, the GWTF believed the agency will attain more consistency within its ground water cleanup programs and promote a better understanding among all stakeholders of the part evaluation of aquifer use, value, and vulnerability play in making cleanup decisions.

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Attachment A

Discussion Paper: Cleanup Goals Appropriate for DNAPL Source Zones

This paper reflects the GWTF's research, analysis and findings as of May 10, 2004 when it was originally posted at http://gwtf.clu-in.org/papers/. The version of the paper included in this report has been modified to reflect updates to web links that were available as of December 2007. Note that Kenneth Lovelace is no longer the contact for this issue paper as mentioned on page A-4. For more current information on the subject, contact either Matthew Charsky (charsky.matthew@epa.gov) or Linda Fiedler (fiedler.linda@epa.gov) of OSWER's Superfund program.

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Cleanup Goals Appropriate for DNAPL Source Zones

Introduction

Notice: It is very important to note that this paper has been prepared by EPA's Ground Water Task Force for informational purposes only. This paper does contain some discussion summarizing EPA's statutory authorities and regulations. However, this paper does not constitute an EPA statute or regulation and does not substitute for such authorities. In addition, the statements in this paper do not constitute official statements of EPA's views and are not binding on EPA or any party.

This options paper is being developed by EPA's Ground Water Task Force, a workgroup established under the "One Cleanup Program" of the Office of Solid Waste and Emergency Response (OSWER).[1] This task force is comprised of EPA and state regulatory officials, and was formed to:

- serve as the main technical/policy/communication/networking resource for OSWER on ground water issues;
- promote cross-program coordination and communication on technical and policy issues related to the cleanup of contaminated ground water;
- identify and prioritize and work to solve and/or provide guidance on ground water issues and projects that will benefit multiple programs; and
- assign subgroups to work on priority issues, and/or make recommendations to EPA senior management on the best course of actions for such issues.

In carrying out its purpose, Ground Water Task Force representatives discussed with Senior EPA and state program managers a variety of implementation challenges cleanup programs face with respect to setting ground water cleanup goals.[2] One of those challenges, which was identified as a priority issue, is differing perspectives on what cleanup goals are appropriate for that portion of the contaminant plume where dense non-aqueous phase liquids (DNAPLs) are present in the subsurface (the DNAPL source zone). The purpose of this paper is to promote dialogue on this issue. It provides a brief background on DNAPLs as a source of contamination, differing stakeholder points of view (based on written or anecdotal input) with respect to challenges posed by DNAPLs, and potential options for addressing these problems. Stakeholders include federal and state regulatory officials, and members of the regulated community, as well as environmental and public interest groups. The Ground Water

[1] For more information concerning the EPA's One Cleanup Program, refer to http://www.epa.gov/oswer/onecleanupprogram/ . For more information concerning the One Cleanup Program Ground Water Task Force, refer to http://gwtf.cluin.org/ .

[2] Oral presentation and discussion on March 4, 2003 before the Cleanup Programs Council, an advisory group for the OSWER One Cleanup Program.

Task Force recognizes that other problems and options may exist, and no decisions have been made at this point with respect to which option(s) the Agency may pursue. Readers are encouraged to provide their comments on the paper and to suggest solutions they believe the Agency should consider to address the problems stated in this paper and/or other problems not mentioned herein. As conveyed in this document, any additional option submitted should describe the particular problem(s) it would address, as well as its associated advantages and disadvantages. These comments will be used in planning future activities of the task force and in developing recommendations for EPA senior managers on a course of action to address the issues raised in this paper.

Questions or comments concerning this paper should be directed to Kenneth Lovelace and sent via email to gwtf@emsus.com by July 31, 2004. Copies of this paper can be obtained from the Ground Water Task Force website: http://gwtf.cluin.org.

EPA recognizes that some stakeholders are concerned that raising issues addressed in this paper may generate pressures to change existing approaches, promote debates that slow down cleanup decisions, and ultimately affect the ability of regulatory programs to impose and achieve cleanup goals. However, the task force believes that avoiding these issues would not be responsive to other concerns raised during stakeholder meetings held by the Agency in 2003 concerning the goals of the One Cleanup Program. Additional stakeholder meetings are planned specifically for this and other options papers developed by the task force. By including states on the task force and promoting public dialogue on these ground water issues, the agency is attempting to fairly balance all of these concerns.

Issue Background

DNAPLs as a Source of Contamination

A non-aqueous phase liquid (NAPL) is a chemical or mixture of chemicals that do not readily mix with water. In water, NAPLs form a separate liquid phase and do not readily dissolve. Dense NAPLs (DNAPLs) sink while light NAPLs (LNAPLs) float. DNAPLs include chemical compounds and mixtures with a wide range of chemical properties, including chlorinated solvents, creosote, coal tar, and polychlorinated biphenyls (PCBs). After a spill, DNAPLs migrate into the subsurface resulting in disconnected blobs of liquid referred to as "residual DNAPL," and continuous distributions of DNAPL sometimes referred to as "pools." Residual and pooled DNAPL occupy pore spaces within granular media (e.g., soil) or fractures in bedrock. DNAPL pools can be mobile or potentially mobile.

The DNAPL source zone is that portion of the subsurface containing residual and/or pooled DNAPL. Ground water flowing through the source zone dissolves some of the DNAPL, giving rise to aqueous phase plumes of contamination hydraulically down-gradient of the source zone. A plume may also result from precipitation infiltrating through residual DNAPLs (or LNAPLs) located in the unsaturated zone (above the water table). Since DNAPLs are only slightly soluble in water, DNAPL source zones can persist for many decades and in some cases for the foreseeable future. Volatile constituents within the DNAPL may continue to release vapor phase contamination to the unsaturated zone or the surrounding ground water. Thus, the nature of the contamination problem at DNAPL sites has two components: 1) the DNAPL source zone, and 2) the aqueous phase plume (and may also include vapor phase contamination in the unsaturated zone).

Some DNAPLs, such as chlorinated solvents, are much denser than water and very mobile in the subsurface. A large DNAPL spill can sink below the water table, spreading laterally as it encounters finer grained layers, and may extend to the base of an aquifer. Pooled DNAPL can migrate due to gravity along the top of down-ward sloping geologic layers or along fractures, and the flow path can be in a direction different from the ground water flow. Pooled DNAPL can also penetrate into deeper aquifers by migrating along fractures in confining layers. For these reasons, delineating the subsurface extent of the DNAPL source zone can be a substantial undertaking. At many sites, DNAPLs are suspected but have not been observed in the subsurface. For other sites, DNAPLs have been observed at some locations but the extent of the DNAPL source zone has not been distinguished from the overall plume.

The number of CERCLA[3] (i.e., Superfund) sites or RCRA[4] Corrective Action facilities with DNAPL source zones is uncertain. However, in the early 1990s, the Superfund program reviewed existing site investigation data from a sample of 712 sites in order to estimate the extent of the DNAPL problem. Results were presented in a 1993 report, which concluded that "...approximately 60% of all NPL sites exhibit a medium to high likelihood of having DNAPLs present as a source of subsurface contamination" (EPA, 1993a; page x).

EPA Cleanup Goals

The goal for ground water remediation at Superfund sites and RCRA Corrective Action facilities is to protect human health and the environment, typically using a combination of short-term measures (e.g., providing alternative water supplies) and long-term measures intended to return contaminated ground water to quality consistent with its designated beneficial uses. In general, ground water has been designated by states as current or future sources of drinking water, although a number of states are looking at other approaches in designating ground water based on use, value, and vulnerability. (See task force options paper: Ground Water Use, Value and Vulnerability as Factors in Setting Cleanup Goals.) For ground water designated as current or future sources of drinking water, long-term (i.e., final) cleanup goals typically include returning contaminated ground water to drinking water standards (e.g, federal maximum contaminant levels (MCLs) or state MCLs).[5] For Superfund sites and RCRA Corrective Action facilities where returning the plume to MCLs is a cleanup goal, MCLs are typically to be attained within the contaminated aquifer and throughout the plume. Thus, long-term cleanup goals at most Superfund sites and RCRA Corrective Action facilities include attainment of drinking water standards throughout the plume of contaminated ground water, which may include the DNAPL source zone (if present) as well as the aqueous contaminant plume.

