EvTEC—a collaborative approach to verifying environmental technology

Prepared by the Environmental Technology Evaluation Center

A service center of the Civil Engineering Research Foundation

April 1998

EvTEC
Environmental Technology Evaluation Center

EvTEC—a collaborative approach to verifying environmental technology

Prepared by the Environmental Technology Evaluation Center

A service center of the Civil Engineering Research Foundation

April 1998

EvTEC
Environmental Technology Evaluation Center

Abstract

This report describes the collaborative process of the Environmental Technology Evaluation Center (EvTEC) and how it was developed to meet the information needs of decision-makers. EvTEC utilizes a market-based approach designed to build consensus among the variety of decision-makers involved in getting a new technology into the marketplace. The activities entailed in the creation and operation of EvTEC have, likewise, been based on input from and involvement of a broad cross-section of the variety of interests in the environmental technology community. The input of these experts ensures that the right questions are asked and that the answers are produced in a form that is most useful to those who will ultimately make the decisions regarding the application of the technology.

The first year of those activities culminated in a major workshop for the "demand side" stakeholders and the establishment of a more formal process for consensus-building. The workshop brought together representatives of a broad network of organizations for the purpose of providing guidance to the establishment of EvTEC and forming an ongoing "Alliance" as a basis of continued collaboration. The further development of the Alliance is viewed as an evolutionary process to be driven by the needs and interest of the member organizations. This report provides a context for that evolution, describing how such a broad-based collaboration can be involved in the provision of objective, credible verification data. This document also describes the EvTEC verification process, outlines the major activities pursued to initiate it, and discusses the next steps in the continuing process of collaboration building.

The material presented in this publication has been prepared in accordance with generally recognized engineering principles and practices, and is for general information only. This information should not be used without first securing competent advice with respect to its suitability for any general or specific application. The contents of this publication are not intended to be and should not be construed to be a standard of the American Society of Civil Engineers (ASCE) and are not intended for use as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document.

No reference made in this publication to any specific method, product, process or service constitutes or implies an endorsement, recommendation, or warranty thereof by ASCE or CERF. ASCE or CERF make no representation or warranty of any kind, whether expressed or implied, concerning the accuracy, completeness, suitability or utility of any information, apparatus, product, or process discussed in this publication, and assumes no liability therefore. Anyone utilizing this information assumes all liability arising from such use, including but not limited to infringement of any patent or patents.

This material is based on work supported by the Civil Engineering Research Foundation and the U.S. Environmental Protection Agency. The U.S. Government has certain rights to this material. Any opinions, findings, and conclusions or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the U.S. Environmental Protection Agency, any other entity of the U.S. Government, or any specific member of the EvTEC Steering Team, and no official endorsement should be inferred.

Copyright © 1998 by the Civil Engineering Research Foundation
All Rights Reserved.
Manufactured in the United States of America

Acknowledgments

The Environmental Technology Evaluation Center (EvTEC) of the Civil Engineering Research Foundation (CERF) prepared this report. CERF wishes to acknowledge the special contributions of individuals whose efforts and suggestions have significantly influenced this report.

The members of the EvTEC Advisory Council provided overall guidance for the effort, offering review and comment on the final report. David Dibner, DRD Architects, compiled and analyzed the results of the workshop and served as principal writer and editorial consultant. We would also like to extend our thanks to those individuals throughout the environmental community who attended the workshop and contributed to identifying research needs as described in this report.

Among CERF staff who also made significant contributions to this report, we wish to acknowledge Melody Spigel, EvTEC Project Coordinator, in managing the logistical support in the EvTEC Workshop and in the editing, design, and layout for this document, Peter Kissinger, CERF Vice President and Director, Highway Innovative Technology Evaluation Center (HITEC), provided oversight and review; and finally, to Will Kirksey, Director, EvTEC, for his work in managing the entire process, including designing the conceptual approach, analyzing attendees' individual comments, and determining ways to best apply this information to the EvTEC technology evaluation process.

This report is based on work supported by the United States Environmental Protection Agency under Cooperative Agreement No. 824884-01-0.

Publication of this report was made possible, in part, through the contributions by members of CERF's New Century Partnership:

Black & Veatch

CH2M Hill

Charles Pankow Builders

Charles J. Pankow Matching Grant

Kenneth A. Roe Memorial Program

Lester B. Knight & Associates, Inc.

Parsons Brinckerhoff, Inc.

The Turner Corporation

Harvey M. Bernstein

Harvey M. Bernstein, President

Civil Engineering Research Foundation

Table of Contents

Abstract ii
Acknowledgments iii
Table of Contents v
Introduction 1
Chapter One: Establishing the Environmental Technology Evaluation Center (EvTEC) 5
Background 6
The Concept 7
Organization 8
The Steering Team 9
The EvTEC Advisory Council 9
The EvTEC Alliance 10
Technology Specific Evaluation Panels 11
The EvTEC Management Team 12
Related Entities 12
Chapter Two: Defining Needs and Concerns 15
The Survey 16
Figure 2-1 Organizations that Perform Evaluations for Entrepreneurs 18
Figure 2-2 Factors That Would Make an EvTEC Report Most Acceptable to Users 19
Chapter Three: The EvTEC Alliance and Workshop 21
The Alliance 22
Membership of the Alliance 22
Structure of the Alliance 22
Development of the Alliance 23
The Workshop Agenda 24
The Workshop Process 25
Workshop Recommendations 26
Chapter Four: The Verification Process 29
Step 1: Applications Submitted 29
Figure 4-1 EvTEC Verification Process 30
Step 2: Eligibility Review 31
Step 3: Evaluation Panel Formed 32
Step 4: Evaluation Plan Developed 33
Step 5: Plan Executed 34
Step 6: Evaluation Report Prepared 35
Chapter Five: The Next Steps 37
Appendix A: Members of the EvTEC Advisory Council 41
Appendix B: Workshop Agenda 43
Appendix C: Additional Workshop Issues and Recommendations 45
Appendix D: Case Studies 51
Case Study: Ice Ban Anti-Icing/De-Icing Product 51
Case Study: Group Evaluation-Stormwater Best Management Practices, A WSDOT/ EvTEC Collaborative Effort 53
Case Study: ThermoEnergy STORS/NitRem/ARP Wastewater Treatment Technologies 55

Introduction

The environmental technology marketplace needs relevant information it can trust. Effective implementation of new and innovative technologies in the environmental field requires a credible, objective source of information that meets the needs of the broad range of decision-makers on the technology "demand side". The most effective way to provide that information is through a consensus-based process, directly involving the community of stakeholders who will ultimately make the decisions regarding the approval, adoption, and use of the technology. To provide this objective evaluation process, the new Environmental Technology Evaluation Center (EvTEC) was created in October 1996.

This report describes the evolution of this new Center from its original concept; through its search for the needs and concerns of relevant interests; the development of its evaluation process in response to this input; the refinement of that process through the direct involvement of stakeholders; to its present status as a viable, operating evaluation center. The report also looks to the future and the next steps to be taken by EvTEC.

