
**Technical Information Needs of
State Superfund Coordinators
Related to Managing Hazardous-
Waste Sites and Spills: A
Response Report**

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June 1983

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STATE SUPERFUND COORDINATORS
RELATED TO MANAGING HAZARDOUS-
WASTE SITES AND SPILLS: A
RESPONSE REPORT

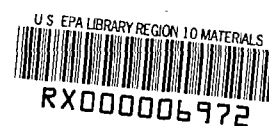
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FOREWORD

This report describes the results of three workshops conducted by Pacific Northwest Laboratory (PNL) under the auspices of the Hazardous Materials Assessment Team, Corvallis Environmental Research Laboratory (CERL), Corvallis, Oregon. The workshops were used to help State and EPA regional representatives identify and rank technical information products for CERL and other Office of Research and Development research laboratories to facilitate emergency and remedial activities at hazardous waste sites and spills. In keeping with the mission of CERL, the workshops focused on, but were not limited to, biological and environmental considerations. Results of the workshops should enable CERL to provide the cognizant EPA research committees and program Offices with recommendations for developing or modifying laboratory programs to meet the needs of their state and regional officials while being consistent with the legislative mandates of the EPA.

SUMMARY

The biological and environmental technical information needs ranked highest by the state Superfund coordinators are as follows:

- environmental criteria for determining extent of cleanup at uncontrolled sites or spills (How clean is clean?)
- guidance for field sampling (environmental and waste)
- guidance for rapid initial screening and decisions to determine appropriate response to a potential site
- field guide describing treatment options and methods (including biological).

This ranking is the result of three workshops sponsored by the Hazardous Materials Assessment Team of the U.S. Environmental Protection Agency's Environmental Research Laboratory in Corvallis, Oregon (CERL). The workshops were held in Philadelphia, Pennsylvania on March 24 and 25, 1983; Atlanta, Georgia on March 28 and 29, 1983; and Denver, Colorado on April 4 and 5, 1983. The workshop participants included state Superfund coordinators from 19 states and individuals from EPA headquarters, regional offices, and EPA laboratories.

A computer-assisted decision-analysis method was used to establish criteria weights for ranking the technical information needs of the workshop participants. Biological and environmental information and services related to management of hazardous-waste sites and spills are within the purview of CERL; however, many nonbiological or nonenvironmental issues were identified by participants. These issues were not deleted from the evaluated list because they provide valuable information that other EPA components can use to define technical information products for use by state and regional Superfund personnel. The nonbiological or nonenvironmental technical information needs ranked highest by the workshop participants are as follows:

- technical information related to the characterization of hazardous materials

- technical descriptions of cleanup alternatives
- guidance related to regulatory and administrative needs of Superfund coordinators
- bibliography of available technical information related to hazardous-waste management.

Frequently in the proceedings of the workshop, various participants would mention particular needs which others indicated were already met. The state representatives seemed to lack knowledge about the availability of existing technical information or seemed to have difficulty using technical information developed for something other than hazardous-waste management. For example, sampling techniques developed for the electrical power industry may be applicable to hazardous-waste management, but state Superfund staffs do not have the resources to find or sufficiently modify this information for their needs. Their expressed needs underscore the fact that technology transfer is often required to make existing knowledge applicable at uncontrolled hazardous-waste sites and spills. It was made clear that basic technical guidance must be presented in a nondetailed, straightforward manner that is applicable to hazardous-waste cleanup activities.

At the end of the workshop, participants critiqued the workshop results and the workshop format. Twenty-two of 23 participants indicated their technical information needs were adequately presented to EPA. Several people noted that they appreciated the opportunity EPA gave them to help develop technical information and services.

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TECHNICAL INFORMATION NEEDS OF STATE SUPERFUND COORDINATORS
RELATED TO MANAGING HAZARDOUS WASTE SITES AND SPILLS:
A WORKING PAPER

INTRODUCTION

The Environmental Protection Agency (EPA) is responsible for the discovery, control and cleanup of hazardous substances and oils released to the environment from spills or from uncontrolled waste sites. The Agency is given this responsibility by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA); the National Contingency Plan of 1982 as amended (NCP); the Resource Conservation and Recovery Act of 1976 (RCRA); and the Federal Water Pollution Control Act of 1972 as amended.

In December 1982, EPA proposed an amendment to the National Contingency Plan. The Amendment includes the National Priorities List (40 CFR Part 300) as Appendix B. Once the National Priorities List is published, EPA projects that the rate of cleanup operations by states will accelerate rapidly. The agency also projects a corresponding increase in requests from states and EPA regions for technical information and services at specific hazardous-waste sites and spills.

Anticipating these requests, CERL asked PNL to conduct a series of computer-assisted decision-analysis workshops to canvass cognizant state and EPA regional representatives about their perceived need for technical-assistance products or services. The workshops were structured to provide a valid consensus of defined and prioritized needs.

This report describes the workshop methods, lists the workshop participants, and presents and discusses the results of the workshops.

WORKSHOP DESCRIPTION

The objective of this project was to determine what kinds of technical information and services are needed by state Superfund coordinators. The EPA will use the list of needs to plan activities that support the efforts of the states to deal with hazardous wastes, both in the context of an emergency response to a spill or sudden release of materials, and in the context of conducting remedial actions to clean up disposal sites. The needs were ranked in order of importance based on a set of criteria developed by the workshop participants. Listing the needs in order of priority along with their rationale (the criteria) provides the EPA with guidance to support development of technical information related to hazardous-waste cleanup.

The three workshops were sponsored by the Hazardous Materials Assessment Team (HMAT) of CERL. The assessment team is charged with evaluating biological and environmental concerns related to Superfund activities. At the workshops, however, the scope of the identified needs extended to nonbiological and nonenvironmental concerns and beyond strict interpretation of the limits of Superfund. The results not within the purview of the HMAT will be made available to other EPA organizations to more fully serve state needs.

Results of the project will serve as one source of information that the HMAT can use to plan future projects. The listing of state needs can be used to help ensure that the limited resources available to HMAT will be used in effective ways to meet the biological and environmental support needed by the states.

METHODS

Three workshops were held to solicit input from representatives of state Superfund coordinators. The workshops were structured to develop a list of needed technical information and technical services in order of priority within a 2-day period. The workshop process was facilitated through use of software developed for a microcomputer that provided

preliminary results at the end of the workshop. The number of participants at each workshop was limited to facilitate open discussion by the participants. By holding the workshops in major cities near the participants, travel time and costs were minimized. Each workshop was conducted in a similar manner, and participants were all provided the same background materials for review before the meetings.

The software used to help facilitate the meetings is called Decision Analysis with Paired Comparisons (DAPC). DAPC was developed by PNL for use in ranking arctic research needs for EPA (States 1982). The software permits participants to have an equal representation in the workshop results and provides a quantitative ranking of issues (in this case, the technical information and service needs) based on scoring of each need against a common set of criteria. Participants developed final lists of criteria and needs from a "strawman" which was presented to them before the workshop. The relative importance of the criteria was determined by the participants, and a weighting factor was assigned to each criterion. The weighting factors were combined with raw scores assigned by each individual to each of the criterion for each need on the list. The sum of weighted raw scores, averaged for the entire group, was used to rank the list. A series of reports, prepared with the software, was available before the end of the workshop for review and comment by the participants. Participants were asked to review these preliminary results and were encouraged to send any additional comments to the PNL authors who were drafting this final report.