Long-term cleanup goals for Superfund sites and RCRA Corrective Action facilities do not always include attaining MCLs throughout the plume. For ground waters that are not designated by states as current or future sources of drinking water, drinking water standards

[3] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was enacted in 1980, and amended in 1986.

[4] The Resource Conservation and Recovery Act (RCRA) was enacted in 1976, and amended in 1984.

[5] Federal Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (enacted in 1974, amended in 1996), and related information are available online at: http://www.epa.gov/OGWDW/mcl.html .

are generally not used as cleanup levels and alternative cleanup goals are typically established, such as control of sources and containment of the plume. Also, where the remedy calls for on-site management of waste materials (such as a landfill), cleanup levels generally do not need to be attained in ground water beneath the waste management area. In such cases, attaining MCLs throughout the plume applies only to that portion of the plume outside the waste management area. Furthermore, both the Superfund and RCRA Corrective Action programs generally allow alternative cleanup goals to be established at sites where attaining MCLs throughout the plume is determined to be technically impracticable (TI). Both of these EPA cleanup programs also establish alternate cleanup limits (ACLs) in lieu of MCLs, under appropriate circumstances. However, ACLs defined under CERCLA are somewhat different from those in RCRA Corrective Action.[6] Some state cleanup programs have provisions for establishing contaminated ground water containment or management zones. Within such a zone, active cleanup of contaminated ground water may be deferred or may not be required. The specifics of how containment or management zones are defined, and what alternative cleanup goals are applied, differ from state to state.

Cleanup Technologies

For the reasons discussed above, sites where DNAPLs are present in the subsurface are very difficult to clean up to drinking water standards. Cleanup technologies applicable to these sites often include individual approaches or various combinations of approaches intended to control migration of contaminants (containment), remove contaminants from the subsurface (extraction), or treat contaminants in place (in-situ treatment). Each of these technology types have been used (with varying degrees of success) on DNAPLs in the source zone or on dissolved contaminants in the plume.

Over the past two decades, significant advancement has been made in the development of these technologies, especially those intended to remove or treat DNAPLs in the source zone. However, site owners and cleanup managers have been reluctant to implement these technologies. Potential reasons for the limited application of source-zone depletion technologies include uncertainties with respect to: 1) actual extent of the DNAPL source-zone, 2) whether MCLs can be attained in the source zone, 3) predicting benefits and adverse impacts of DNAPL depletion where MCLs are not likely to be attained, and 4) the acceptability of cleanup goals other than MCLs (EPA, 2003).

Potential Benefits and Impacts of DNAPL Mass Reduction

Reducing the quantity of DNAPL mass in the source zone can have several potential benefits, regardless of whether MCLs can be attained in the source zone. A recent national panel report specifically addresses cleanup of DNAPL source zones. This panel, convened by EPA's Office of Research and Development, completed a report titled: The DNAPL Remediation Challenge: Is There A Case For Source Depletion? The Executive Summary of this report provides the following conclusions regarding the potential benefits of DNAPL mass depletion (EPA, 2003; page xi):

[6] ACLs used in the Superfund program are defined in CERCLA 121(d)(2)(B)(ii). Guidance for use of ACLs in RCRA is provided in EPA, 1987.

> Regardless of the site owner, there is a range of benefits, from a risk management perspective, that may result from DNAPL source-zone depletion. These include explicit benefits such as: 1) mitigating the future potential for human contact and exposure through long-term reduction of volume, toxicity, and mobility of the DNAPL, 2) mitigating the future potential for unacceptable ecological impacts, 3) reducing the duration and cost of other technologies employed in conjunction with the source removal technology, and 4) reducing the life-cycle cost of site cleanup. These benefits can be achieved if the source depletion option can result in the following outcomes: 1) reduction of DNAPL mobility, if mobile DNAPL is present, 2) reduction in environmental risk to receptors; 3) reduced longevity of ground water remediation, and 4) reduction of the rate of mass discharged from the DNAPL source zone. These outcomes could then lead to enhanced efficiency of complimentary technologies used for ground water remediation as well as potential reduction in life-cycle costs. Implicit benefits of DNAPL source-zone depletion include: 1) minimizing risks of failure of long-term containment strategies, 2) mitigating public stakeholders' concerns, 3) enhancing a company's "green image" as stewards of the environment, and 4) minimizing future uncertain transaction costs associated with management of the site.

The 2003 national panel report also summarized the potential adverse impacts of DNAPL mass depletion as follows (EPA, 2003, page xi):

> Adverse impacts of DNAPL source depletion could include: 1) expansion of the DNAPL source zone due to mobilization of the residual DNAPL, 2) undesirable changes in the DNAPL distribution (i.e., DNAPL architecture), and 3) undesirable changes in the physical, geochemical and microbial conditions that may cause long-term aquifer degradation, and/or may adversely impact subsequent remediation technologies. All of these adverse impacts could increase life-cycle costs of site cleanup.
>
> Quantitative predictions of these potential benefits and adverse impacts to aid decision making on whether to implement DNAPL source depletion actions are highly uncertain. These uncertainties remain as significant barriers to more widespread use of source depletion options.

Need for Alternative Cleanup Goals

Several national advisory panels have studied the difficulties associated with cleanup of contaminated ground water, including the particular problems posed by DNAPLs, and have issued summary reports of their findings. In 1994, the National Research Council (NRC)[7] completed the report: Alternatives for Ground Water Cleanup. This report recommended that sites be categorized according to the "Relative Ease of Cleaning Up Contaminated Aquifers as a Function of Contaminant Chemistry and Hydrogeology" and gave an example of such a categorization scheme (Table ES-1), which clearly indicates that DNAPLs are the most difficult type of contaminant problem to clean up (NRC, 1994; page 5). Among other findings, this report included the following findings regarding "Setting Cleanup Goals" (NRC, 1994; page 18) (bold text is from original):

[7] The National Research Council (NRC) is the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering. More information about the NRC can be obtained from: http://www.nationalacademies.org/nrc/ .

Conclusion. Existing procedures for setting ground water cleanup goals do not adequately account for the diversity of contaminated sites and the technical complexity of ground water cleanup. Whether goals established under existing procedures adequately protect public health and the environment, or whether they are overprotective or underprotective, is uncertain, as are the costs to society when these goals cannot be achieved.

Recommendation 1. Although the committee recognizes that different agencies must operate under different authorities, all regulatory agencies should recognize that ground water restoration to health-based goals is impracticable with existing technologies at a large number of sites.

The Executive Summary of 2003 national panel report provides the following conclusions regarding "Appropriate Metrics For Performance Assessment" (EPA, 2003; page xi):

> The Panel assessed the technical basis for using drinking water standards, such as Maximum Contaminant Levels (MCLs), as the single performance goal for successful DNAPL source-zone remediation and the use of chemical analyses in ground water samples from monitoring wells as the primary metric by which to judge performance of ground water remediation systems. Although an MCL goal may be consistent with prevailing state and federal laws for all ground water considered a potential source of drinking water and is a goal that is easily comprehended by the public, this goal is not likely to be achieved within a reasonable time frame in source zones at the vast majority of DNAPL sites. Thus, the exclusive reliance on this goal inhibits the application of source depletion technologies because achieving MCLs in the source zone is beyond the capabilities of currently available in-situ technologies in most geologic settings.

Problem Statements

For the purpose of this options paper, the Ground Water Task Force developed generalized problem statements based on written and anecdotal information. However, the problem statements listed below do not necessarily represent the position of EPA. Rather, these problem statements attempt to capture the perspectives of various stakeholders, such as federal and state regulatory officials, and members of the regulated community, as well as environmental and public interest groups. Also, individual opinions can vary as much within these respective groups as between them. Furthermore, these problem statements are not listed in any order of importance or priority, and do not represent all possible points of view associated with remediation of a DNAPL source zone.