The key ingredient in this developmental process was the continuous and substantive involvement of a wide spectrum of stakeholder interests who contributed to the development of EvTEC at multiple levels, ranging from broad policy guidance to the development of specific test protocols for individual technologies. In particular, this involvement is focused in three specific structural components of EvTEC:

- An **Advisory Council** composed of twelve senior representatives from a broad cross section of interests provides overall guidance on policy and business aspects of EvTEC.
- An **Alliance,** open to representatives of demand side stakeholders, provides a network for sharing information, access to expertise, and dissemination of evaluation results.
- A unique **Technology Evaluation Panel** formed for each technology evaluation to represent all relevant stakeholder interests by developing a technology-specific protocol and overseeing the testing and report preparation.

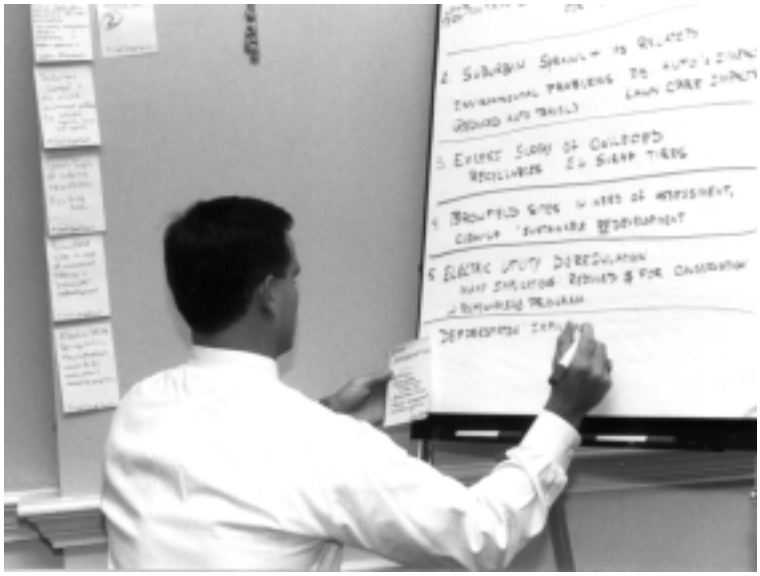
EvTEC is based on a proven collaborative model designed to build consensus among the variety of decision-makers involved in getting a new technology into the marketplace. The Civil Engineering Research Foundation (CERF), through a cooperative agreement with the U.S. Environmental Protection Agency (EPA), created EvTEC to conduct performance verification of environmental technologies.

The basis for this collaborative model is the "virtual center" approach pioneered by CERF's Highway Innovative Technology Evaluation Center. HITEC was established to provide market-based, benchmark evaluations for highway and bridge technology, using networks of expertise, testing facilities, and demonstration sites. Such a process is effective in identifying needs and conducting performance verifications in a manner that produces the information most valuable to the users of these technologies. While HITEC provided a strong basis for this approach, the different nature of the decision-making process in the acceptance of innovative environmental technology required special steps to tailor the process.

With this in mind, EvTEC undertook an organized process to involve environmental technology decision-makers and "enablers" of innovation in the activity of designing the means to implement the virtual center model for environmental technology. Planning and development of EvTEC has been based on input from and involvement of a broad cross-section of the variety of interests in the environmental technology community. Especially important in this development was the creation and involvement of the EvTEC Alliance. Alliance members not only helped to refine the evaluation process, but also are expected to be a key source for obtaining the experts involved in carrying out the technical evaluations and disseminating evaluation results to the key decision-makers for specific technologies.

This report provides a context for the evolution of EvTEC, describing the EvTEC verification process and how the broad-based collaboration with the Alliance will support the provision of objective, credible

verification data. The report will give special emphasis to the EvTEC Alliance Workshop as a major milestone in the development of a consensus-based approach, and describe the implementation of workshop recommendations and the next steps in the continuing process of collaboration building.



This report, in essence, describes the progress of EvTEC to build a collaborative, market-based approach through its first year of existence. **Chapter 1** describes the concept, formation and organization of EvTEC, including the collaborative efforts involved in defining its purpose and function. **Chapter 2** describes the methods used by EvTEC in obtaining input from the environmental community to learn of its concerns and needs, and includes some of the major revelations of this information-gathering process. It also describes the creation of the EvTEC Alliance, a key component in assuring stakeholder participation in the verification process.

The EvTEC Alliance Workshop, described in **Chapter 3**, was a major milestone in the development of the consensus-based approach. The workshop brought together representatives of a broad network of organizations for the purposes of providing guidance to EvTEC on such issues as: refining the evaluation process; ways to generate wide collaborative involvement; methods to identify high priority problems; how best to develop useful data and information; and the most effective way to communicate results. The chapter also reports the major recommendations of the workshop participants.

Chapter 4 contains a description of the EvTEC process for the verification of new products and technologies. It emphasizes the importance of the involvement and collaborative efforts of many sectors of the environmental community. **Chapter 5** focuses on the activity underway to implement the recommendations of the workshop and some of the next steps that will continue the evolutionary process to build the capability of EvTEC to provide the environmental community with objective, credible verification data.

The Appendices contain additional background information on EvTEC and its formation. This includes lists of Advisory Council members; the Alliance workshop agenda; a list of additional issues and recommendations from the workshop; and case studies describing the technology evaluations already underway by EvTEC.

During its first year of existence, EvTEC has developed an organization focused on outreach and networking, established a verification process, and identified means to communicate its results. As the focus of activity shifts to operations and specific initiatives, collaboration building becomes even more essential. Coordination activities will expand with other verification entities and the community of stakeholders.

Clearly, the direct involvement of those stakeholders in the process of verifying technologies is essential. Especially important are the states and the public and private sector technology users. The input of these experts ensures that the right questions are asked and that the answers are produced in a form that is most useful to those who will ultimately make the decisions regarding the application of the technology. This process also is the key "value-added" for the technology vendor, providing first hand information about the needs and preferences of the market and providing a core of knowledgeable users.

We invite the readers of this report to become involved in helping us improve our ability to serve the needs for innovative technology in the environmental community. Your continued involvement and collaboration is the means to achieve the goal of accelerating the development and use of environmentally beneficial technology. Information on how you can become involved is provided in Chapter 5 and on the back cover of this report.

Chapter One

Establishing the Environmental Technology Evaluation Center (EvTEC)

Accelerating the adoption of environmental technology requires more than technical performance evaluation. There are usually other issues of equal or greater importance that must be considered in bringing an environmental technology to the marketplace. CERF established EvTEC based on a proven collaborative model for technology performance verification designed to focus on the full range of relevant market issues. The model, pioneered by CERF's Highway Innovative Technology Evaluation Center (HITEC), is that of the market-based "virtual" center, which utilizes networks of experts, test facilities, and other stakeholders. The CERF staff members are the facilitators of a process that relies on collaboration and consensus of many stakeholder interests, beginning with the identification of technology needs, through the activities necessary to develop test protocols and conduct verifications, to the documentation and dissemination of evaluation results.

The [EvTEC] model is that of the market-based "virtual" center, which utilizes networks of experts, test facilities, and other stakeholders.

EvTEC adopted that model, but began with the recognition that experiences in the fields of highway and bridge technology would not completely translate to the environmental technology market. In particular, the process for approval of environmental technology is more complex, with a larger number of decision points and participating organizations, more intricate regulatory structures, and more public scrutiny. Adapting the HITEC model to help speed innovation in the environmental marketplace requires substantial effort to identify and appropriately involve the decision-makers and enablers on the demand side of the environmental technology community. The approach must be efficient, flexible, and versatile, because the size and diversity of this community indicates that a particular technology may be of interest to only a small group, and the time and resources available for participation is limited.