At the beginning of the workshops, the objectives of the meetings were described and the DAPC system was introduced. Participants then proceeded to develop a list of technical information needs and a list of criteria to be used for ranking them. Most of the workshop effort involved developing the list, reaching a common understanding of the meanings of the criteria, and reaching consensus on the wording of the items included on the list of needs. Once the lists were developed, the software procedure was used to generate two evaluation forms that each participant was asked to complete.

The first evaluation provided the data for assigning weighting factors to the criteria. Every possible pair of criteria was considered. Participants indicated, for each pair, which of the two criteria was more important in ranking their needs. These comparisons were used to distribute 100 points among the criteria as weighting factors.

The participants used the second evaluation form to score each of their needs against each of the ranked criteria. A measurement scale [least important (0) to most important (9)] was used for the scoring. In addition, participants could decline to score a particular need against a particular criterion if they wished to defer to the rest of the group for that score.

The software was used to compute the mean raw score of the group for each need against each criterion. Each criterion was then multiplied by its weighting factor, and the resulting products were summed over all criteria for each need. The software listed the needs in ranked order according to the total score given to each need. Small differences among total scores are not significant because of the variance among scores; thus, the relative importance of closely ranked needs cannot be judged accurately. Accordingly, it is most useful to group the needs into categories of priority that include a range of scores. Scores can range from 0 to 900. A high score typically would be anything over 700 points, but needs ranked in the upper 600s could also be considered important.

The ranking analysis can be conducted for subsets of the needs or for subgroups of the participants. The criteria weights and the ranking of needs of a subgroup of participants are based only on the data for the subgroup. At these workshops, several individuals asked for a copy of their individual ranking of needs, and a copy was given to them.

After the workshop, we verified data entry and analyzed the workshop results in detail by examining subsets of the needs and subgroups of the participants. For purposes of this report, we analyzed the data twice: once for the state representatives only, and then for

the entire group at each workshop (which included representatives of some of the EPA regional offices and of other EPA groups).

A "strawman" list of criteria and needs was developed before the workshops to provide a basis for opening discussion (Tables 1 and 2). The "strawman" provided examples of needs and criteria and was used to illustrate the DAPC method. The "strawman" lists, developed in a preliminary workshop attended by PNL and EPA staff, were mailed to participants for their review before the workshops. During each workshop, the participants modified the "strawman" by changing wording and deleting or adding items to it to develop their own list of needs and evaluation criteria. The "strawman" included biological and environmental needs, but participants were invited to include on their final lists any nonbiological and nonenvironmental needs related to hazardous waste and to Superfund activities.

Because the lists of needs and criteria were developed and modified at each workshop, the scores cannot be combined to yield a single, objective ranking of all needs. We noted, however, that there were many similarities among the items listed, and we grouped them by category to aid in understanding the results.

PARTICIPANTS

At least one person from each state and one from each of EPA's regional offices were invited to the workshops. The list of invitees was developed from a list of "state Superfund coordinators" within each EPA region. The regional lists were provided by the cognizant EPA regional Superfund coordinator. Invitees were each sent a letter from the HMAT describing the objective of the workshop and requesting attendance and participation of the addressee or his delegate. The letters were followed up by phone calls made by PNL staff to confirm who the attendee would be. Additional information was sent to those people included on the revised list of attendees. The information included background on the workshop, the "strawman" lists of needs and criteria, and administrative information.

Attendees were offered reimbursement for lodging and meals during the workshop, and several actions were taken to facilitate attendance by those invited to the workshop. Transportation expenses were minimized by holding the workshops in Philadelphia for states in EPA Regions I, II, III, and V; in Atlanta for states in Regions IV, VI, and VII; and in Denver for Regions VIII, IX, and X. Invitees who said they could not attend because of schedule conflicts were given the option of attending one of the other workshops. Twenty-two representatives of 19 states attended the workshops (see list below). The invitees from the other states were sent a form with a post-paid return envelope for providing their technical information needs after the workshops. Although their comments could not be included in the ranked list of information needs, their needs are listed in the Results section of this report.

PHILADELPHIA

<u>STATES</u>	<u>EPA REGIONS</u>	<u>OTHERS</u>
Maryland	III	Corvallis Environmental Research
New Jersey	V	Laboratory, Corvallis, OR
New York		Environmental Response Team, Edison, NJ
Pennsylvania		Regional Services Staff, Washington D.C.
Virginia		

ATLANTA

<u>STATES</u>	<u>EPA REGIONS</u>	<u>OTHERS</u>
Alabama	IV	Corvallis Environmental Research
Arkansas		Laboratory, Corvallis, OR
Florida		Environmental Response Team, Edison, NJ
Kentucky		Municipal Environmental Research
Missouri		Laboratory, Cincinnati, OH
Nebraska		
North Carolina		
Oklahoma		
South Carolina		
Texas		

DENVER

<u>STATES</u>	<u>EPA REGIONS</u>	<u>OTHERS</u>
Idaho	VIII	Environmental Response Team, Edison, NJ
Montana		National Enforcement Investigations Center
Utah		Denver, CO
Washington		

In addition to the state representatives who participated in the workshops, the EPA regional offices were invited to send attendees who could contribute to the objectives of the workshop. Four of the regions were thus represented. Other people who attended were from EPA headquarters in Washington D.C., the Municipal Environmental Research Laboratory in Cincinnati, Ohio, and the National Enforcement Investigations Center in Denver, Colorado. The EPA Hazardous Materials Assessment Team (Corvallis, Oregon) was represented at two of the workshops, and the Environmental Response Team (Edison, New Jersey) participated in all four workshops. The latter group are expected to represent users of the workshop results and were present to clarify the objective of the workshop and to learn firsthand of the needs of the states.

A list of workshop participants, including their affiliation, address, and phone number, is given in Appendix A. The participants were asked to provide information about their training and their involvement with Superfund. Responses were obtained from all participants. Their background training included biology (14), environmental science (8), engineering (9), hydrology (2), and chemistry (2). Most (22) indicated they had a technical supervisory role. Many (10 to 14) indicated a role in administration, policy development, enforcement, or cleanup. In addition, three said they were involved in site evaluations, and two indicated a role in hazard assessment.

Most of the participants (31) have worked in remedial response, and about half (16) have worked on emergency responses. More than half of the participants had worked at one or more Superfund sites or spills

(median = 2 sites), but 11 had no specific site or spill experience, and only 7 had worked at more than 5 sites or spills. One person had experience at over 150 sites and spills.

RESULTS

The workshop results are presented separately for each workshop. The evaluation criteria are listed with the weights assigned to them by the state representatives and the weights assigned to them by all participants. Also listed are the technical information needs of the workshop participants. Technical information needs are presented in two lists: 1) a ranked list of all the technical information needs evaluated by the participants, and 2) a ranked list of the biological and environmental technical information needs. Both lists of technical information needs include the rank and evaluation scores both of the state participants and of all participants.

PHILADELPHIA

Ten criteria were developed and weighted by the workshop participants at Philadelphia (Table 3). The criterion weighted heaviest by the state participants and by all participants, including those representing the states, was "application to development of information for decision process." The evaluation scale for this criterion ranged from a low of "not required or necessary" to a high of "required or necessary." Other heavily weighted criteria included applicability of the technical information to many sites and application to cost-benefit decisions.

Using the criteria listed in Table 3, the workshop participants evaluated 28 technical information needs (Table 4). The highest-ranked technical information needs of the state participants are as follows:

- guidance manual for field sampling (environmental and waste)
- field guide for rapid, onsite screening of hazardous material
- guidance manual for determining effective cleanup levels at uncontrolled sites and spills
- guidance manual for assessing alternative actions at a Superfund site.