1. **Site owners[8] say that cleanup to drinking water standards (e.g., MCLs) is not a realistic goal for DNAPL source zones, yet they are rarely allowed to use alternative goals.** Federal and state site managers continue to set such stringent goals within the DNAPL source zone, even though most technical experts agree that attaining MCLs within the DNAPL source zone is not possible with currently available technologies at most DNAPL sites. Site managers are not utilizing program flexibilities for setting alternative cleanup

[8] In this paper the term "site owners " is used to refer to those parties responsible or potentially responsible for the release of contaminants to the environment, and therefore, for paying cleanup costs.

goals for this portion of the plume (e.g., technical impracticability decisions, containment zones, or similar).

2. **Technology developers say that continued adherence to overly stringent cleanup goals for DNAPL source zones inhibits the potential use of existing technologies and is detrimental to development of new methods.** Currently available in-situ treatment methods, such as thermal and oxidation technologies, can remove significant quantities of DNAPL from the source zone. However, site owners are reluctant to consider using such technologies in remedies because they feel that attaining MCLs in the source zone is not likely to be achieved, even with the most promising technologies.

3. **Federal and state site managers say that alternative cleanup goals often cannot be applied because the DNAPL source zone has not been distinguished from the overall plume.** For many sites, the DNAPL source zone has not been delineated. Regulatory officials are reluctant to use program flexibilities (e.g., technical impracticability decisions, containment zones, or similar) in these cases, because there is no basis for defining the portions of the plume where alternative goals are to be applied. Site managers say that site owners are not interested in delineating the DNAPL zone and typically want alternative goals to be applied to the entire plume, which would mean that none of the plume (neither source zones nor aqueous phase plumes) would be cleaned up. Continued adherence to stringent cleanup goals is the best way to make sure that DNAPL sites get cleaned up.

4. **Federal and state site managers are concerned that alternative cleanup goals have uncertain reliability and long-term costs.** Alternative cleanup goals, such as containment or exposure control, will require that ground water monitoring and site controls be maintained throughout the foreseeable future. The long-term reliability of containment systems and exposure controls is uncertain. Also the effectiveness of such systems and controls often is not well documented. Containment systems have high capital costs, and hydraulic (i.e., pumping) containment systems also have high operating costs. Components used in containment systems have a finite operating life (e.g., pumps, wells, piping, flow barriers), and replacement costs are not typically considered during remedy selection. Institutional controls (e.g., deed covenants or well drilling restrictions) also have long-term costs associated with monitoring and enforcement. Long-term custodial care[9] of sites with DNAPL source zones cannot be maintained if site owners go out of business; or if federal and state governments decide to eliminate funding for "orphan sites" at some time in the future. For sites where cleanup to MCLs can be achieved in the DNAPL source zone and throughout the plume, uncertainties, long-term costs, and other disadvantages associated with long-term custodial care can be avoided.

5. **Federal and state site managers say that although source depletion is sometimes a cleanup goal, there is currently no accepted performance measures to determine the effectiveness of DNAPL mass removal.** There is no agreement among technical experts on what performance measures should be used to indicate that DNAPL mass has been

[9] Long-term custodial care includes all activities needed to ensure the protectiveness of a remedy into the foreseeable future, which will likely include multiple generations. These activities include site monitoring; maintenance of remedy components, replacement of remedy components as needed; and monitoring and enforcement of institutional controls.

removed to the extent practicable from the DNAPL source zone. A 1996 EPA guidance says that long-term objectives for the DNAPL source zone are to (EPA, 1996; page 14):

> ... control further migration of contaminants from subsurface DNAPLs to the surrounding ground water and reduce the quantity of DNAPL to the extent practicable.

Although total DNAPL mass removed by recovery systems is relatively easy to measure, estimates of total mass present in the subsurface are highly uncertain and are typically underestimated. This means there is no good way to estimate the fraction of DNAPL mass removed from the subsurface with an acceptable level of confidence. In some cases, a sharp decline and leveling off of mass recovery over time has been used to indicate that DNAPL has been removed to the extent practicable. However, there is no standardized method for determining when the mass recovery has leveled off. Also, leveling off of mass recovery can result from a poorly designed recovery system.

6. **Site owners say that source depletion should not be a cleanup goal because the potential benefits of DNAPL mass removal are outweighed by disadvantages.** Some site owners believe that such efforts are unlikely to remove all of the DNAPL from the source zone, which means that a plume of contaminated ground water will persist and remedies to contain or otherwise manage the plume will still be required. Site owners also say that mass removal from the source zone is unnecessary as long as the entire plume is contained and institutional controls are established. Also, attempts to remove DNAPL mass could have detrimental effects, such as causing further migration of the DNAPL. Site owners say that containment of the plume, including the DNAPL source zone, is protective and consistent with EPA guidance (e.g., the 1993 TI guidance).

7. **Managers of federal and state cleanup programs say that flexibility in setting appropriate cleanup goals for DNAPL source zones is also a concern when revisiting operating remedies.** Improved decision making approaches will be helpful when selecting the initial remedy and also when revisiting operating remedies. Many DNAPL sites have remedies that were selected several years ago, when the state of knowledge concerning problems posed by DNAPLs was less advanced. Reasons for revisiting cleanup goals during the operating phase of a remedy could include:

   - desire to reduce annual operating costs,
   - desire to change to a more effective cleanup technology,
   - lack of progress toward existing cleanup goals,
   - new or previously unrecognized contamination problems, and/or changes in land use.

   Those who are paying remedy costs (site owners, federal and state cleanup programs) generally want to reduce long-term remedy costs. Since annual maintenance costs are higher for operating systems (e.g., pump and treat, in-situ treatment systems), site owners and cleanup programs would like to turn off these components of the remedy sooner rather than later.

8. **Federal and state site managers say that they should be able to revisit technical impracticability (TI) decisions.** If a TI decision is made for DNAPL source zones (or for other site conditions), federal and state site managers want to be able to revisit the TI decision at some time in the future when new cleanup technologies become available. Cleanup of the site is preferable to long-term custodial care for the reasons discussed above. EPA's 1993 "Guidance for Evaluating the Technical Impracticability of Ground Water Restoration" states that TI decisions "...will be subject to future review by EPA" (EPA, 1993b; page 25). However, this guidance also indicates that TI decisions can be permanent for Superfund sites if the remedy continues to be "protective." In contrast, the 1993 guidance indicates that TI decisions are not permanent for RCRA facilities (EPA, 1993b; page 25).

EPA DNAPL Related Projects

The projects listed below are technology demonstration projects and multi-year research efforts intended to address one or more of the problems identified above. All of these projects were recommended in the findings of a recent national panel report: titled: The DNAPL Remediation Challenge: Is There A Case For Source Depletion? (EPA, 2003). EPA's ability to continue and/or initiate these DNAPL-related projects is dependent upon resources and their relative priority compared to research needs for other issues.

Project A - A review of existing data from sites where sufficient documentation is available to assess the performance of DNAPL source depletion efforts, including long-term impacts on the plume (EPA, 2003; Section 5.2, No. 4).

Project B - Develop guidelines for data that should be collected to document field demonstrations of source depletion technologies, prior to initiation of DNAPL removal, during operation and after completion of DNAPL removal (EPA, 2003; Section 5.2, No. 3).

Project C - Develop and validate technologies for measurement of mass flux from DNAPL source zones, and other measures for evaluating the effectiveness of DNAPL mass removal (EPA, 2003; Section 5.2, No. 5).

Project D - Continue research and demonstration projects to develop, test, and validate the most promising technologies for DNAPL source zone characterization and mass depletion. Much of this work is being undertaken in partnership with other federal and state agencies, and with industry groups (EPA, 2003; Section 5.2, No. 2).