Perhaps the key difference in the environmental community is the variety of constituencies involved. It is essential to coordinate closely with a variety of other entities. The states are of particular importance both as

regulators and as operators of existing verification efforts. Other verification activities are underway through the ETV program of the EPA and the programs of other government agencies. An important basis for success in the development of a verification effort is to identify and understand these other activities and develop a complementary program. With that basis, it is possible to obtain the broad-based involvement, create the credible verification process, and develop the recognized mechanisms for communication of results that are necessary for success.

This chapter explains how EvTEC has been designed to respond to the requirements of the environmental community, describes the evolutionary process used to develop EvTEC, and indicates the participants involved.

Background

EvTEC began through a cooperative agreement with the Environmental Protection Agency (EPA). Recognizing that the use of new technologies would allow faster and more thorough pollution prevention, control, cleanup and monitoring, while bringing the overall cost of regulatory compliance down, EPA's Office of Research and Development (ORD) created the Environmental Technology Verification Program (ETV). This program is intended to verify the performance of new, commercially-ready environmental technologies and transfer this information to customer groups such as state permitting agencies and consulting engineering organizations. The goal is to expand the environmental technology choices of public and private decision-makers both in the United States and abroad. The program, which is described in their document *Verification Strategy* (EPA/600/K-96/003 - February 1997), lays out a ten year scenario in which pilot programs are competitively selected and funded for their early years after which the individual programs are expected to be self sustaining. As stated, the goal of the program is to:

"Verify the environmental performance characteristics of commercial-ready technology through the evaluation of objective and quality assured data, so that potential purchasers and permitters are provided with an independent and credible assessment of what they are buying and permitting."

CERF has concentrated on the role of facilitating, coordinating, and integrating the efforts of diverse organizations and interests...

Nearly all of the pilot centers established under the ETV program to date are for the technical verification of technologies in very specific fields (e.g. small package drinking water systems and indoor air products).

In contrast, EvTEC was selected to provide a program to test the effectiveness of an independent organization using a market-based approach to verify the full spectrum of environmental technologies, including those where no regulatory mandates or standards for use currently exist. In fulfilling this function, EvTEC will cooperate with the other centers, including conducting joint evaluations or referring applicants to other ETV programs, if appropriate.

Consistent with the ETV Program goal, the overall goal of EvTEC may be simply stated as:

"Accelerating the deployment and use of environmentally beneficial technology."

This goal is also consistent with the mission of CERF. CERF was established as the research affiliate of the American Society of Civil Engineers (ASCE), with the purpose of serving as a collaborative research organization to enhance the quality, timeliness, and effective delivery of innovation to the marketplace. In fulfilling this mission, CERF has concentrated on the role of facilitating, coordinating, and integrating the efforts of diverse organizations and interests to create consensus programs that build partnerships for the common good. EvTEC is intended to build on that tradition by encouraging the wide variety of stakeholders in the environmental community to work together in a consensus-building process to verify technology performance.

The Concept

As mentioned previously, EvTEC is based on the organizational concept of the "virtual center" model. The "virtual center" structure relies on networks of experts, testing facilities and stakeholders to provide the most appropriate approach for each technology to be evaluated, without the high overhead costs of conventional evaluation centers. In other

words, EvTEC is not a "bricks and mortar" facility, and it does not have a large staff of experts to verify technologies; rather it is designed to work with and leverage the expertise of existing facilities. The approach is designed to maximize flexibility and effectiveness. This approach also helps to ensure that there is no bias for or against particular technologies, and no limitations on facility use or expertise.

The process must be stakeholder driven.

The key to the success of this model goes beyond simply networking with experts and test facilities. The process must be stakeholder driven. Stakeholder needs are the key to the identification of appropriate issues, technologies, test protocols, and distribution networks. This is especially true when developing an evaluation panel. The crucial component of successful verification is developing an evaluation panel with the right cross-section of expertise to represent all relevant interests (e.g., technical, regulatory, operational, financial, etc.). This type of panel can develop a consensus evaluation protocol that will address the issues of significance to making the deployment and use decisions. It is this aspect that has led to the success of HITEC, and will drive EvTEC's development.

Specifically, translating the success of this stakeholder-driven model to the environmental community requires:

- **Defining the needs and concerns of the environmental community**
- **Identifying key stakeholders and involving them in evaluation activities**
- **Coordinating evaluation activities with other verification/ demonstration programs**
- **Ensuring balance and lack of bias in the evaluation panels**
- **Producing first rate test protocols and high quality results that meet stakeholder needs**
- **Developing a clear, consistent means of reporting results to the appropriate audience**

Furthermore, these activities must be accomplished in a manner that minimizes the time and resource demands on stakeholders, and allows them to define the level of involvement that is consistent with the value that they receive from the process.

Organization

The interaction with the stakeholder community led us to adopt a framework for collaboration that is based on simple and flexible

organizational units. These units allow EvTEC to maintain a small core staff and facilitate the process of involvement of others. The various components of the EvTEC organization include:

The purpose of the Alliance is to create a means for stakeholders to obtain information ...and to participate...

The Steering Team

To ensure the appropriate involvement of relevant interests, EvTEC's first year of operation began with the creation of a steering team of senior level representatives of this community of stakeholders. With the guidance of that team, EvTEC staff undertook substantial information gathering and dissemination. Activities included surveys, questionnaires, conference presentations, papers and articles, conversations with key individuals, and meetings with key organizations. This activity reinforced the need to establish a formal structure, similar to that used in HITEC, for involvement and communication with the community of environmental technology users.

The EvTEC Advisory Council

EvTEC's first year culminated with the formation of a formal Advisory Council to continue the work of the steering team. The Council was established to provide high-level policy guidance and direction to the organization. It is composed of a small but broad-based group of senior executives from a cross section of the environmental community, including representatives from facility owners and operators, consulting engineering firms, local, state, and federal government, and the financial community.

The Council is designed to:

- **Recommend the overall direction and policies of EvTEC**
- **Provide guidance to the EvTEC staff on operation of the program**
- **Suggest appropriate linkages to other organizations within the environmental community**
- **Seek additional avenues for the application of EvTEC services, including the potential for international collaborations**
- **Maintain EvTEC's focus of developing comprehensive, unbiased technology verifications and the broad communication of results**

Members of the Council are selected from high-level executives of prominent environmental-related organizations, who donate their services for a term of 2 years, without compensation. A listing of the current members of the EvTEC Advisory Board can be found in Appendix A.

The EvTEC Alliance

The Purpose of the Alliance is to create a means for stakeholders to obtain information about verification activities and to participate in the evaluation process.

The Alliance is the basis for widespread involvement in the EvTEC verification program. The purpose of the Alliance is to create a means for stakeholders to obtain information about verification activities and to participate in the evaluation process. It is open to the full range of public and private sector stakeholders on the "demand side" of environmental technology. It is intended to provide an opportunity for broad participation in EvTEC's program. The Alliance is structured to allow for a comprehensive interaction with the technology user community (e.g., organizations that recommend, specify, approve, authorize, purchase, or operate environmental technologies). To promote widespread involvement, the Alliance is designed so that participation requires no funding or significant commitments of other resources from the member organizations.