These needs were ranked 1, 2, 3, and 4 by the state participants and 3, 4, 1, and 2, respectively, by all participants.

Of the 28 technical information needs ranked at Philadelphia, 16 dealt with biological or environmental aspects of hazardous-waste management. The ranked biological and environmental technical information needs of the Philadelphia workshop participants are listed in Table 5. The highest-ranked needs of the state participants are as follows:

- guidance manual for field sampling (environmental and waste)
- guidance manual for determining effective cleanup levels at uncontrolled sites and spills.

These needs were ranked 1 and 2 by the state participants and 2 and 1, respectively by all participants. The two highest-ranked biological and environmental technical information needs of the state participants were also their highest-ranked needs in the evaluation of all needs.

ATLANTA

Nine criteria were developed and weighted by the workshop participants at Atlanta (Table 6). The criterion weighted heaviest by state participants and by all participants was whether or not the information was "relevant to state Superfund needs." The evaluation scale for this criterion ranged from a low of "irrelevant" to a high of "very important." Other heavily weighted criteria were related to multi-characteristic application, "real world" experience involved in the development of the information, and practicality to cleanup of hazardous-waste sites or spills.

Using the criteria listed in Table 6, the workshop participants evaluated 36 technical information needs (Table 7). The highest-ranked technical information needs of the state participants are as follows:

- environmental criteria for determining extent of cleanup at uncontrolled sites and spills
- guidance manual for containment techniques related to hazardous wastes

- streamlined administrative procedures and guidance for compliance with paperwork requirements at Superfund sites
- cross-referenced data base of hazardous-waste components and associated containment groups.

These needs were ranked 1, 2, 3, and 4 by the state participants and 1, 4, 9, and 2, respectively, by all participants.

Of the 36 technical information needs ranked at Atlanta, 15 were related to the biological or environmental aspects of hazardous-waste management. The biological and environmental technical information needs of the Atlanta workshop participants are ranked in Table 8. One environmental technical information need of state participants was clearly ranked highest. The need is:

- environmental criteria for determining extent of cleanup at uncontrolled sites and spills.

This need was ranked 1 by the state participants and by all participants. This need was also ranked 1 by state participants and by all participants in the evaluation of all needs.

DENVER

Nine criteria were developed and weighted by the workshop participants at Denver (Table 9). The criterion weighted heaviest by state participants and by all participants was "ease of application of the product (practicality)." The evaluation scale ranged from a low of "difficult to understand and use" to a high of "easy to understand and use." Two other criteria were also weighted heavily by the participants: "area of information deficiency" and "site application."

Using the criteria listed in Table 9, the workshop participants evaluated 28 technical information needs (Table 10). The highest-ranked technical information needs of the state participants are as follows:

- guidance for developing public information programs for Superfund sites
- status report of regulations related to exempted and de-listed wastes

- bibliography of reports dealing with cleanup and indexed by waste, media, and treatment technologies
- equipment pool that can be accessed rapidly for use at hazardous-waste sites and spills
- guidance for determining cost-effectiveness of available mitigation activities
- field guide for rapid onsite chemical characterization of hazardous waste.

These needs were ranked 1, 2, 3, 4, 5, and 6 by the state participants and 2, 12, 1, 21, 9, and 8, respectively, by all participants.

Of the 28 technical information needs ranked at Denver, 11 were related to the biological or environmental aspects of hazardous-waste management. The biological and environmental technical information needs of the Denver workshop participants are ranked in Table 11. The needs ranked highest by the state participants are as follows:

- guidance for rapid initial screening and decisions to determine appropriate response to a potential hazardous-waste site
- field guide describing treatment methods and options
- environmental criteria for determining extent of cleanup at uncontrolled sites and spills.

These needs were ranked 1, 2, and 3 by the state participants and 2, 1, and 9, respectively, by all participants. These biological and environmental technical information needs were ranked 13, 14, and 15 by the state participants in the evaluation of all needs. They were ranked 5, 3, and 20 by all participants.

COMBINED RESULTS

The ranked list of biological and environmental technical information needs from the Philadelphia and Atlanta workshops indicate one need at each workshop that is clearly the highest ranked. At Denver, however, three biological and environmental technical

information needs were ranked high and cannot be distinguished using the evaluation score. The highest-ranked need in Atlanta was similar to the third-ranked need in Denver.

Our subjective evaluation of these five technical information needs suggests that there are four high-ranked biological and environmental technical information needs of state Superfund coordinators related to the management of hazardous-waste sites and spills. These biological and environmental technical information needs are as follows:

- guidance manual for field sampling (environmental and waste)
- environmental criteria for determining extent of cleanup at uncontrolled sites and spills
- guidance for rapid initial screening and decisions to determine appropriate response to a potential site
- field guide describing treatment methods and options (including biological treatment).

Nonbiological or nonenvironmental technical information needs were ranked second and fourth at Philadelphia, second, third, and fourth at Atlanta, and first, second, and third at Denver. These eight needs can be categorized into four general technical information needs for hazardous-waste management. The needs that were ranked highest at the three Superfund workshops are as follows:

- technical information related to the characterization of hazardous materials (rank 2 Philadelphia, rank 4 Atlanta)
- technical descriptions of cleanup alternatives (rank 4 Philadelphia, rank 2 Atlanta)
- guidance related to regulatory and administrative needs of Superfund coordinators (rank 2 Atlanta, rank 1 and 2 Denver)
- bibliography of available technical information related to hazardous-waste management (rank 3 Denver).

MAIL RESULTS

Six Superfund coordinators responded by mail to the request for a listing of their technical information needs. Responses were from Arizona, California, Hawaii, Illinois, Mississippi, and Vermont. The most frequently listed needs were related to these three aspects of waste characterization: 1) synergistic toxicity, 2) evaluation of sampling and monitoring gear, and 3) waste mobility in the environment. Also listed by more than one respondent were technical information needs related to: 1) the need to know what technical information is available, 2) protection of waste site workers, and 3) decision criteria related to the cleanup process (i.e., How clean is clean?).

DISCUSSION

The objective of this project was to determine what kinds of technical information and services are needed by state Superfund coordinators. Three workshops were conducted to canvas cognizant state and EPA representatives about their needs. In keeping with the mission of CERL, the workshops focused on, but were not limited to, biological and environmental considerations. We discussed 1) the biological and environmental technical information needs ranked at the workshops, 2) the nonbiological and nonenvironmental technical information needs ranked at the workshops, and 3) critiques of the workshops prepared by the participants.

BIOLOGICAL AND ENVIRONMENTAL TECHNICAL INFORMATION NEEDS

Forty-two biological and environmental technical information needs were presented and evaluated by the participants of all three workshops. The needs can be grouped into seven general categories, which we have listed in chronological order as they might relate to the management of a hazardous waste site or spill. For example, activities expected to occur prior to emergency or remedial action are discussed first, technical information related to cleanup or containment of wastes is discussed second, and post-closure technical information needs are discussed last.

Pre-treatment Site Assessment

Workshop participants identified five areas of technical information they need for assessing a site and gathering information to determine appropriate responses, identify concerns, and rank sites (Table 12). Pre-treatment site assessment was the number one environmental technical information need at the Denver workshop.