Options for Addressing Problems

The options listed below are intended to address one or more of the problems identified above. They are listed in approximate order of increasing complexity and time to complete. For instance, the longer-term projects require the collection of additional supporting data. It is assumed that the statutory and regulatory framework for EPA cleanup programs will not change in the near future, so all options fall within the current framework for these programs. It is also assumed that training and outreach activities are an essential component of each option. A brief discussion of advantages and disadvantages is included for each option. A matrix table showing the problems addressed by each option is included as Table 1.

Option 1 - Develop a fact sheet describing the potential benefits of DNAPL mass removal from the source zone, as well as the potential disadvantages.

Advantages: No additional studies would be needed to develop such a fact sheet. The potential benefits of DNAPL source removal are often overlooked. This may encourage greater consideration and use of DNAPL recovery and/or treatment technologies for site remedies. May encourage delineation of the DNAPL source zone.

Disadvantages: Simply listing potential benefits and disadvantages without guidance on the types of sites where source depletion should (or should not) be included as a remediation goal (Option 6) will not be very helpful. Also, since there are currently no accepted performance measures to determine the effectiveness of DNAPL mass removal, it may be difficult to determine whether benefits have been realized at a particular site.

Option 2 - Develop a fact sheet describing program flexibilities and alternative cleanup goals that may be applied to the DNAPL source zone other than attainment of MCLs. Program flexibilities (e.g., technical impracticability decisions, containment zones, or similar) would be those that may be allowed under federal or state cleanup programs. The alternative goals would typically apply only to the DNAPL source zone rather than the entire plume, in accordance with existing policy.

Advantages: No additional studies would be needed to develop such a fact sheet. It may encourage site managers to make greater use of program flexibilities currently available from federal and state programs for the DNAPL source zone. TI decisions as well as other flexibilities would be discussed (e.g., containment zones, or similar designations). It may encourage delineation of the DNAPL source zone.

Disadvantages: Would only apply to sites where DNAPL source zone has been delineated, which may be a small minority of sites. May not increase use of program flexibilities. If examples of program flexibilities are described but not mandated, this fact sheet may not be very helpful.

Option 3 - Develop a supplemental EPA guidance on technical impracticability (TI) that clarifies some or all of the following questions for Superfund and other EPA cleanup programs:

- circumstances that would warrant revisiting a TI decision;
- what a TI evaluation report should look like;
- how the TI decision process can be used to encourage delineation of DNAPL source zones;
- can a simplified (or streamlined) TI decision process be applied to operating remedies; and
- how the TI decision process can be used to encourage use of innovative source removal technologies.

Advantages: No additional studies would be needed to develop such a guidance. Clarification of when a TI decision can be revisited may especially help the Superfund

program (Problem 8). TI determinations are currently an option in both the Superfund and RCRA Corrective Action programs. Current guidance would be updated. This guidance could address several questions or concerns regarding the TI decision process, such as the examples given above. Such a guidance could resolve questions that are currently discouraging TI determinations.

Disadvantages: Some federal and state cleanup programs may prefer to use program flexibilities other than TI for DNAPL source zones. For these programs, a supplemental TI guidance would have limited usefulness. Providing guidance on the TI decision process, without guidance on the types of sites where source depletion should (or should not) be included as a remediation goal (Option 6) may not be very helpful in determining when DNAPL source reduction should (or should not) be attempted.

Option 4 - Develop a policy memorandum re-emphasizing existing EPA policy that program flexibilities are to be used for DNAPL source zones as a means of setting cleanup goals that are achievable in a reasonable time frame. Such program flexibilities may include TI determinations, containment zones, ground water classification exemptions, or similar flexibilities that are available at a particular site from either the federal or state cleanup program overseeing the cleanup at that site. The memorandum would reiterate EPA's current policy that cleanup goals for DNAPL source zones should not include restoration of ground water to drinking water standards, if this goal cannot be achieved in a "reasonable time frame" based on site conditions.

Advantages: No additional studies would be needed to develop such a policy. This is not a policy change because EPA's cleanup expectations (as stated in the regulations for Superfund) are to: "... return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site" (Federal Register, 1990; §300.430 (a)(1)(F)). This memorandum would clarify EPA's national policy on cleanup expectations for DNAPL source zones, clarify that cleanup goals should be scientifically defensible, and apply only to sites where DNAPL source zones have been delineated.

Disadvantages: Such a policy memorandum would be similar to a policy issued by OSWER in 1995 (EPA, 1995), which has had little discernable effect on remedy decisions. No guidance would be provided on the types of sites where source depletion should (or should not) be included as a remediation goal, and therefore, would not provide much useful guidance to decision makers. This policy would only apply to sites where the DNAPL source zone has been delineated, which may be a small minority of sites. It is not clear whether such a policy memorandum would provide an incentive to delineate such source zones. Providing guidance on "reasonable time frame" may be difficult. This option does not address any of the concerns regarding TI determinations (Problem 8). Since there is currently insufficient guidance regarding what a "reasonable time frame" is for attaining cleanup goals, this policy may not be helpful unless this question is also addressed.

Option 5 - Develop guidance on recommended methods and approaches for delineating the extent of the DNAPL source zone.

Advantages: This guidance would explain which characterization methods, including newly developed and conventional tools, are most helpful in delineating the spatial extent of the

DNAPL zone. This would update existing guidance. This may encourage more site managers to characterize the DNAPL zone.

Disadvantages: There may not be a clear consensus on which characterization methods are most helpful. If there is no such consensus, then additional research and demonstration projects will need to be completed before such a guidance can be initiated (Project D). To be useful this document will need to do more than simply describe field methods. It will also need to address how field data should be evaluated, level of detail needed for delineation of the DNAPL source zone as a function of the types of remedies being considered, value to be placed on direct versus indirect indicators of DNAPL, and other considerations.

Option 6 - Develop guidance providing a qualitative approach for determining when source depletion technologies should be implemented, or should not be implemented. This guidance would attempt to identify types of site conditions where:

- MCLs are potentially achievable in the DNAPL source zone;
- MCLs are not likely to be achieved;
- Benefits of source depletion efforts tend to outweigh disadvantages; and
- Types of sites where source depletion should be included as a remediation goal (regardless of whether or not MCLs are likely to be achieved within the DNAPL source zone).

A*dvantages:* This would provide a useful decision-making tool. No such guidance currently exists. This project was included in the recommendations of a recent national panel report (EPA, 2003). It may encourage delineation of the DNAPL source zone.

Disadvantages: There is currently a lack of well documented case studies, and therefore, a lack of scientific consensus on these topics. Consequently, this project may not be feasible at present. A separate project to evaluate existing data from sites where DNAPL source depletion efforts were undertaken (Project A) would need to be completed before such a decision making approach could be developed. Also, results of this data evaluation (Project A) may be inconclusive. If results of Project A are inconclusive, then additional research and demonstration projects will need to be completed before such a guidance can be initiated (Project D).

Option 7 - Develop guidance on performance measures for the effectiveness of DNAPL mass removal, and on how to determine when active DNAPL removal efforts should be discontinued. Such measures could include trend analysis for mass removal rates, mass flux data, or other parameters for gauging remedy performance.

Advantages: Currently there is no EPA guidance on this topic. This guidance may encourage more site managers to include DNAPL depletion as a cleanup goal for the source zone, and spur wider use of technologies designed to attain this goal. May encourage delineation of the DNAPL source zone.

Disadvantages: There may not be a clear consensus on which performance measures are most helpful. Additional research and field testing of technologies for measurement of mass flux and other potential performance measures (Project C) are needed before these methods can be included in such a guidance.

Option 8 - Develop guidance describing improved methods for comparing long-term remedies, which would allow a more realistic accounting of the costs and other disadvantages of long-term custodial care. This would include long-term costs of maintaining containment systems, equipment replacement, monitoring and enforcing institutional controls, and site monitoring.