The Alliance is designed to function as a network of interested collaborators to:

- **Provide information on the concerns and needs of the environmental community**
- **Share expertise and information for evaluations**
- **Help disseminate the results of the evaluations**
- **Improve communications among participating organizations**
- **Identify meaningful technology focus areas for the future**
- **Identify existing barriers that inhibit the use of new technologies**
- **Define environmental problem areas for group evaluation of a variety of technologies that offer potential solutions**
- **Suggest specific opportunities in which appropriate areas will be defined for government and industry collaborative projects on specific issues**
- **Make recommendations to improve EvTEC's operations**

The Alliance first came together in September, 1997, participating in a workshop to develop recommendations regarding the future operations and goals of EvTEC. Invitations to join the Alliance were extended to an extensive list of relevant individuals and organizations. Over 80 individuals, representing 55 organizations came together at the workshop to help form the Alliance as a basis of continued collaboration. Invited participants represented most segments of the "demand-side" of environmental stakeholders. These included all levels of governmental

regulators, private and public groups, who specify, authorize or purchase technologies, and organizations and professional associations representing consumers, users, and operators of environmental technologies. Their involvement provided an overall endorsement of the concept and specific recommendations for enhancements. They also generated the enthusiasm necessary to make the Alliance a viable entity.

...Panel members... fashion an evaluation process which is unique for each specific...technology.

The recommendations from the workshop have provided the basis for tailoring the evaluation process to meet stakeholder needs. EvTEC is developing specific communication approaches and additional activities that will implement the recommendations, creating the mechanisms to involve Alliance members in the operation and further development of the program. Furthermore, the organizations represented on the Alliance are expected to be a key source for obtaining the experts involved on Technical Evaluation Panels for specific technologies and the link to a diversity of distribution channels for disseminating verification results.

See Chapter 3 for a description of the workshop and a listing of the recommendations. Also, see Chapter 4, which details the verification process and describes the involvement of Alliance members in all its steps. Chapter 5 provides a description of some of the immediate actions being taken to enhance the functioning of the Alliance.

Technology Specific Evaluation Panels

A main component of the EvTEC consensus-based evaluation process is the establishment of a unique panel of experts chosen specifically for each technology to be evaluated. These technology evaluation panels are composed of outside experts from a wide variety of technical, regulatory, operational, public interest, and other organizations. As panel members, they fashion an evaluation process which is unique for each specific product or technology to be examined. They then help guide the process as it moves through its various stages. Based on the type of technology and the stakeholder community involved, EvTEC, with the assistance of the Alliance, will identify representatives from the users, regulators, engineers and contractors, legal and financial community, public interests, and other appropriate constituencies. They will be brought together to establish a focused, impartial Technology Evaluation Panel.

This panel will:

- **Identify the specific issues and concerns that need to be resolved before the product can be adopted for the identified use**

- **Oversee the development and execution of an Evaluation Plan which will address those issues and concerns**
- **Suggest the best methods for the extensive communication of the results of the evaluations, both to a general audience and targeted to key interests for the particular technology**

Panel members are selected from an extensive pool of experts that EvTEC establishes by invitation or through recommendations by technical organizations. The selection criteria include requirements designed to protect the applicant's intellectual property and promote objective, credible results. Each panel member must agree to:

These panels offer one of the most important value-added aspects of the process.

- **Sign a confidentiality agreement**
- **Notify EvTEC if a conflict of interest exists or may arise**
- **Devote the required time to an evaluation project**

Panel members are recognized for their contribution to the evaluation process in any documents published on the evaluation project by the Center.

These panels offer one of the most important value-added aspects of the process. In these panels the expert knowledge of the key stakeholders has a direct impact on the evaluation of a technology, asking the questions and raising the issues that are crucial to understanding technology performance. These panels of stakeholders drive the verification process, ensuring that the right questions are asked, the tests and demonstrations are properly interpreted, and that the results are clearly and widely reported.

The EvTEC Management Team

EvTEC has a small, experienced management team to facilitate the evaluation process and build the coordination among the groups and individuals necessary to make the process work. This structure provides a core team that can understand and deal with the technical issues, and also provide the administrative and fiscal oversight and management direction needed to maintain a focused, results-oriented program.

Related Entities

In addition to the specific elements of the EvTEC framework, other organizations will participate in the program. The most common types of participation will be:

- **Partnerships with organizations and government agencies with a particular environmental problem, wanting to solicit and verify environmental technologies to address that problem through a group evaluation**
- **Contracts and agreements with verification entities, test sites, and laboratories to conduct the tests and demonstrations**

The approach to working with verification entities is another feature that supports a broad-based collaborative approach. Just as the evaluation panel is unique to the technology under consideration, EvTEC can work with the stakeholder community and panelists to identify the test site or facility that is most appropriate to deal with the specific technology. This maximizes the flexibility of the stakeholders to address the key issues in a manner that will produce the answers of value to them.

Chapter Two

Defining Needs and Concerns

Soon after EvTEC was established, a broad-based steering team was brought together to provide overall guidance to the launching of the program. This team of senior professionals brought a wealth of experience in the environmental technology field to bear on the issues surrounding the start-up of EvTEC. Meeting monthly, it served as a precursor to the Advisory Council and as a key means of assimilating and validating a wide variety of input from many sources. This steering team was composed of a diverse set of interests in the environmental technology community, including federal, state, and local government, consulting engineers, the financial community, and private sector technology owners. They set as the early objectives for EvTEC:

- **Defining goals and establishing an organizational structure to achieve them**
- **Understanding market demands for technology**
- **Establishing a presence through informing the public and industry**
- **Establishing strategic alliances for the active involvement of key stakeholders**
- **Developing effective communication tools for dissemination of information**

...an initiative to gather information on issues regarding environmental technology verification was begun shortly after the Center's formation.

The measure of the success of the hard work and planning efforts of the steering team is the fact that, less than one year after these efforts began, EvTEC has developed into an active and viable organization for consensus-based technology verification.

As part of the effort to be responsive to the organizations EvTEC was designed to serve, an initiative to gather information on issues regarding environmental technology verification was begun shortly after the Center's formation. This initiative included surveys, questionnaires, conference presentations, papers and articles, conversations with key individuals and meetings with key organizations.

...the success of EvTEC depends on the involvement of [Alliance] members...

The centerpiece of the initiative was the activity surrounding the creation of the Alliance, reaching its peak with the workshop in September 1997. The concept of the Alliance began in conversations with experienced individuals and evolved with additional discussion, concept papers, and feedback. This is an appropriate beginning, since the success of EvTEC depends on the involvement of its members, providing continuing input and feedback on the focus, methods, operation, and results of EvTEC. The creation of the Alliance and its purpose is described more fully in Chapter 3.

The Survey

A major input to assist EvTEC in gaining an understanding of the environmental technology community was a survey to determine their needs and concerns, and their interest in and their potential use of EvTEC services. This comprehensive, ten-page survey instrument was initiated in March 1997.

The questionnaire was distributed to solicit information from the three major segments of the environmental community:

Users and Regulators of new and innovative environmental products and systems. These organizations included federal, state, and local government agencies in the public sector; private sector organizations who incorporate environmental products in their activities, e.g., design/consulting engineering; construction contractors; financial institutions; and trade associations whose members are technology users or otherwise interested in the results of technology verification. These Users, in essence, create the demand for these new products and once they are on the market, apply them in the activities they perform.