Biological Concepts

Biological concepts of hazardous-waste management that were discussed at the workshops included bioavailability, biotransportation, bioaccumulation, and biodegradation. The availability, accumulation, and transport of wastes must be assessed to determine risks, design

monitoring programs, and select the appropriate treatment or cleanup option. Biodegradation is the basis for biotreatment. Seven technical information needs related to these concepts were discussed and evaluated at the three workshops (Table 13).

Bioassay as an Assessment Technique

Bioassays can be used to assess the toxicity of hazardous wastes and determine the "risk" at hazardous waste sites and spills. Technical information needs related to the use of bioassays at hazardous-waste sites and spills were discussed at the three workshops (Table 14).

Risk

Risk and the assessment of risk has many components, such as risks to the public, to site workers, and to the environment. The multi-component aspects of risk are evident by the number of technical information needs discussed and evaluated at the workshops. Ten risk-related technical information needs (almost 25% of the biological and environmental needs) were ranked at the three workshops (Table 15). At Atlanta, the needs ranked 2, 3, 4, 5, and 6 were related to the assessment of risk. At Philadelphia, the needs ranked 4, 7, and 9 were related to risk, and at Denver the needs ranked 4 and 11 were related to risk.

Treatment of Hazardous Waste

Biological and environmental aspects of waste treatment were discussed and ranked at the workshops. Six technical information needs were related to biological treatment techniques and to assessment of environmental impacts of cleanup alternatives (Table 16). The need ranked 2 at the Denver workshop was a field guide describing available treatment methods, including biological techniques.

Hazardous-Waste-Site Monitoring

Workshop participants ranked nine technical information needs related to environmental monitoring of hazardous-waste sites (Table 17). Monitoring needs vary as cleanup at a waste site progresses; monitoring during treatment or cleanup is different from post-closure monitoring. The difference is reflected in the described needs. Five of the

monitoring needs related to general aspects of monitoring; however, three needs were specific to post-closure monitoring. The needs ranked 1 and 2 by the Philadelphia participants related to monitoring. Post-closure monitoring ranked 5, 6, and 7, respectively, at Philadelphia, Denver, and Atlanta.

How Clean Is Clean?

Management of a waste site or spill ends when the site is "clean". Although the participants generally agreed that this determination is a political or legal question at many sites, many technical considerations need to be addressed. The technical aspects of "How clean is clean?" were discussed at all workshops. Technical guidance related to this question was ranked 1st at Atlanta and 3rd at Philadelphia and Denver (Table 18).

NONBIOLOGICAL AND NONENVIRONMENTAL TECHNICAL INFORMATION NEEDS

Forty-nine nonbiological and nonenvironmental technical information needs were discussed and ranked at the three workshops. They can be grouped generally into four broad categories: 1) nonenvironmental aspects of site and waste characterization, 2) access to available technical information, 3) legal and administrative aspects of hazardous-waste management, and 4) cost-effectiveness of waste-management decisions. Twenty-three of these technical information needs are related to site and waste characterization. Needs discussed and ranked include development and use of data bases for characterizing waste, assessment of available field and laboratory equipment that can be used at hazardous-waste sites and spills, and development of criteria for use in characterizing wastes.

Nine of the 23 technical information needs were related to a need to know what technical information was available. Discussions at all three workshops were frequently interrupted by a comment that the information was available in a document, or at a particular location, or by calling a particular phone number. Many of the technical information needs of state Superfund coordinators have probably been addressed in

some form, but the information is not always readily accessible, and potential users may not be aware of what technical information is available.

Eight information needs related to legal and administrative aspects of Superfund were discussed and ranked. State participants expressed concern that much of their Superfund responsibilities were administrative rather than technical because of EPA regulations. Participants at the Atlanta workshop suggested that it would be useful to "streamline" EPA regulations at Superfund sites.

The cost-effectiveness of available treatment techniques was important to the state workshop participants. Three information needs were related to cost-effectiveness. In Philadelphia, no needs for information about cost-effectiveness were ranked; however, one of the heaviest-weighted evaluation criteria was related to cost-effectiveness.

FORMAT AND SCOPE OF TECHNICAL INFORMATION

The format and scope of technical information products developed by EPA to assist state Superfund personnel is important because of the varied and complex nature of hazardous-waste management. Hazardous-waste managers must be conversant in or have access to information from a variety of disciplines. For example, waste characterization requires a knowledge of chemistry, site characterization a knowledge of ecology, waste treatment and waste containment a knowledge of engineering, and waste-site monitoring a knowledge of statistics. As indicated by the workshop participant profiles (pages 6-8), state Superfund coordinators have academic training in one discipline, and many coordinators have limited on-scene experience. Because of the broad technical requirements of hazardous-waste management, information developed to guide state Superfund coordinators must provide, but not be limited to, a basic overview of the aspect of hazardous-waste management that is being addressed. Guidance must be directed to provide assistance at the level of decisions made by state and local personnel (Table 3, Criterion 1; Table 6, Criterion 1). For example, state personnel are not generally responsible for engineering design of a cleanup option. They

are responsible for preparing and evaluating proposals from prospective design contractors. Guidance should be directed towards assisting state and local personnel at this level of decision making.

Much of the technical information necessary to manage hazardous-waste sites may already be available. However, the guidance may be beyond the scope of the state Superfund coordinators' needs or be more detailed than necessary for their use. Existing guidance often describes techniques for developing or collecting data to make decisions or guidance is developed particularly for engineering design. Where possible, technical information should be presented for making decisions without requiring the development of new data. Guidance must address available options and questions that have to be asked to determine the utility of solution alternatives for specific problems. For example, is biological treatment of hazardous waste an option at a Superfund site? (Table 11, Rank 2; Table 8, Rank 13, Table 5, Rank 11). Useful guidance related to biological treatment methods should therefore discuss 1) what options are available, 2) what questions must be addressed to determine the utility of the treatment options, and 3) what are the advantages and disadvantages of the available options.

Guidance manuals for field sampling (Table 5, Rank 1) are available (Cochran 1977; States et al. 1978; Weber 1972). Guidance to determine the extent of cleanup (Table 5, Rank 2; Table 8, Rank 1; Table 11, Rank 3) is also available (Melcalf and Eddy 1979; Pojasek 1980; Tolman et al. 1978). These sources of guidance, however, do not adequately address the problems of managing an uncontrolled hazardous-waste site. Superfund staff members at the State level have had difficulty using the available information because they lack the resources necessary to make technology transfers. Therefore, it is essential that guidance documents developed by EPA for state and regional Superfund personnel provide a basic overview of each aspect of hazardous-waste management, provide assistance for making decisions, and apply available technical information to hazardous-waste-site management.

WORKSHOP CRITIQUE

Before the workshop ended, participants were asked to comment on 1) whether or not their technical information needs were adequately presented to the EPA, 2) what they liked or did not like about the workshop, and 3) what they liked or did not like about the workshop objectives. They were also asked to make suggestions for improving the workshop.

Twenty-two of the participants felt their technical information needs were adequately presented to EPA. One state participant did not believe his needs were presented. Many state participants were pleased that EPA extended an opportunity to the states to provide input to the development of technical information they need for managing hazardous-waste sites and spills. One participant commented, "I see this as a very positive experience, and I hope EPA will use this technique of state involvement again." On the other hand, some people expressed doubt that EPA would use the information presented at the workshops. One state participant wrote, "I doubt if EPA will respond effectively to our expressed needs."