Advantages: Currently, there is no EPA guidance on this topic. This guidance would allow EPA to start fresh with new ideas for 1) utilizing the latest technologies; 2) being responsive to a wide spectrum of stakeholders, including state and local governments, environmental groups, and the general public; and 3) comparing costs and reliability issues associated with long-term custodial care.

Disadvantages: Currently there is no consensus on how to do such a comparison. Therefore, this project may not be feasible at present. No research activities are currently planned to develop or test potential improved methods for comparing long-term remedies.

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Table 1: Cleanup Goals Appropriate for DNAPL Source Zones: Matrix Summary of Problems Addressed by Each Option								
	Options (primary focus)*							
Problem Statements	**1 p**	**2 p**	**3 p**	**4 p**	**5 t**	**6 t**	**7 t**	**8 t**
1. Cleanup to MCLs not a realistic goal for DNAPL zones, yet alternative goals are rarely used.	1**	2	2	2	1	2	2	2
2. Overly stringent cleanup goals inhibit use of existing technologies.	1	2	2	2	1	2	2	2
3. Alternative goals often can't be applied because DNAPL zone has not been distinguished from overall plume.	1	2	1	1	3	1	2	
4. Alternative goals have uncertain reliability and long-term costs.							3	3
5. No accepted performance measures for effectiveness of DNAPL mass removal.							3	2
6. Potential benefits of DNAPL mass removal outweighed by disadvantages.	1					2	1	1
7. Setting appropriate cleanup goals for DNAPL zones is also a concern when revisiting operating remedies.	1	2	2	2	1	2	3	3
8. Should be able to revisit TI decisions.			3	2		1		

NOTES:

* Initial/primary focus of option: **p**=policy; **t**=technical and/or research study

** **3** = Option provides significant contribution to resolution of problem.
2 = Option provides some help to resolution of problem.
1 = Option may provide help to address problem.

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Attachment B

Discussion Paper: Ground Water Use, Value, and Vulnerability as Factors in Setting Cleanup Goals

This paper reflects the GWTF's research, analysis and findings as of May 10, 2004 when it was originally posted at http://gwtf.clu-in.org/papers/. The version of the paper included in this report has been modified to reflect updates to web links that were available as of December 2007. Note that Kenneth Lovelace is no longer the contact for this issue paper as mentioned on page B-6. For more current information on the subject, contact Guy Tomassoni (tomassoni.guy@epa.gov) of OSWER's Center for Program Analysis.

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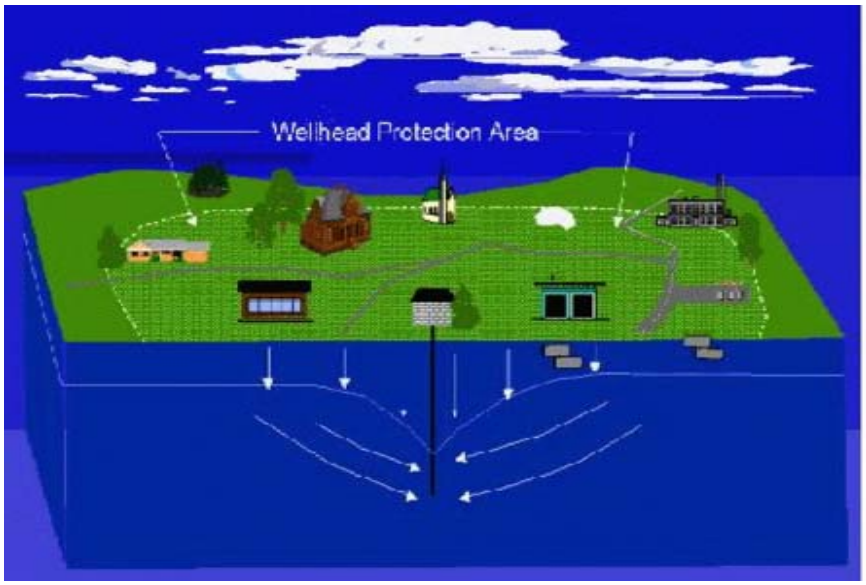
Ground Water Use, Value, and Vulnerability as Factors in Setting Cleanup Goals

Issues/Options paper developed by the Cross-Program Ground Water Task Force
Established under EPA's One Cleanup Program



Introduction

Notice: It is very important to note that this paper has been prepared by EPA's Ground Water Task Force for informational purposes only. This paper does contain some discussion summarizing EPA's statutory authorities and regulations. However, this paper does not constitute an EPA statute or regulation and does not substitute for such authorities. In addition, the statements in this paper do not constitute official statements of EPA's views and are not binding on EPA or any party.

This options paper is being developed by EPA's Ground Water Task Force, a workgroup established under the One Cleanup Program of the Office of Solid Waste and Emergency Response (OSWER).[19] This task force is comprised of EPA and state regulatory officials, and was formed to:

- serve as the main technical / policy / communication / networking resource for OSWER on ground water issues;
- promote cross-program coordination and communication on technical and policy issues related to the cleanup of contaminated ground water;
- identify and prioritize and work to solve and/or provide guidance on ground water issues and projects that will benefit multiple programs; and
- assign subgroups to work on priority issues, and/or making recommendations to EPA senior management on the best course of actions for such issues.

In carrying out its purpose, Ground Water Task Force representatives discussed with senior EPA and state managers a variety of implementation challenges cleanup programs face with respect to setting ground water cleanup goals.[20] One of those challenges, which was identified as a priority issue, is associated with differing perspectives on how ground water use, value and vulnerability (see Highlight Box on the following page) should influence site-specific ground water cleanup goals. The purpose of this paper is to promote dialogue by providing a brief background, followed by differing stakeholder points of view (based on written or anecdotal input) with respect to problems and/or challenges, and potential options for addressing these problems. Stakeholders include federal and state regulatory officials, and members of the regulated community, as well as environmental and public interest groups.

These points of view do not necessarily represent the position of EPA and are provided to assist in framing the issues presented. The Ground Water Task Force recognizes that other problems and options may exist, and no decisions have been made at this point with respect to which option(s) the Agency may pursue. Readers are encouraged to provide their comments on the paper and to suggest solutions they believe the Agency should consider to

[19] For more information concerning the EPA's One Cleanup Program, refer to http://www.epa.gov/swerrims/onecleanupprogram/index.htm. For more information concerning the One Cleanup Program Ground Water Task Force, refer to http://gwtf.cluin.org/.

[20] Oral presentation and discussion on March 4, 2003 before the Cleanup Programs Council, an advisory group for the OSWER One Cleanup Program.

Ground Water Use, Value and Vulnerability
(Definitions provided for the purpose of this paper)

Ground water use typically refers to the current use(s) and functions of ground water as well as future reasonably expected use(s). Ground water use can generally be divided into drinking water, ecological, agricultural, industrial/commercial uses or functions, and recreational. Drinking water use includes both public supply and individual (household or domestic) water systems. Ecological use commonly refers to ground water functions, such as providing base flow to surface water to support habitat; ground water (most notably in karst settings) may also serve as an ecologic habitat in and of itself. Agricultural use generally refers to crop irrigation and live-stock watering. Industrial/commercial use refers to in any industrial process, such as for cooling water in manufacturing, or commercial uses, such as car wash facilities. Recreational use generally pertains to impacts on surface water caused by ground water; however, ground water in karst settings can be used for recreational purposes, such as cave diving. All of these uses and functions are considered "beneficial uses" of ground water. Furthermore, within a range of reasonably expected uses and functions, the maximum (or highest) beneficial ground water use refers to the use or function that warrants the most stringent ground water cleanup levels. (see Figure 1 reflecting ground water use in the United States.)