Entrepreneurs, Inventors, Developers, or Marketers of new or innovative environmental technologies, products, or practices. Included in this segment were the individual inventors of new technology and small entrepreneurial organizations, as well as large corporations who develop and market new products for use in the environment. In effect, this category covers the "input end" of the innovation pipeline, and this segment would require the benefit from the services of evaluators such as EvTEC to verify their new technology so their technologies may reach the marketplace more quickly and cheaply.

Laboratories, Research Institutes, and Evaluation and Testing Organizations are the organizations performing the research evaluations and testing of new environmental products necessary for their verification. The members of this group also vary greatly, and include universities, research institutes, private and public laboratories, and testing facilities. This segment also consists of labs or testing divisions of large manufacturing organizations.

Responses were received from various representatives of all components of these stakeholder communities. The results were reported

in September 1997. In addition, information was gathered through several smaller, more targeted questionnaires, involvement with a variety of environmental technology organizations, and broad review of the literature.

The wealth of information gathered led to a number of important conclusions, some of which confirmed expectations and some of which were surprising. The discussion below briefly summarizes some of those conclusions. A more complete discussion of these issues is provided in the CERF Report #40288, dated September 1997, entitled *Accelerating Environmental Technology Implementation.*

The major conclusions include the following:

Present evaluation practices:

- **Most entrepreneurs (product developers) perform and pay for their own evaluations.**
- **While entrepreneurs are often required to develop different evaluations for different users of their products, the majority agreed that one evaluation plan could be formulated to satisfy the technical criteria important to all users.**
- **Independent, objective performance data is an important asset in gaining acceptance of a product.**
- **There is often a mismatch between vendor and user expectations regarding verification.**

Primary obstacles to innovation:

- **Constraints caused by existing regulations and permit procedures**
- **Potential liability too great**
- **Existing product evaluations are inadequate**
- **Constraints caused by existing standards and specifications**
- **No budgets or funding for new product adoption**

Advanced communication technology could significantly accelerate adoption of technologies:

- **Written reports were the most popular current method of communication of evaluation results.**
- **When asked about future methods of technology transfer, posting on the World Wide Web was ranked equally to hard-copy reports.**

A collaborative approach to verification could accelerate environmental innovation.

Most valuable services that EvTEC could provide include:

- **Technical evaluation of products**
- **Clearinghouse for environmental product information**
- **Assessment of regulatory acceptance of products**
- **Referrals to funding sources**

Factors that would make an EvTEC report most acceptable to users:

- **Testing performed by a known laboratory**
- **Federal/state regulator on panel**
- **User's organization represented on panel**

Figures 2-1 and 2-2 illustrate the value of the collaborative evaluation process. Figure 2-1 shows that the large majority of entrepreneurs conduct their own testing, yet as Figure 2-2 indicates, credibility with decision makers requires an independent, collaborative approach. Participation in a process like EvTEC could provide technology vendors a more rapid path to acceptance by the market.

In addition the survey respondents identified the important technical

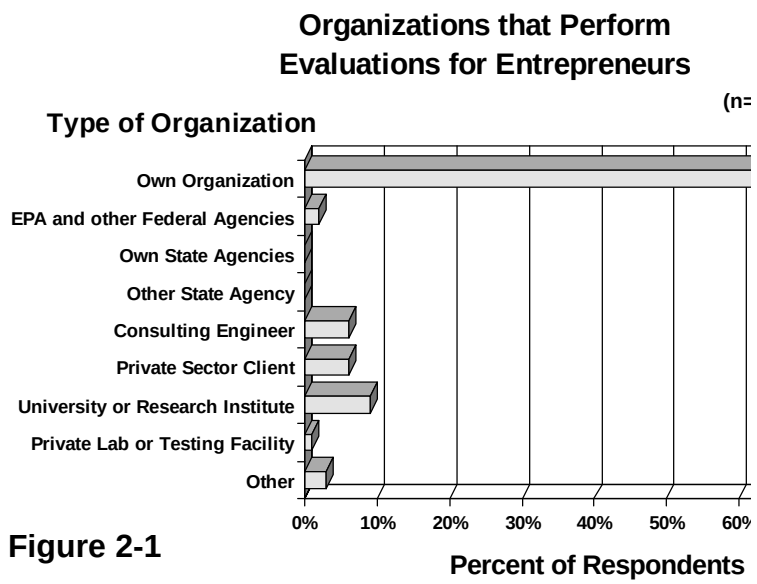


Figure 2-1

areas that they felt needed to be addressed as well as their major concerns regarding constraints by regulations and potential liability. They also indicated that change was needed in present product evaluation systems and the methods by which the results were communicated to the decision-makers in the environmental community. The survey results also provided a strong indication that an impartial, consensus-based collaborative system for technology evaluation, such as envisioned by EvTEC, could be successful in providing credible verifications of innovative environmental products and technologies.

This information gathering effort provided the foundation for the development of the EvTEC verification process that is described in Chapter 4.

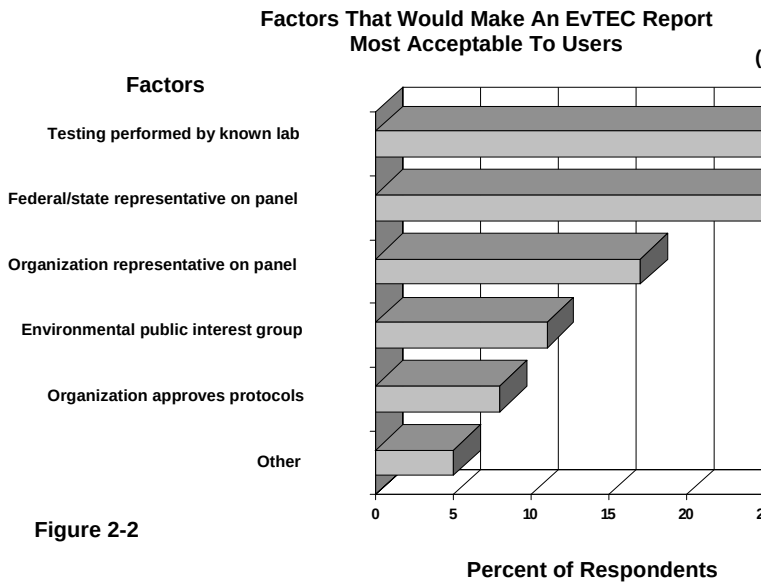


Figure 2-2

Chapter Three

The EvTEC Alliance and Workshop

The EvTEC Alliance was formed to allow decision-makers and technology users within the environmental community to participate directly in the establishment and refinement of the verification process and the conduct of verifications. The goal of the Alliance is to improve the ability of the verification process to meet the needs of those who make decisions regarding environmental technology innovation. The most effective means to establish the Alliance as a key participant in the EvTEC verification process was to fully involve Alliance members early in its design and development. Toward that end, invitations to join the Alliance were extended to representatives of the full spectrum of interests on the environmental technology demand side. These representatives were sent background information on EvTEC and the Alliance concept, and were invited to participate in a workshop held in Washington, DC on September 9-11, 1997.

The goal of the Alliance is to improve the ability of the verification process to meet the needs of those who make decisions regarding environmental technology innovation.