The most frequently stated "like" was the open discussions that evolved during the workshops and the opportunity to share needs with other state Superfund representatives. Eleven participants liked the format of the workshops, especially the presentation of preliminary results at the end of the workshop. Only two participants expressed concern over the format. One participant believed that a questionnaire mailed to the group would have provided the same service, and another participant expressed a "basic distrust of statistics."

The most frequently expressed dislike was that the criteria lacked adequate explanation. Most who commented on the criteria stated that the function of the criteria (to evaluate needs) was not adequately explained before the criteria were developed. Six participants stated that more states should have been represented at the workshop. Five participants specifically stated that the workshop invitation did not arrive in time for them to prepare for the workshop. (Invitations were sent out on January 31, 1983. The first workshop began March 24,

1983.) Most of these comments were prefaced with the suspicion that receipt of the invitation and workshop information was an intrastate problem. A typical comment was, "A breakdown in communication within my agency did not allow me to prepare adequately."

Several suggestions were made on how to improve the workshop. The suggestions included: 1) giving more advance information, 2) improving the explanation of the criteria, and 3) facilitating broader participant representation.

The workshop critique also invited "other comments." One participant stated that much of the information requested during the workshop was currently available. This participant stated, "I was really surprised by the lack of knowledge and (technical information needs) availability." Most of the other comments were positive. One participant simply stated "Thank you" to express thanks to EPA for providing the states with an opportunity to identify and rank their technical information needs.

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TABLE 1. Criteria Developed at the "Strawman" Workshop

Ease of application of product: (0 = Extensive training required;
9=minimum training required)

Technical Utility: Cross-Control technology application (0=limited
number of technologies: 9=many technologies)

Temporal need: When is the information needed? (0=the information will
be most useful several years from now: 9=the information is needed
now)

Cross-media application: (0=applicable to only one medium; 9=applicable
to all media)

Enforcement/cost recovery: (0=irrelevant; 9=very important)

Multi-site application: (0=information useful at limited number of
superfund sites; 9=information useful at many superfund sites)

Multi-chemical application: (0=information applicable to limited number
of hazardous chemicals; 9=information applicable to many hazardous
chemicals)

Applicability to other state environmental programs: (0=not applicable;
9=universally applicable)

TABLE 2. Technical Information Needs Ranked at the "Strawman" Workshop

- Field guide for evaluating environmental risk at a Superfund site. What are the risks of delaying cleanup? What are the components of determining risk: to the public?; to the workers?; to the environment?
- Biotransportation assessment: (How much waste is being transported from the waste site by plants and animals?)
- Field guide that defines methods for monitoring wildlife utilization of the waste site
- Data base with rapid access to microbiological degradation data
- Field guide for rapid onsite chemical characterization of hazardous waste
- Guidance manual for special considerations due to unique environmental conditions (e.g., permafrost, rainforest, arid region)
- Guidance manual for designing experiments to assess biotransformation potential of hazardous wastes
- Evaluation of relative efficiency of various bioassay testing procedures
- Guidance manual of procedures to evaluate the potential bioavailability of hazardous materials and transformation products
- Data base of bioavailability of hazardous materials and transformation products
- Summary and review of biotreatment activities at Superfund sites.
Summary to include: sites using biotreatment; contractor; description and evaluation of effort
- List of contractors that have: assessment, biotreatment, or monitoring capabilities. List should include: contractor name, address, capability statement
- Assessment of Superfund sites indicating sites with waste and site characteristics suitable for biotreatment
- Field guide describing biotreatment methods and options
- List of hazardous wastes and applicable biotreatment techniques
- Field guide for determining site compatibility with biotreatment of hazardous wastes

TABLE 2. (contd)

Guidance manual for environmental impact assessment associated with available biotreatment options

Summary of federal legislation as it related to treatment of Superfund sites

Guidance manual for statistical input to field monitoring of waste site cleanup

Guidance manual for use and limitation of available laboratory analytical equipment

Guidance manual for chemical monitoring in soil and water including: detection limits of available methods; problems with available methods

Field guide to biological monitoring at hazardous-waste sites (sampling design, objectives, etc.)

Field guide for post-closure monitoring of Superfund sites

Environmental criteria for determining extent of cleanup at uncontrolled sites or spills. (How clean is clean?)

TABLE 3. Criteria Weights Assigned by Participants at Philadelphia Workshop

<u>CRITERIA WEIGHTS</u>		<u>Criteria Description</u>
<u>State Participants</u>	<u>All Participants</u>	
17	17	Application to development of information for decision process (0 = not required or necessary; 9 = required or necessary)
13	11	Multi-site application: (0 = information useful at limited number of superfund sites; 9 = information useful at many Superfund sites)
12	13	Application to cost-benefit decisions (0 = not applicable; 9 = very important)
10	9	Multi-chemical application: (0 = information applicable to limited number of hazardous chemicals; 9 = information applicable to many hazardous chemicals)
10	11	Temporal need: When is the information needed? (0 = the information will be most useful several years from now; 9 = the information is needed now)
9	9	Ease of application of product: (0 = difficult; 9 = easy)
9	10	Cost of gathering and implementing information (0 = expensive to implement; 9 = low implementation cost)
7	6	Enforcement/cost recovery (0 = irrelevant; 9 = very important)
7	6	Technical/program diversity: Scope of application (0 = limited number of technologies; 9 = diverse application)

TABLE 3. (contd)

CRITERIA WEIGHTS		Criteria Description
<u>State Participants</u>	<u>All Participants</u>	
6	7	Cross-media/program application: (0 = applicable to only one medium; 9 = applicable to all media)

TABLE 4. Ranked Technical Information Needs of Philadelphia Workshop Participants

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
1	771	3	732	Guidance manual for field sampling (environmental and waste): sampling programs; statistical design; equipment.
2	768	4	713	Field guide for rapid onsite hazardous material screening (personal safety, bulking potential, waste compatibility, etc.)
3	767	1	764	Guidance manual for determining effective cleanup levels at uncontrolled sites or spills.
4	755	2	749	Guidance manual for assessing alternative actions at a Superfund site.
5	724	9	689	Guidance manual for statistical input to field monitoring of waste site cleanup.
6	724	5	708	Evaluation of relative hazards due to critical exposure routes.
7	718	23	613	List of contractors that have: assessment, treatment, or monitoring capabilities. List should include contractor name, address, response time, capability statement.
8	713	8	691	Guidance manual for use and limitations of available equipment for in-field analysis of hazardous wastes.
9	709	12	666	Field guide for post-closure monitoring of Superfund sites.
10	702	6	707	Guidance manual for design of feasibility studies at Superfund sites.

TABLE 4. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
11	695	21	622	Guidance manual for ranking sites in terms of potential effects on health and the environment and determining priority for cleanup.
12	694	10	688	Handbook for preparation of health assessments (workers and public-at-large) at a Superfund site.
13	690	18	652	List of EPA oil and hazardous waste technical information available and technical activities in progress.
14	671	13	663	Field guide to biological monitoring at hazardous-waste sites (sampling design, objectives, etc.)
15	667	11	682	Techniques for order-of-magnitude initial analysis (easy to apply in field but with sufficient resolving power to be useful).
16	659	19	652	Guidance manual for use and limitations of available laboratory analytical equipment.
17	657	16	655	Guidance manual for assessing transformation and persistence of hazardous wastes.
18	654	7	696	Field guide for initial assessment of 'risk' at a site.
19	652	17	654	Technical reference manual for geophysical techniques for detection and investigation of waste sites, including: cost, effectiveness.