Ground water value is typically considered in three ways: for its current uses; for its future or reasonably expected uses; and for its intrinsic value. Current use value depends to a large part on need. Ground water is more valuable where it is the only source of water, where it is less costly than treating and distributing surface water, or where it supports ecological habitat. Current use value can also consider the "costs" associated with impacts from contaminated ground water on surrounding media (e.g., underlying drinking water aquifers, overlying air— particularly indoor air, and adjacent surface water). Future or reasonably expected values refer to the value people place on ground water they expect to use in the future; the value will depend on the particular expected use or uses (e.g., drinking water, industrial). Society places an intrinsic value on ground water, which is distinct from economic value. Intrinsic value refers to the value people place on just knowing clean ground water exists and will be available for future generations, irrespective of current or expected uses. While the value of ground water is often difficult to quantify, it will certainly increase as the expense of treating surface water increases, and as existing surface water and ground water supplies reach capacity with continuing development.

Ground water vulnerability refers to the relative ease with which a contaminant introduced into the environment can negatively impact ground water quality and/or quantity. Vulnerability depends to a large extent upon local conditions including, for example, hydrogeology, contaminant properties, size or volume of a release, and location of the source of contamination. Shallow ground water is generally more vulnerable than deep ground water. Private (domestic) water supplies can be particularly vulnerable because (1) they are generally shallower than public water supplies, (2) regulatory agencies generally require little or no monitoring or testing for these wells, and (3) homeowners may be unaware of contamination unless there is a taste or odor problem (EPA, 2003). Furthermore, vulnerability can change over time. For example, anthropogenic activities, such as mining or construction, can remove or alter protective overburden thus making underlying aquifers more vulnerable.

address the problems stated in this paper and/or other problems not mentioned herein. As conveyed in this document, any additional option submitted should describe the particular problem(s) it would address, as well as associated advantages and disadvantages. These comments will be used in planning future activities of the task force and in developing recommendations for EPA senior managers on a course of action to address the issues raised in this paper.

Questions or comments concerning this paper should be directed to Ken Lovelace and sent via email to gwtf@emsus.com **by July 31, 2004.** Copies of this paper can be obtained from the Ground Water Task Force website: http://gwtf.cluin.org/.

EPA recognizes that some stakeholders are concerned that raising issues addressed in this paper may generate pressures to change existing approaches, promote debates that slow down cleanup decisions, and ultimately affect the ability of regulatory programs to impose and achieve cleanup goals. However, the task force believes that avoiding these issues would not be responsive to other concerns raised during stakeholder meetings held by the Agency in 2003 concerning the goals of the One Cleanup Program. Additional stakeholder meetings are planned specifically for this and other options papers developed by the task force. By including states on the task force and promoting public dialogue on these ground water issues, the Agency is attempting to fairly balance all of these concerns.

Background

Since the 1970s, EPA and states have enacted a number of laws and regulations (as well as supporting initiatives, guidance, and policies) concerning both the protection as well as cleanup of contaminated ground water. To date, the most concise, cross-programmatic statements concerning EPA's ground water related policies were provided in the document titled, "Protecting the Nation's Ground Water: EPA's Ground Water Strategy for the 1990s" (EPA, 1991). Several of the key principles, findings, and recommendations are presented below.

Overall Goal:

- "The overall goal of EPA's ground water policy is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the nation's ground water resources."

With respect to remediation:

- "Ground water remediation activities must be prioritized to limit the risk of adverse effects to human health first, and then to restore currently used and reasonably expected sources of drinking water and ground water closely hydrogeologically connected to surface waters, whenever such restorations are practicable and attainable."

- "Given the costs and technical limitations associated with ground water cleanup, a framework should be established that ensures the environment and public health benefit from each dollar spent is maximized. Thus in making remedial decisions, EPA must take a realistic approach to restoration [of contaminated ground water] based

upon actual and reasonably expected uses of the resource as well as social and economic values."

With respect to federal, state and local responsibilities:

- "The primary responsibility for coordinating and implementing ground water protection programs has always been and should continue to be vested with the states. An effective ground water protection program should link federal, state, and local activities into a coherent and coordinated plan of action."

In the early 1990s, EPA encouraged states to institute Comprehensive Ground Water Protection Programs (EPA, 1992). The basic goal of the CSGWPP-partnership between the states and EPA is to achieve a more efficient, coherent, and comprehensive approach to the nation's ground water resources. More specific goals of an individual State CSGWPP are to consider ground water use, value, and vulnerability in setting priorities for both prevention and remediation.

EPA's cleanup programs fully supported CSGWPPs in their directive titled, "The Role of CSGWPPs in EPA Remediation Programs" (EPA, 1997a). While relatively few states have pursued CSGWPPs (see http://cfpub.epa.gov/safewater/sourcewater/) many other states have over the years developed other approaches to designate ground water based on use, value, and vulnerability. Some of the many approaches, which are often used as factors in setting ground water cleanup goals, include:

- formal state-wide (mapped) classification systems (see for example, Connecticut's system at http://www.ct.gov/dep/cwp/view.asp?a=2698&q=323132&depNav_GID=1707 , and ground water classification exception areas (see for example, New Jersey's provisions at http://www.state.nj.us/dep/srp/dl/ceaguid2.pdf).

- non-degradation policies (e.g., Rhode Island, Maine, Wyoming) that recognize all ground water as a source of drinking water;

- states that presume as a starting point that all ground water is a potential source of drinking water, but allow for site-specific variations of that classification (see for example, Michigan waiver provision available at http://www.michigan.gov/deq/0,1607,7-135-3311-58095--,00.html and their guidance on Ground Water Not In An Aquifer (GWNIAA) determinations available at http://www.deq.state.mi.us/documents/deq-wmd-swp-gwnia-ftp.pdf.

- urban use designations as part of voluntary and brownfield cleanup bills (see for example Ohio's Urban Setting Designations available at http://www.epa.state.oh.us/derr/vap/docs/fact8.pdf.

- ground water management zone approaches that recognize impairment (which allows for long-term responses like natural attenuation) without changing a ground water classification (see for example, Illinois' Ground Water Management Zones (http://www.epa.state.il.us/land/regulatory-programs/permits-and-management/establishing-groundwater-management-zone.html) and California's

Containment Zone Policy http://www.swrcb.ca.gov/plnspols/docs/wqplans/res92-49.html), and

- Nebraska's approach to designating and classifying ground water, and their ground water remediation protocol available Title 118, Chapters 6, 7, and 8 and Appendix A. (available at http://www.deq.state.ne.us/RuleAndR.nsf/pages/118-TOC).

Later in the 1990s, Congress amended the Safe Drinking Water Act placing a new focus on assessing and protecting sources of drinking water (see EPA, 2003b). The basic elements of source water assessment and protection include delineating areas of ground water and surface water that supply public drinking water systems, assessing those areas with respect to susceptibility of the drinking water sources to actual or potential sources of contamination, and developing protection/management strategies and contingency plans. EPA anticipates that these delineated source water areas will help to focus both protection and remediation activities.

Regulations and supporting policy and guidance for the three federal cleanup programs (Superfund, RCRA Corrective Action, Underground Storage Tanks) address the role of ground water use, among other factors, in setting cleanup goals. For example, the Superfund Rules of Thumb for Remedy Selection (EPA, 1997b) provides regulatory references and guidance pertaining to selecting cleanup goals for ground water that is a either a current, potential, or not anticipated to be a source of drinking water. The Handbook of Ground Water Protection and Cleanup Policies for RCRA Corrective Action (EPA, 2002) addresses setting cleanup goals based on various designated uses of ground water. In approving protective corrective action plans for releases from underground storage tanks, 40 CFR 280.66 (http://www.epa.gov/swerust1/fedlaws/cfr.htm) specifies a number of factors to be considered. These include the hydrogeologic characteristics of the facility and the surrounding area, and the proximity, quality and current and future uses of surface water and ground water in the surrounding area.

Problem Statements

For the purpose of this options paper, the Ground Water Task Force developed generalized problem statements based on written and anecdotal information. However, the problem statements listed below do not necessarily represent the position of EPA. Rather, these problem statements attempt to capture the perspectives of various stakeholders, such as federal and state regulatory officials, members of the regulated community, and environmental and public interest groups. Also, individual opinions can vary as much within these respective groups as between them. Furthermore, these problem statements are not listed in any order of importance or priority, and do not represent all possible points of view associated with the role of ground water use, value, and vulnerability in setting cleanup goals.