This initial workshop was conducted to establish the Alliance and define its operating processes. Information from the survey was used as a basis for interaction with Alliance representatives prior to the workshop. Invitees were sent summaries of the information gathered and asked for comments and suggestions on the Alliance concept, as well as suggestions of significant problems or issues regarding environmental technology verification and suggestions of potential technology needs and issues which the Alliance and EvTEC should address. The workshop had the dual purpose of serving as the first opportunity for interaction among members of the Alliance and providing a key forum for input and feedback to EvTEC. A detailed agenda of the workshop is included in Appendix B.

The Alliance

The objectives of forming the Alliance are:

- **To assist in the establishment and enhancement of the EvTEC verification process**
- **To allow decision-makers to participate in, and provide feedback to specific EvTEC panels and in environmental technology verification activities in general**
- **To create a network to disseminate the results of EvTEC evaluations, and other technology verification data and information to users and enablers of environmental technologies**
- **To facilitate increased communication and cooperation among the organizations, businesses, and government agencies involved in the review, evaluation, verification, and acceptance of innovative environmental technologies**

The intent is to make participation in the Alliance easy for members, requiring no fees or significant commitment of resources, and allowing them to become involved to the extent that has value to them.

Membership of the Alliance

The Alliance is open to the full range of public and private sector "demand side" stakeholders, i.e., representatives of the organizations and individuals who regulate, recommend, specify, approve, authorize, purchase, or operate environmental technologies.

Structure of the Alliance

The Alliance is envisioned to operate as a network of collaborators. All members are encouraged to initiate ideas, suggestions, or activities appropriate for EvTEC involvement. Members will be kept informed of all opportunities for involvement in all relevant verification activities, but are not required to participate in any activity. The intent is to make participation in the Alliance easy for members, requiring no fees or significant commitment of resources, and allowing them to become involved to the extent that has value to them.

Communication will take full advantage of electronic technology but also will be accomplished through a combination of conventional media such as faxes, mailings and occasional informational meetings as necessary. Ad-hoc committees of the Alliance may be formed around specific purposes, such as communications, data acceptability, or specific technology interests and technical protocols.

Development of the Alliance

The success of the Alliance as an ongoing, organized network for collaboration depends on the involvement of its members. Thus, developing this concept into a reality required substantial input and feedback on the focus and methods of operation of the Alliance. In this spirit, prior to the workshop, invitees were given summaries of information collected on market issues and background information on EvTEC and the evaluation process concept. They were requested to provide comments and suggestions on the concept, as well as suggestions of significant problems or issues regarding environmental technology verification and suggestions of potential case studies which the Alliance and EvTEC should address.

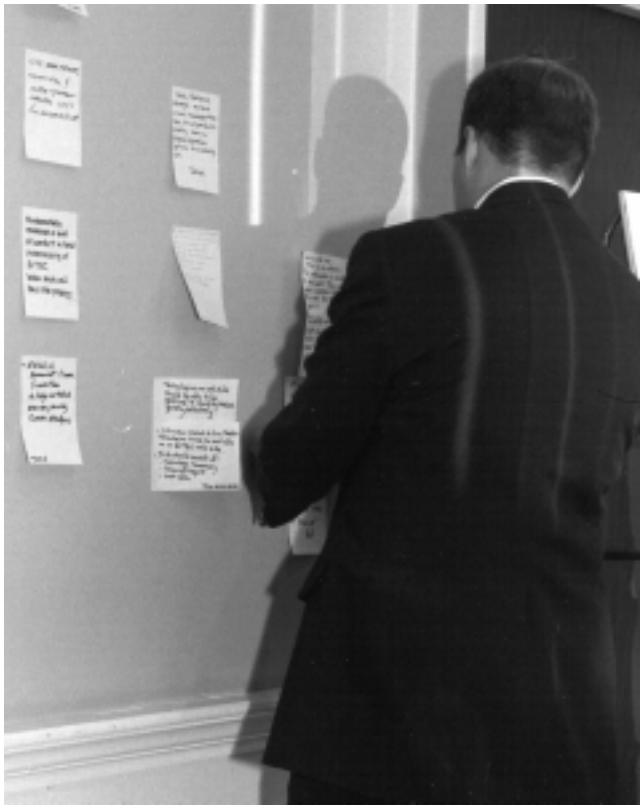
These suggestions were included as input to the workshop. The participants at the meeting then worked to define the focus, suggest methods to refine the verification process, recommend communication procedures, and establish or enhance the person-to-person and organizational relationships which support the functioning of the Alliance.

The objectives of this Workshop were threefold:

- **To further acquaint the Alliance members with EvTEC and its verification process**
- **To establish Alliance members as future participants in the evaluation process**
- **To receive input and feedback to enhance the EvTEC process and operations**

The Workshop Agenda

The workshop began with overview presentations to set the context for the meeting and define the EvTEC process and focus. These presentations included an overview of how the process works for highway technologies, including a case study of a successful client of the HITEC verification program. In addition, presentations were made by a panel of representatives from key stakeholder groups. Throughout these presentations, ample opportunity was provided for questions and comments. The agenda then expanded participant involvement through four "breakout" sessions. These sessions provided the opportunity for small group discussion devoted to obtaining input and suggestions focused on the following four issues:



Session #1 Integrating the Alliance into the EvTEC Verification Process

Objective: Identify opportunities to enhance the ability of the EvTEC process to meet the needs of the members of the Alliance.

EvTEC is designed to be technology user driven. This breakout session examined the entire evaluation process to identify specific recommendations for means to ensure the incorporation of user needs. These included procedures to attract candidate technologies; means to identify and involve appropriate expertise when conducting evaluations; best methods for Alliance members to communicate among themselves; and listing of specific opportunities for formal collaborative agreements.

Session #2 High Priority Problems/Technology Needs (Candidates for Group Technology Evaluations)

Objective: Identify specific environmental problems or technology needs that can be addressed through EvTEC group evaluations.

EvTEC group evaluations are generated by the identification of a specific environmental problem or need, for which a variety of technology solutions are thought to exist. EvTEC, usually in cooperation with a host agency or organization wanting to solve a problem, issues a solicitation for products or technologies that address the problem and evaluates them against a common protocol developed by a single evaluation panel. This breakout session was designed to identify problems of this type.

Session #3 Developing Useful Data and Information

Objective: Define means to improve the usefulness of data and information generated through the EvTEC verification process.

The value of technology verification is enhanced if the results of the process are delivered to decision-makers in a form they can use.

The key to an effective evaluation process is producing objective, credible, and useful data. Achieving this requires that we fully understand the key data needs of appropriate user organizations. This breakout session was designed to provide recommendations on this issue. Discussion topics included information needed to meet regulatory requirements; the means to create broad-based acceptance of technical protocols and the resulting data across multiple jurisdictions; and the important factors in creating credibility in a verification.

Session #4 Effective Communication of Evaluation Results

Objective: Identify effective means to communicate the results of EvTEC verifications to the members of the Alliance and other technology users.

The value of technology verification is enhanced immeasurably if the results of the process are delivered to the appropriate decision-makers in a form they can use. This breakout session was designed to create recommendations that help ensure that the results of EvTEC verifications reach and have an impact on those decision-makers. Issues included key audiences; appropriate media; useful reports and formats; and identifying existing communication networks that could be utilized.

The Workshop Process

Each of the breakout topics was repeated in a second session and each Alliance member was asked to attend two different topics. Participants

were asked to contribute their ideas and recommendations in collaboration with each other. Discussions were held on the various suggestions and at the end of each session, the attendees were asked to rate these recommendations through a priority voting process. The top-rated recommendations from each breakout session were then displayed and discussed the following morning in plenary session, and all attendees were asked to choose their top priorities from among all of the recommended topics from all of the sessions.