TABLE 4. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
20	642	25	576	Summary and review of treatment activities at Superfund sites. Summary to include: treatment used; contractor; description and evaluation of effort.
21	630	15	656	Listing of bioassay methods. How can a battery of tests be used for assessments? What tests are available? What are their advantages and limitations?
22	626	20	626	Treatment reference manual describing biotreatment methods and options, including: guidance for determining waste and site compatibility with biotreatment.
23	615	14	662	Handbook for preparation of environmental assessments at a Superfund site.
24	602	24	596	Guidance manual for environmental impact assessment associated with available biotreatment options.
25	585	22	614	Data base of bioavailability of hazardous materials and transformation products.
26	553	27	556	Guidance manual of procedures to evaluate the potential bioavailability of hazardous materials and transformation products.
27	545	28	545	Data base with rapid access to microbiological degradation data.
28	526	26	566	Technical reference manual for remote sensing techniques for detection and investigation of waste sites, including: cost, effectiveness.

TABLE 5. Biological and Environmental Technical Information Needs of Philadelphia Workshop Participants

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
1	771	2	732	Guidance manual for field sampling (environmental and waste): sampling programs; statistical design; equipment.
2	767	1	764	Guidance manual for determining effective cleanup levels at uncontrolled sites or spills.
3	724	5	689	Guidance manual for statistical input to field monitoring of waste site cleanup.
4	724	3	708	Evaluation of relative hazards due to critical exposure routes.
5	709	7	666	Field guide for post-closure monitoring of Superfund sites.
6	695	12	622	Guidance manual for ranking sites in terms of potential effects on health and the environment and determining priority for cleanup.
7	694	6	688	Handbook for preparation of health assessments (workers and public-at-large) at a Superfund site.
8	671	8	663	Field guide to biological monitoring at hazardous-waste sites (sampling design, objectives, etc.).
9	654	4	696	Field guide for initial assessment of 'risk' at a site.
10	630	10	656	Listing of bioassay methods. How can a battery of tests be used for assessments? What tests are available? What are their advantages and limitations?

TABLE 5. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evalu- ation Score</u>	<u>Rank</u>	<u>Evalu- ation Score</u>	
11	626	11	626	Treatment reference manual describing biotreatment methods and options, including: guidance for determining waste and site compatibility with biotreatment.
12	615	9	662	Handbook for preparation of environmental assessments at a Superfund site.
13	602	14	596	Guidance manual for environmental impact assessment associated with available biotreatment options.
14	585	13	614	Data base of bioavailability of hazardous materials and transformation products.
15	553	15	556	Guidance manual of procedures to evaluate the potential bioavailability of hazardous materials and transformation products.
16	545	16	545	Data base with rapid access to microbiological degradation data.

TABLE 6. Sorted Criteria Weights of Participants at Atlanta Workshop

CRITERIA WEIGHTS		
STATE PARTICIPANTS	ALL PARTICIPANTS	
17	16	Relevant to state Superfund needs (0 = irrelevant; 9 = very important)
14	13	Multi-characteristic applicability; including technologies, sites, chemicals, and media (0 = limited applicability; 9 = broad application)
14	14	'Real world' experience involved in development of technical information (0 = theoretical only; 9 = based on experience)
13	15	Practicality to cleanup of hazardous waste sites or spills (0 = not practical; 9 = very practical)
11	12	Cost-effectiveness of implementing product (0 = expensive; 9 = low cost)
11	10	Temporal need: When is the information needed? (0 = extensive training required; 9 = minimal training required)
9	8	Ease of application of product (0 = extensive training required; 9 = minimal training required)
7	7	Frequency of update of technical information (0 = infrequent; 9 = continuous)
3	3	Enforcement/cost recovery (0 = irrelevant; 9 = very important)

TABLE 7. Ranked Technical Information Needs of Atlanta Workshop Participants

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
1	741	1	735	Environmental criteria for determining extent of cleanup at uncontrolled sites or spills (How clean is clean?), including site use considerations. Presented by media. Related to contracting requirements.
2	732	4	716	Guidance manual for containment techniques related to hazardous wastes.
3	726	9	696	Streamlined administrative procedures and guidance to compliance with paperwork requirements at Superfund sites.
4	726	2	716	Cross-referenced data base of hazardous-waste components and associated contaminant groups. Including environmental chemistry, toxicity, industrial use.
5	709	3	716	Summary and review of treatment activities at hazardous-waste sites. Include treatment and monitoring methods used, site contractor, and site and waste characteristics.
6	709	6	704	Accessible list of available technical information.
7	706	5	705	Guidance for determining the most cost-effective cleanup option at uncontrolled hazardous-waste sites.
8	706	11	681	Guidance manual for removal techniques related to hazardous wastes.
9	694	7	699	Data base of hazardous-waste toxicity to human populations.

TABLE 7. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
10	684	8	697	Field guide for rapid onsite physical and chemical characterization of hazardous waste, including: shock sensitivity, water reactivity, compatibility.
11	681	15	665	Comparison of available exposure models for human health risks due to hazardous wastes. Help determine allowable residual concentrations in the environment.
12	678	12	680	Field guide for evaluating environmental risk at a Superfund site. What are the risks of delaying cleanup? What are the components of determining risk: to the public?; to the workers?; to the environment?
13	672	13	677	Guidance for interactive assessment and ranking processes for hazardous-waste sites.
14	670	10	682	Guidance manual for disposal techniques related to hazardous wastes.
15	664	14	668	Guidance for determining hazardous-waste toxicity to human populations.
16	637	16	649	Assessment of available toxicity data related to Superfund sites.
17	631	19	639	Guidance manual for use and limitations of available equipment for in-field analysis of hazardous wastes.
18	631	20	634	Technical reference manual describing background levels and day-to-day chemical use of potentially hazardous materials.

TABLE 7. (contd)

STATE PARTICIPANTS		ALL PARTICIPANTS		TECHNICAL INFORMATION NEEDS DESCRIPTION
Rank	Evaluation Score	Rank	Evaluation Score	
19	624	18	641	Guidance related to decontamination procedures for hazardous-waste site workers and equipment.
20	619	22	615	Field guide for post-closure monitoring of Superfund sites.
21	617	23	609	Assessment of Mitre model utility for Superfund sites (update or modify for Superfund programs).
22	617	17	643	Guidance for establishing when hazardous waste becomes an environmental concern.
23	611	21	628	Guidance manual for chemical monitoring in soil and water, including: detection limits of available methods; problems with available methods.
24	581	25	596	Guidance manual for application of biological assessment techniques to cleanup decisions, including bioavailability, bioaccumulation, food chain transfer.
25	579	24	598	Assessment of techniques to assess leachate characteristics (including, e.g. toxicity test)
26	576	28	584	Guidance manual for use of bioavailability, bioaccumulation and food chain transfer data related to cleanup decisions.
27	567	26	585	Biological considerations of managing hazardous-waste sites and spills, including: biological aspects of site assessment, description and assessment of bioassay procedures, post-treatment monitoring.

TABLE 7. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
28	560	29	583	Guidance related to determining 'responsible party' for a hazardous-waste site.
29	559	27	584	Guidance manual for statistical input to field monitoring of waste site cleanup. (Including budget considerations).
30	536	30	560	Guidance for identification and quantification of dilute waste (concentrations near detection limits).
31	535	31	557	Biological concepts and available data related to biological treatment of hazardous wastes. Updated microbiological degradation data, biotransformation techniques, bioavailability data and evaluation techniques.
32	534	34	545	Guidance manual for use and limitations of available laboratory analytical equipment.
33	524	33	545	Summary of federal legislation as it related to treatment of Superfund sites.
34	516	32	547	Uniform fact sheet of Superfund sites, with frequent updates. Including characteristics, treatment, etc.
35	489	35	531	Evaluation of relative efficacy of various bioassay testing procedures. (Relevance to public health.)
36	394	36	419	Guidance manual for special considerations due to unique environmental conditions (e.g., permafrost, rain-forest, arid region, buildings, coastal plains, mangrove swamps).