1. There does not appear to be enough awareness by the general public, regulated community, and government officials pertaining to the various ground water functions, associated values and vulnerability of drinking water supplies to contamination. Adding to this problem is the lack of awareness and understanding of how aquifers are connected to other aquifers and to surface water, as well as long-term aspects of contaminant migration. Furthermore, there is uncertainty with respect to how various contaminants (individually and cumulatively) affect public health and environmental quality.

2. There appears to be an increasing demand for reliance on exposure controls rather than cleaning up contaminated ground water. Decisions not to cleanup may be short-sighted with regard to increasing future demands for clean drinking water supplies.

3. There is a lack of agreement among stakeholders regarding methods to determine which ground waters are "reasonably expected" to be a source of drinking water, and how those decisions should influence cleanup objectives. For example, some programs require cleanup to drinking water standards only for ground water currently planned to be used as a drinking water supply rather than considering multi-generational long-term needs. Other programs require cleanup to drinking water standards for ground water that, in the view of some stakeholders, would never be used as drinking water supply due to insufficient quantity and quality. A related problem is the lack of clear direction on determining appropriate levels or degree of cleanup for ground water not determined to be a reasonably expected source of drinking water.

4. Ground water cleanup activities and decisions are often not prioritized in a manner that would result in addressing the most pressing needs or maximizing the public health benefit of monies spent.

Options for Addressing Problems

The options listed below are intended to address one or more of the problems identified above. It is assumed that the statutory and regulatory framework for EPA cleanup programs will not change in the near future, so all options fall within the current framework for these programs. It is also assumed that training and outreach activities are an essential component of each option. Furthermore, in evaluating options, the Agency will take into account resource needs in terms of time, staff and dollars. A brief discussion of advantages and disadvantages is included for each option. A matrix table showing the problems addressed by each option is included as Table 1.

Option 1 - Develop a series of educational fact sheets and Internet training seminars (targeted primarily to government officials and members of the regulated community) to raise awareness of ground water use, value, and vulnerability, interconnection between ground water and surface water systems, and health impacts to contaminants most commonly found in ground water. This effort would include summaries of the findings from the upcoming 2004 Ground Water report to Congress.

Advantages: This option would help to address problem #1 and would build on EPA's ground water valuation studies conducted in the early 1990s. It also may also help address problem #2 by helping people understand the implications of current trends in ground water cleanups.

Disadvantages: It wouldn't likely provide much benefit with respect to other identified problems.

Option 2 - Conduct research on the impacts on other developed nations that have resulted from either the presence or lack of strong ground water protection programs.

Advantages: This option would help address problem #1 and may also help address problem #2 by helping people understand the implications of current trends in ground water cleanups.

Disadvantages: It would only provide information and would not in and of itself promote any direct changes.

Option 3 - Develop summaries of how individual EPA and state cleanup programs consider ground water use, value, and vulnerability in setting cleanup goals (e.g., ground water classification and classification exception systems, ground water management zone type approaches). These summaries would be written with Internet links to more detailed resources. EPA would provide access to these summaries via its One Cleanup Program website. This option could also involve low-cost Internet training to raise awareness of the range of approaches being used by EPA and states.

Advantages: This option would address, to various degrees, most of the identified problems. For example, providing access to these summaries could address problems 1 and 2 by raising awareness of EPA and state efforts to protect valuable ground water resources. Also, it could potentially lead to broader acceptance of successful approaches that respond to problems 3 and 4. In particular, it would highlight approaches used by states to distinguish between situations where a drinking water pathway should or should not be considered in site-specific risk evaluations. Additionally, these summaries and the associated resource links would help ensure that interested stakeholders were more fully aware of the flexibilities within a particular program. Lastly, the training element of this option would increase the visibility and understanding of the various approaches being used.

Disadvantages: One of the key disadvantages of this option is keeping current the needed information. Another disadvantage is that it would highlight programmatic differences that may result in unwanted pressure on some programs to adopt changes to the way in which they currently set ground water cleanup goals.

Option 4 - Takes option 3 one step further by developing an EPA policy memo that explains how EPA cleanup programs acknowledge the various approaches used by states in setting ground water cleanup goals based on ground water use, value, and vulnerability. For example, the policy statement would clarify how state ground water management zone policy could influence goals established under EPA's cleanup programs. Internet training could also be used to increase awareness and understanding of the policy statement.

Advantages: This option offers the same advantages as Options 3 with the added benefit of clarifying EPA's policies on the subject.

Disadvantages: This option is associated with same disadvantages posed by Options 3. An additional disadvantage would be a clear statement of policy on the subject, which may in some circumstances limit flexibility desired by some stakeholders.

Option 5 - Using information from federal and state cleanup programs, develop a general framework that describes how to prioritize sites according to problem severity and ground water use, value, and vulnerability. This framework would clearly describe how ground water use, value, and vulnerability as well as specific problem magnitude (e.g., risk) can be used to prioritize sites and influence remedial decisions. This framework would describe how a prioritization system directed at site-specific ground water problems can work within statewide general classification systems and how, for example, ground water management zone policy could influence goals established under EPA's cleanup programs.

Advantages: This option would address many of the problems identified by encouraging consistency across programs, and by defining the key variables (use, value, and vulnerability) that should be considered in remedial decisions.

Disadvantages: This option would be fairly resource intensive in terms of federal and state staff and contractor support needed to develop the framework. The objective of this option would be similar in many ways to EPA's Office of Water initiative in the early 1990s to promote Comprehensive State Ground Water Protection Programs (CSGWPPs). Therefore, this option may be associated with many of the challenges realized in the CSGWPP initiative.

Option 6 - Use defined Source Water Assessment Program (SWAP) areas (required by the 1996 amendments to the Safe Drinking Water Act) to promote consistency in ground water cleanup decision making. The option would involve establishing a means that would encourage stakeholders to become more aware of and involved with various ground water cleanups taking place within or near an individual Source Water Assessment Area. The objective would be that cleanups could be selected to maximize efficiencies and benefits within a particular source water area.

Advantages: This option would specifically address most of the identified problems. States have completed their SWAP delineations. These areas, which include both ground and surface water and ground water-surface water interaction, could be used to help address ground water cleanup and other ground water management related issues. This option could promote greater consistency in cleanup goals, at least within source SWAP areas. Additionally, Source Water Assessments are based on a relatively new program that has significant public interest.

Disadvantages: Reluctance of states to release detailed SWAP information. It does not address private water supplies. Additionally, coordination among cleanup projects within a Source Water Area could be viewed by some as an additional hurdle that could cause delays.

Option 7 - Promote and provide funding assistance for regular meetings within an individual state or watershed that brings together the various programs and stakeholders involved with ground water cleanup and protection. One of the objectives of these meetings would be to help prioritize cleanup actions based on factors, such as magnitude and extent of ground water contamination, as well as ground water use, value, and vulnerability.

Advantages: Depending on the planning and agenda, these meetings could help address most of the stated problems. Topics could include, for example: trends in ground water use, progress of ground water cleanups; coordination of success stories; training on new technologies, guidance, policy, etc.

Disadvantages: As noted in the opening paragraph to these options, the ability to support and implement these meetings may be limited by available resources.