The discussions involved representatives from many different sectors of the environmental community. In both the breakout and plenary sessions there were lively exchanges of information and many different suggestions and comments resulted.

Workshop Recommendations

The following are the top overall recommendations, from the consensus voting by all attendees. The recommendations are grouped in three categories:

Recommendations for development of objective, credible verifications

- **Evaluation plans should include the information necessary to help purchasers' decision making**
- **Evaluations should include relative parameters and issues, (e.g., life-cycle cost, consequential byproducts, continuous performance capabilities)**
- **QA/QC must be recognized as an important function in any data collection process**
- **Focus on data and analysis issues. Carefully define test protocols. They are the critical elements to success of any product**
- **Data should be generated or verified by a third party, independent source**
- **Establish EvTEC's credibility through demonstrating:**

  What are the benefits of EvTEC

  Why organizations should use EvTEC

  The value of the "EvTEC process"

Recommendations for coordination activities

- **Coordinate evaluation activities with other verification/ demonstration projects**
- **Coordinate evaluation activities with key stakeholders (e.g., EPA, states, consultants)**
- **Define and involve stakeholders broadly and thoroughly (e.g., business, state/local government, competitors, environmentalists, academics)**

Recommendations for communications

- **Build a system around an Internet web site with the following features:**
  - Ability to conduct database queries
  - Provides all levels of documentation
    - full verification report
    - executive summary
    - fact sheet
    - newsletter
    - bulletins with consistent language
  - Free access, or access at a modest cost
- **Utilize a consistent report format**
- **Conduct ongoing efforts to identify key stakeholders including the following categories:** target market, (i.e., users/enablers of the specific technology), vendors, alliance members, associations, Intergovernmental organizations, federal agencies (e.g., DOD, DOE), state and local regulators, public interest groups, environmental groups, multi-state organizations such as the Interstate Technology and Regulatory Cooperation Working Group (ITRC)
- **Incorporate all media forms in a coordinated outreach program:** newsletters, quarterly reports, trade/allied association publications, journals, conferences, trade shows, e-mail, electronic variations, awards programs

Additional suggestions and recommendations appear in Appendix C.

Chapter 4 describes the EvTEC verification process as refined with the help of input from the survey and recommendations from the workshop. It also includes notations indicating the potential areas of involvement of Alliance members in all aspects of the process.

Chapter 5 outlines the next steps for incorporating other aspects of the feedback from the Alliance and the workshop into the further development of the EvTEC program.

Chapter Four

The Verification Process

EvTEC's process for verifying the performance of environmental technology is based upon the same proven collaborative, consensus-based evaluation process employed by the other CERF Innovation Centers (HITEC and CEITEC). As a result, it is flexible enough to accommodate the full spectrum of environmental technologies. The key ingredient is that it relies on evaluation panels consisting of experts from a broad range of activities, including users, regulators, engineering consultants, and researchers, to design the evaluation plan and oversee its execution.

The key ingredient is that [the EvTEC process] relies on evaluation panels consisting of experts from a broad range of activities...

This chapter provides a description of the six-step EvTEC process. Since EvTEC intends to provide personalized service to every applicant, the details of the individual steps may vary from product to product. A chart illustrating the verification process is included as Figure 4-1.

As described in the previous chapter, the verification process relies substantially upon the input and participation of members of the Alliance. To illustrate this point we have noted in the margins next to each step, the potential involvement of Alliance members.

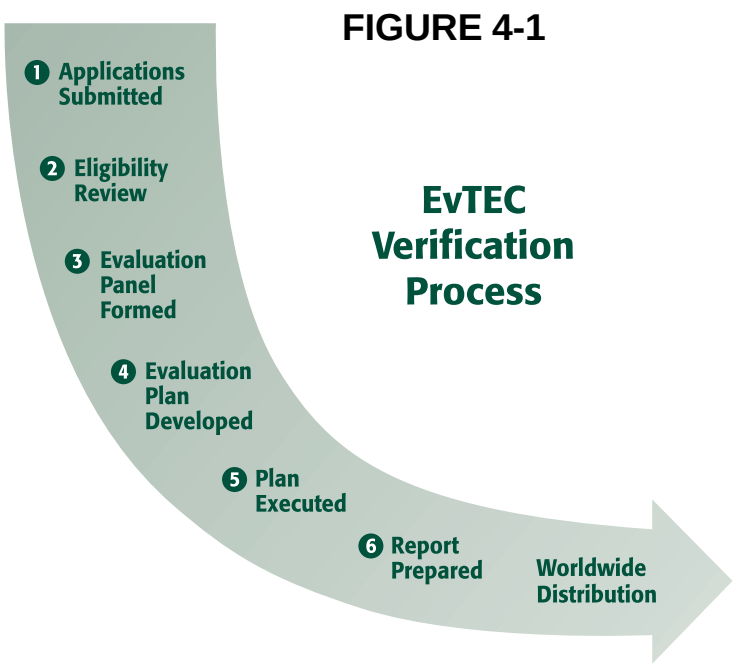
Step 1: Applications Submitted

Applications may come to EvTEC in a variety of ways:

- **Referrals**
- **Single product applications**
- **Group evaluations of several vendors of the same or similar technology**

EvTEC accepts applications from individuals and companies who are interested in obtaining an evaluation of their product. Applicants may include technology developers, entrepreneurs and others.

The products and technologies evaluated by EvTEC might be materials,



services, pieces of equipment, processes or other such products that could be applied usefully to solve environmental problems. We use the term **product** throughout this chapter to describe the wide range of technologies and systems that meet EvTEC's niche of focusing on innovative technologies.

Depending upon the type of technology or product, EvTEC's staff can also utilize the expertise available through other CERF centers such as HITEC, which specializes in highway and bridge applications, or CEITEC that encompasses other infrastructure-related technologies from the civil engineering and construction industries. It is important to highlight that EvTEC is organized to handle only commercial-ready products that are beyond the concept or prototype stage and are sufficiently developed and ready to be marketed and sold.

Alliance members may assist in the initiation of a product evaluation in the following ways:

ROLE OF THE ALLIANCE IN STEP ONE: Referrals
• Members of the Alliance who know of a promising technology may contact EvTEC or refer the vendor to EvTEC. This is particularly useful to members who are technology owner-operators who often receive unsolicited calls from vendors of new technology, but have no means to perform evaluations.

Group Evaluation
• An environmental problem may be identified by an Alliance member that needs to be addressed through the application of innovative technology. In cooperation with the Alliance, EvTEC would draft and publish a solicitation for suppliers of technologies that address the problem to participate in a group evaluation. This group evaluation is especially valuable when there is a widespread problem without a recognized technology or product for its solution.

Single Product Evaluation
• A technology owner or developer applies to EvTEC for an evaluation. In this case, EvTEC would inform the members of the Alliance and provide them with general information about the technology. Members of the Alliance with knowledge of or interest in the technology could respond either with additional information, or by identifying potential volunteers to serve on an evaluation panel. Information that is especially important to obtain from members at this stage is the potential value of the technology and the crucial issues which must be considered in a verification.