TABLE 8. Biological and Environmental Technical Information Needs of Atlanta Workshop Participants

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
1	741	1	735	Environmental criteria for determining extent of cleanup at uncontrolled sites or spills (How clean is clean?), including site use considerations. Presented by media. Related to contracting requirements.
2	694	2	699	Data base of hazardous-waste toxicity to human populations.
3	681	5	665	Comparison of available exposure models for human health risks due to hazardous wastes. Help determine allowable residual concentrations in the environment.
4	678	3	680	Field guide for evaluating environmental risk at a Superfund site. What are the risks of delaying cleanup? What are the components of determining risk: to the public; to the workers; to the environment?
5	664	4	668	Guidance for determining hazardous-waste toxicity to human populations.
6	637	6	649	Assessment of available toxicity data related to Superfund sites.
7	619	8	615	Field guide for post-closure monitoring of Superfund sites.
8	617	7	643	Guidance for establishing when hazardous waste becomes an environmental concern.
9	581	9	596	Guidance manual for application of biological assessment techniques to cleanup decisions, including bioavailability, bioaccumulation, food chain transfer.

TABLE 8. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
10	576	12	584	Guidance manual for use of bioavailability, bioaccumulation and food chain transfer data related to cleanup decisions.
11	567	10	585	Biological considerations of managing hazardous-waste sites and spills. Including: biological aspects of site assessment, description and assessment of bioassay procedures, post-treatment monitoring.
12	559	11	584	Guidance manual for statistical input to field monitoring of waste site cleanup. (Including budget considerations.)
13	535	13	557	Biological concepts and available data related to biological treatment of hazardous wastes. Updated microbiological degradation data, biotransformation techniques, bioavailability data and evaluation techniques.
14	489	14	531	Evaluation of relative efficacy of various bioassay testing procedures. (Relevance to public health.)
15	394	15	419	Guidance manual for special considerations due to unique environmental conditions (e.g., permafrost, rainforest, arid region, buildings, coastal plains, mangrove swamps).

TABLE 9. Criteria Weights of Participants at Denver Workshop

<u>CRITERIA WEIGHT</u>		<u>CRITERIA DESCRIPTION</u>
<u>STATE PARTICIPANTS</u>	<u>ALL PARTICIPANTS</u>	
15	15	Ease of application of product (practicality): (0 = difficult to understand and use; 9 = easy to understand and use).
15	15	Area of information deficiency: (0=information available but limited utility in present form; 9 = no information currently available)
14	15	Site application: (0 = information useful at limited number of sites; 9 = information useful at many sites)
10	12	Number of potential users and potential frequency of use (0 = limited use; 9 = extensive use)
10	10	Cross-media application; (0 = applicable to only one medium; 9 = applicable to all media)
10	11	Treatment technology application: (0 = limited to one treatment technology; 9 = applicable to many treatment technologies)
10	9	Equipment required to use product: (0 = expensive and has limited availability; 9 = no special equipment required)
8	5	Cost of implementing information: (0 = prohibitively expensive; 9 = cheap)
8	6	Training required to use information: (0 = extensive; 9 = no training)

TABLE 10. Ranked Technical Information Needs of Denver Workshop Participants

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
1	759	2	708	Guidance for developing public information programs for Superfund sites.
2	736	12	677	Status report on regulations related to exempted and de-listed wastes. What are characteristics of exempted and de-listed wastes?
3	722	1	710	Bibliography of reports dealing with cleanup indexed by waste, media, and treatment technologies.
4	711	21	661	Equipment pool. Rapid access to analytical equipment on loan basis. What is available? Where? Response time?
5	710	9	681	Guidance for determining cost-effectiveness of available mitigative activities (e.g., containment, treatment, removal).
6	710	8	689	Field guide for rapid onsite chemical characterization of hazardous waste.
7	702	14	671	Guidance for application of RCRA to Superfund sites. How does RCRA apply? When do sites fall under RCRA rules? Who is then responsible for followup activities?
8	699	10	680	Guidance for immediate and cost-effectiveness cleanup of hazardous-waste sites and spills.
9	698	6	693	Access to available technical information related to all aspects of hazardous-waste management. What's available? Where is it? How can I get it? Updated searchable data base.

TABLE 10. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
10	692	11	678	Guidance for treatment and control of exempted wastes (e.g., mining wastes, drilling wastes).
11	688	4	700	Summary and review of past and on-going treatment activities at hazardous-waste sites and spills. Include treatment methods used; on-site coordinator's name; contractor; description and evaluation of cleanup.
12	685	7	689	Guidance for determining when immediate need is satisfied: When is first phase of cleanup completed? When can we begin pre-closure activities or additional investigation if needed?
13	682	5	695	Guidance for rapid initial screening and decisions to determine appropriate response to a potential site. Objective, economic, and consistent way to assess a site based on limited information.
14	681	3	707	Field guide describing treatment methods and options, including biological, chemical, and physical treatments. List of treatable hazardous wastes.
15	680	20	661	Environmental criteria for determining extent of cleanup at uncontrolled sites or spills (How clean is clean?).
16	679	23	645	Uniform criteria for site characterization. How can sites be assigned a priority for further action?

TABLE 10. (contd)

STATE PARTICIPANTS		ALL PARTICIPANTS		TECHNICAL INFORMATION NEEDS DESCRIPTION
Rank	Evaluation Score	Rank	Evaluation Score	
17	676	22	658	Guidance manual for use and limitations of equipment for in-field analysis of hazardous wastes.
18	665	18	662	Field guide for evaluating environmental risk at a hazardous-waste site. What are the risks of delaying cleanup? What are the components of determining risks: to the public?; to the workers?; to the environment?
19	655	13	673	Field guide for assessing bioavailability, transformation and degradation of hazardous wastes. Include all media; information on acceptable environmental concentrations; bioavailability, transformation, and degradation data base.
20	649	16	667	Guidance to design of monitoring programs for post-closure including chemical, biological, and physical monitoring. Analytical methods; statistical design; frequency; location.
21	641	24	613	Assessment of available bioassay techniques for characterization of hazardous wastes and environmental contamination.
22	639	17	665	Guidance to design of monitoring programs for site assessment and cleanup including chemical, biological, and physical monitoring. Analytical methods; statistical design; frequency; location.
23	639	19	661	Field guide for determining environmental transport and on-site containment of hazardous materials.

TABLE 10. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
24	638	15	670	Guidance to determining effects of cleanup alternatives. (Can impacts of cleanup be greater than taking no action?)
25	614	25	604	Guidance for application of technical information to assignment of responsibility/liability.
26	524	26	556	Field guide for assessment of stability of existing surface impoundments and tailings piles and ponds.
27	510	27	550	Guidance related to availability, collection and evaluation of epidemiological data.
28	480	28	501	Description of available treatment methods for acid mine drainage, including: evaluation of available methods; descriptions, cost-effectiveness.