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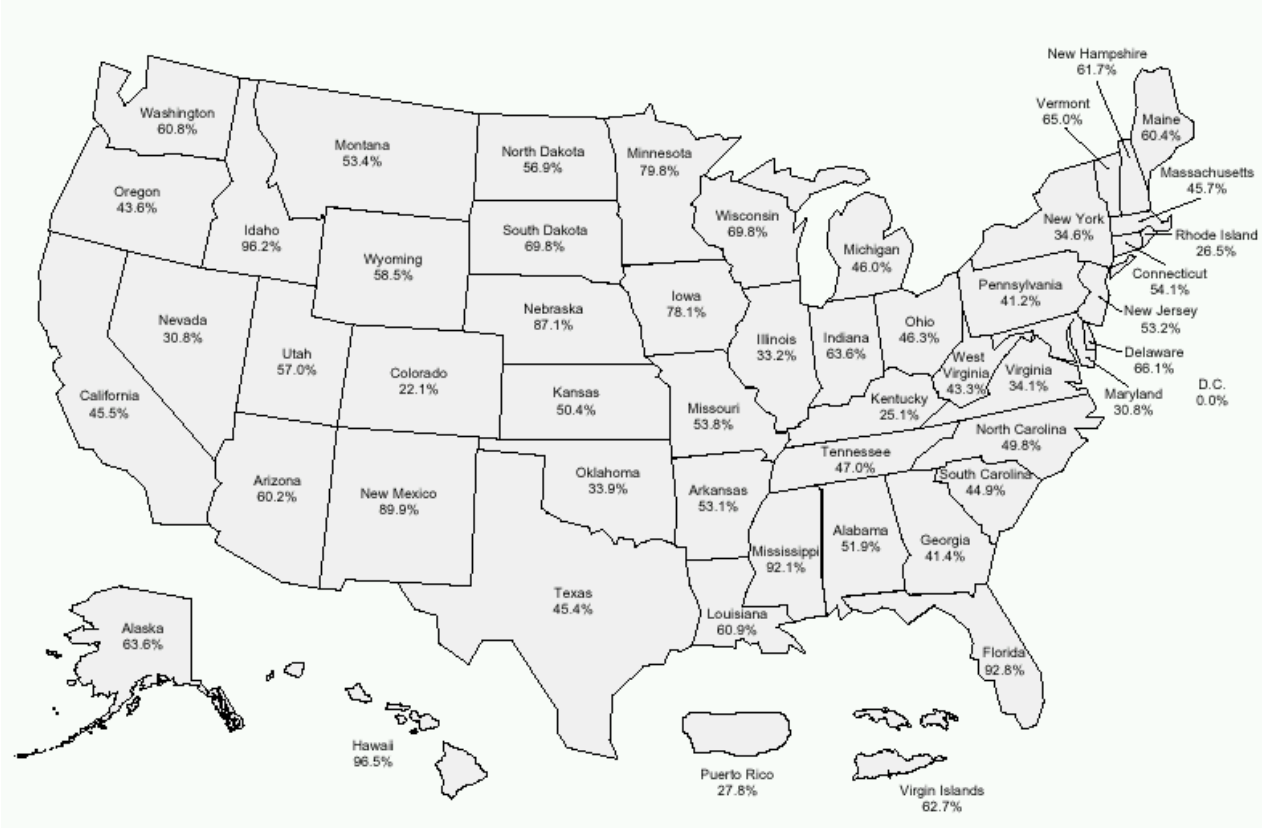
Figure 1
Ground Water Use by States
(Solley et. al, 1998)



The Role of Ground Water Use, Value, and Vulnerability (UVV) in Setting Cleanup Goals: Matrix of Options Addressing Identified Problems				
	Problem #1: Insufficient recognition of ground water UVV.	Problem #2: Trend toward exposure controls over cleanup.	Problem #3: Lack of agreement on identifying future ground water use decisions and how UVV should influence cleanups.	Problem #4: Ground water cleanup activities/decisions often not prioritized to maximize benefits.
Option #1: Fact sheets and education on ground water UVV.	3	1	1	1
Option #2: Research other countries' ground water programs.	2	2	1	1
Option #3: Summaries and education on how programs consider ground water UVV in setting goals.	2	2	3	3
Option #4: New policy and training on ground water UVV in setting cleanup goals.	1	3	3	3
Option #5: Create framework for prioritizing cleanups based on ground water UVV.	1	3	3	3
Option #6: Use SWAP areas to promote greater consistency in ground water cleanups.	1	3	3	3
Option #7: Promote ground water cleanup coordination meetings.	2	2	2	2

3 = Option provides significant contribution to resolution of problem.
2 = Option provides some help to resolve the problem.
1 = Option may provide help to address problem.

Attachment C

GWTF Web Page

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CLU-IN

EPA United States Environmental Protection Agency

Ground Water Task Force

News
Upcoming Events
Discussion Papers
Examples of Cleanup Approaches
Cross-Program Resources
Task Force Meeting Summaries
Task Force Members
Member Program Descriptions
Contact the Task Force

Ground water is an essential national resource - over half of the U.S. population relies on it for drinking water. However a large percentage of the nation's contaminated sites impacts ground water. And ground water contamination is usually very difficult to characterize and clean up, often requiring decades of treatment and monitoring. Almost every cleanup program must devote a significant level of attention and resources to ground water issues.

Each ground water contamination problem is uniquely complex, yet there are many common issues related to the management and cleanup of these problems. It is important that the nation's cleanup programs share the knowledge of their unique ground water problems and work together to ensure the most effective, efficient and protective ground water cleanups.

Task Force Purpose:

- The task force will serve as the main technical / policy / communication / networking resource for OSWER on ground water issues.
- The task force will promote cross-program coordination and communication on technical and policy issues related to the cleanup of contaminated ground water.
- The task force will identify, prioritize and work to solve and/or provide guidance on ground water issues and projects that will benefit multiple cleanup programs.
- For priority issues and projects, the task force will either assign a subgroup to work on the issue, or make recommendations to EPA senior management on the best course of action.

The Ground Water Task Force is one component of EPA's One Cleanup Program, which is integrating the assessment and cleanup efforts of solid and hazardous waste cleanup programs to increase the speed and efficiency of environmental cleanups and improve the sharing of information with affected citizens. Task Force efforts are conducted under Initiative I: More Effective and Consistent Cleanups of the One Cleanup Program, and general Task Force information is also available within this portion of the One Cleanup Program web site.

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Attachment D

Individuals and Organizations that Submitted Comments on One or Both Discussion Papers

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Individuals and Organizations that Submitted Comments on One or Both Discussion Papers

EPA
Robin Anderson, OSRTI
Philip Berger, OW
Andy Crossland, Region 2
Richard Freitas, Region 9
Rene Fuentes, Region 10
Elizabeth Janes, Water Office Region 9
Marcella Hutchinson, Region 8
Dave Jenkins, Region 4
Jeff Johnson, RCRA Region 7
Mitch Kaplan, Region 9
Steve Mangion, ORD Region 1
Kevin McCormack, OW
Carol Monell, Region 4
Wayne Naylor, RCRA Region 3
Howard Orlean, Region 10
Lisa Price, RCRA Region 6
Roy Simon, OW

Other
Pierre Sargent, United States Geological Survey

Private Sector/Regulated Community
Richard Kapuscinski, ENVIRON International Corporation for General Motors
Kimberly Gates, NAVFAC
Jim Hatton, Earthtech
Harley Hopkins, American Petroleum Institute
Richard Jackson, Intera Inc.
Donald Koch, C.C. Johnson & Malhotra
Lorraine Krupa-Gershman, American Chemistry Council
W. Caffey Norman, (Patton Boggs) TCE Issues Group
Pat O'Hara, Cummings/Riter
John Quarles & Michael Steinberg, Morgan, Lewis & Bockius LLP
Chris Reimer, NGWA
Greg Rucker, Westinghouse Savannah River Company
Bob Schreiber, Camp, Dresser, & McGhee (CDM)
Hans Stroo, Retec
Superfund Settlements Project and RCRA Corrective Action Project
Andre Tartre, Ecoremediation
Laura Yeh, Naval Facilities Engineering Service Center

States
Walter Avramenko, State of Colorado
Dale Bridgford, State of Michigan
Daniel Burke, State of Texas
Judy Canova, State of South Carolina
Tom Gallagher, State of Nevada
John Gelting, State of South Carolina
Ed Jones, State of Washington
Jennifer Kaduck, ASTSWMO
David Larsen, State of Utah
Bob Pierce, State of Georgia
Bruce Stuart, State of Missouri