Table 11. Biological and Environmental Technical Information Needs of the Denver Workshop Participants

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evaluation Score</u>	<u>Rank</u>	<u>Evaluation Score</u>	
1	682	2	695	Guidance for rapid initial screening and decisions to determine appropriate response to a potential site. Objective, economic, and consistent way to assess a site based on limited information.
2	681	1	707	Field guide describing treatment methods and options, including biological, chemical, and physical treatments. List of treatable hazardous wastes.
3	680	9	661	Environmental criteria for determining extent of cleanup at uncontrolled sites or spills (How clean is clean?).
4	665	7	662	Field guide for evaluating environmental risk at a hazardous waste site. What are the risks of delaying cleanup? What are the components of determining risks: to the public; to workers; to the environment.
5	655	3	673	Field guide for assessing bioavailability, transformation and degradation of hazardous wastes. Include all media; information on acceptable environmental concentrations; bioavailability, transformation and degradation data base.
6	649	5	667	Guidance to design of monitoring programs for post-closure including chemical, biological, and physical monitoring. Analytical methods; statistical design; frequency location.

TABLE 11. (contd)

<u>STATE PARTICIPANTS</u>		<u>ALL PARTICIPANTS</u>		<u>TECHNICAL INFORMATION NEEDS DESCRIPTION</u>
<u>Rank</u>	<u>Evalu- ation Score</u>	<u>Rank</u>	<u>Evalu- ation Score</u>	
7	641	10	613	Assessment of available bioassay techniques for characterizations of hazardous wastes and environmental contamination.
8	639	6	665	Guidance to design of monitoring programs for site assessment and cleanup including chemical, biological, and physical monitoring. Analytical methods; statistical design; frequency; location.
9	639	8	661	Field guide for determining environmental transport and on-site containment of hazardous materials.
10	638	4	670	Guidance to determining effects of cleanup alternatives. (Can impacts of cleanup be greater than taking no action?)
11	510	11	550	Guidance related to availability collection and evaluation of epidemiological data.

TABLE 12. Technical Information Needs Related to Pre-Treatment Site Assessment and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Guidance for rapid initial screening and decisions to determine appropriate response to a potential site. Objective, economic, and consistent way to assess a site based on limited information.			1
Guidance manual for ranking sites in terms of potential effects on health and the environment and determining priority for cleanup.	6		
Guidance for establishing when hazardous waste becomes an environmental concern.		8	
Biological considerations of managing hazardous-waste sites and spills, including: biological aspects of site assessment, description and assessment of bioassay procedures, post-treatment monitoring.		11	
Guidance manual for special considerations due to unique environmental conditions (e.g., permafrost, rainforest, arid region, buildings, coastal plains, mangrove swamps).		15	

TABLE 13. Technical Information Needs Related to Biological Concepts and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Field guide for assessing bioavailability, transformation and degradation, of hazardous wastes. Include all media; information on acceptable environmental concentrations; bioavailability, transformation, and degradation data base.			5
Field guide for determining environmental transport and on-site containment of hazardous materials.			9
Guidance manual for application of biological assessment techniques to cleanup decisions, including bioavailability, bioaccumulation, food chain transfer.		9	
Guidance manual for use of bioavailability, bioaccumulation and food chain transfer data related to cleanup decisions.		10	
Data base of bioavailability of hazardous materials and transformation products.	14		
Guidance manual of procedures to evaluate the potential bioavailability of hazardous materials and transformation products.	15		
Data base with rapid access to microbiological degradation data.	16		

TABLE 14. Technical Information Needs Related to Bioassays and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Assessment of available bioassay techniques for characterization of hazardous wastes and environmental contamination.			7
Listing of bioassay methods. How can a battery of tests be used for assessments? What tests are available? What are their advantages and limitations?	10		
Biological considerations of managing hazardous-waste sites and spills, including: biological aspects of site assessment, description and assessment of bioassay procedures, post-treatment monitoring.		11	

TABLE 15. Technical Information Needs Related to Risk Assessment and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Data base of hazardous-waste toxicity to human populations.		2	
Comparison of available exposure models for human health risks due to hazardous wastes. Help determine allowable residual concentrations in the environment.		3	
Field guide for evaluating environmental risk at a Superfund site. What are the risks of delaying clean-up? What are the components of determining risk: to the public?; to the workers?; to the environment?		4	
Evaluation of relative hazards due to critical exposure routes.	4		
Field guide for evaluating environmental risk at a hazardous-waste site. What are the risks of delaying cleanup? What are the components of determining risks: to the public; to workers; to the environment?			4
Guidance for determining hazardous waste toxicity to human populations.		5	
Assessment of available toxicity data related to Superfund sites.		6	
Handbook for preparation of health assessments (workers and public-at-large) at a Superfund site.	7		
Field guide for initial assessment of 'risk' at a site.	9		
Guidance related to availability, collection and evaluation of epidemiological data.			11

TABLE 16. Technical Information Needs Related to Treatment of Hazardous Waste and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Field guide describing treatment methods and options, including biological, chemical, and physical treatments. List of treatable hazardous wastes.			2
Treatment reference manual describing biotreatment methods and options, including: guidance for determining waste and site compatibility with biotreatment.	11		
Biological concepts and available data related to biological treatment of hazardous wastes. Updated microbiological degradation data, biotransformation techniques, bioavailability data and evaluation techniques.		13	
Guidance to determining effects of cleanup alternatives. (Can impacts of cleanup be greater than taking no action?)			10
Handbook for preparation of environmental assessments at a Superfund site.	12		
Guidance manual for environmental impact assessment associated with available biotreatment options.	13		

TABLE 17. Technical Information Needs Related to Hazardous-Waste Site Monitoring and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Evaluation of relative efficacy of various bioassay testing procedures. (Relevance to public health.)		14	
Guidance manual for field sampling (environmental and waste): sampling programs; statistical design; equipment.	1		
Guidance manual for determining effective cleanup levels at uncontrolled sites or spills.	2		
Field guide to biological monitoring at hazardous-waste sites (sampling design, objectives, etc.).	8		
Guidance to design of monitoring programs for site assessment and cleanup including chemical, biological, and physical monitoring. Analytical methods; statistical design; frequency; location.			8
Guidance manual for statistical input to field monitoring of waste site cleanup. (Including budget considerations.)		12	
Field guide for post-closure monitoring of Superfund sites.	5		
Guidance to design of monitoring programs for post-closure including chemical, biological, and physical monitoring. Analytical methods; statistical design; frequency; location.			6
Field guide for post-closure monitoring of Superfund sites.		7	
Biological considerations of managing hazardous waste sites and spills, including: biological aspects of site assessment, description and assessment of bioassay procedures, post-treatment monitoring.		11	

TABLE 18. Technical Information Needs Related to "How Clean is Clean?"
and the Rank Order of the Needs Established at Each Workshop

<u>TECHNICAL INFORMATION NEEDS</u>	<u>Workshop Location</u>		
	<u>PHILADELPHIA</u>	<u>ATLANTA</u>	<u>DENVER</u>
Environmental criteria for determining extent of cleanup at uncontrolled sites or spills (How clean is clean?), including site use considerations. Presented by media. Related to contracting requirements.		1	
Guidance manual for statistical input to field monitoring of waste site cleanup.	3		
Environmental criteria for determining of cleanup at uncontrolled sites or spills (How clean is clean?).			3

APPENDIX

WORKSHOP PARTICIPANTS

APPENDIX

WORKSHOP PARTICIPANTS

The names, addresses, and affiliations of workshop participants are listed in this appendix. The listing is organized by workshop and, within each workshop, by EPA regional offices, state representatives, and others.

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