Step 2: Eligibility Review

Upon submission of an application, the applicant receives a written acknowledgment of receipt from EvTEC. The application is then reviewed by EvTEC staff. If necessary, EvTEC will arrange for examination by an independent technical consultant. Any questions will be reviewed directly with the applicant. The purposes of this review or "screening process" are to ascertain if the application is complete and whether it meets the five criteria necessary for an EvTEC evaluation:

1. The applicant **owns the product** and its associated technologies, or controls the right to use it under a licensing or other legal agreement.
2. The product has **innovative features that cannot easily be evaluated against an existing standard.** In this context, an "existing standard" means a nationally recognized or widely accepted standard, code or specification.
3. The product must be **"market ready"**, beyond the conceptual stage and ready for introduction into use.
4. The issues in question regarding product performance must be such that **definitive tests can be devised** to obtain clear, unambiguous results.
5. The technology meets a significant need, indicated by clear interest in the technology from the demand side stakeholders.

If the review indicates that a product does not meet the eligibility criteria, EvTEC staff will contact the applicant and discuss the determination. As appropriate, EvTEC may refer the applicant to other organizations whose mission and capabilities might better assist them in their efforts to develop or market their product.

Once an application is accepted, EvTEC and the applicant discuss the next steps in the evaluation process, including the formation of a Technical Evaluation Panel. Following these discussions, a formal agreement will be executed between the applicant and EvTEC, referencing the pertinent material provided in the application.

The overall goal is to assemble a cross-section of potential users that is diverse with respect to organization, expertise, experience, and geographic region.

ROLE OF THE ALLIANCE IN STEP TWO:
• Members of the Alliance who have a particular expertise in the product or technology will be queried regarding their assessment of its viability and its potential value; suggestions for potential panelists; possible sources of funding for those applicants that face financial constraints; and other information needed by EvTEC during the eligibility review and acceptance process.

Step 3: Evaluation Panel Formed

This step creates the core of the unique value of an EvTEC evaluation. EvTEC assembles the technical evaluation panel composed of experts from public or private owners and operators, government, consulting engineers, and other stakeholders where appropriate, such as members of the financial community, academia, and public interest groups.

The size and composition of the panel vary depending on the nature of the technology being evaluated. The overall goal is to assemble a cross-section of potential users that is diverse with respect to organization, expertise, experience, and geographic region. Such a panel is capable of identifying the most crucial technical issues and concerns to be addressed during the evaluation and to answer the questions and meet the information needs of the applicant's market.

The Technical Evaluation Panel operates with the knowledge and participation of the applicant. Although the decisions regarding the planning and conduct of the evaluation ultimately reside with the Panel, the

applicant's liaison representative is expected and encouraged to attend meetings and fully cooperate with the Panel members in carrying out their mission.

In order to promote a high standard of professional conduct and confidentiality, EvTEC requires all panelists to complete non-disclosure agreements, notify EvTEC if a conflict of interest exists or may arise, and comply with EvTEC's Governing Principles.

ROLE OF THE ALLIANCE IN STEP THREE:
• This panel will likely include individuals recommended or referred to EvTEC by Alliance members. Regulators involved with the specific technology being evaluated will be included as panel members when appropriate. The panel may also include Alliance members themselves, though their participation on panels is not required. Alliance members who are interested in the technology but not serving on the panel may stay informed of progress in the evaluation.

Step 4: Evaluation Plan Developed

For each product accepted for an evaluation, the Technical Evaluation Panel meets to establish specific evaluation criteria against which the performance of a product can be measured. The Panel prepares a comprehensive evaluation plan for conducting an evaluation, consistent with the EvTEC Technical Protocol.

Typically, the applicant makes an initial presentation about the product to the Panel, including recommendations about the type of evaluation considered necessary or beneficial to the applicant. The objective of this initial meeting is to develop a consensus on the nature and scope of the evaluation to be performed, the performance criteria to be used, and the detailed Evaluation Plan. The meeting also serves to verify the initial screening process performed by EvTEC staff. Following the development of the draft plan, a second meeting may be held, but is often not required until the plan is executed.

The nature and scope of the Evaluation Plan is driven by the expert panel and is tailored specifically to the product under evaluation. The Plan identifies the scope of the evaluation, the specific evaluation criteria, testing and data collection procedures, Quality Assurance and Quality Control (QA/QC) requirements, the proposed schedule, the suggested site location(s) for the evaluation activities, the facilities to be used, consulting services

required, and the evaluation budget or fee necessary to complete the activities proposed in the plan.

The applicant is given time to review the completed Plan, including the budget developed for completion of the evaluation. This review will afford the applicant an opportunity to decide whether sufficient interest and funds exist to proceed with the evaluation.

ROLE OF THE ALLIANCE IN STEP FOUR:
• Alliance members not serving on the panel do not have direct involvement in the development of evaluation plans. However, special interest networks may be created to provide additional information and plan reviews by interested Alliance members. When the evaluation plan is complete for a particular technology, the Alliance will be notified, and, as appropriate, members may propose additional demonstration sites or testing facilities.

Upon the applicant's approval of the Evaluation Plan, EvTEC staff will initiate a written agreement with the applicant to obtain a commitment to proceed.

Step 5: Plan Executed

Once the applicant approves the Evaluation Plan, the Plan is executed. This may include, as appropriate, executing a contract with individuals, organizations or facilities selected to conduct testing, demonstrations, and analyses.

The Technical Evaluation Panel meets as necessary to oversee the conduct of the evaluation, including where applicable, monitoring the progress, QA/QC, and reviewing data generated during the evaluation.

Evaluation activities are conducted at the most appropriate technical facilities or locations, with consideration given to cost effectiveness. Potential locations include university research centers, private laboratories, federal or state laboratories, and public and private test sites.

ROLE OF THE ALLIANCE IN STEP FIVE:
• Alliance members not serving on the panel do not have direct involvement in the execution of evaluation plans, but, again, the special interest networks and general information will keep them informed of the progress of the verification. In addition, Alliance members may volunteer to host a field test of the technology.

Step 6: Evaluation Report Prepared

Upon completion of the tasks outlined in the Evaluation Plan, an extensive Evaluation Report is prepared in accordance with the Plan and the EvTEC Technical Protocol. The Technical Evaluation Panel oversees the preparation of the Report.

The Report will clearly, comprehensively and accurately document the results of the evaluation of the product against the specific criteria detailed in the Plan and analyze and expand the findings regarding issues of performance and operations. It also may serve to assist the applicant to introduce and market the product to potential customers.

EvTEC then meets with the applicant to review the Evaluation Report and to arrange for its publication and distribution.

Reports will be broadly distributed to a cross-section of federal, state, and local environmental and public works officials, consulting engineers, and other potential users of the product. Distribution will be made by means of a variety of relevant media including web sites, reports, journals, e-mail, and trade publications. The costs associated with this distribution are included in the evaluation fee.

ROLE OF THE ALLIANCE IN STEP SIX:

- Alliance members not serving on the panel do not have direct involvement in the preparation of evaluation reports, but will receive the results.
- A verification statement/technical summary will be distributed to all members of the Alliance. This document is a summary of the evaluation report. The full report will be made available free of charge to Alliance members upon request.
- Members of the Alliance would be asked to bring the verification results to the attention of appropriate staff in their organizations, and distribute it further through their available networks to their constituents as appropriate. The objective is to ensure that EvTEC evaluation results and verification statements are delivered directly to those key decision-makers that recommend, specify, authorize, approve, and/or purchase environmental technologies.

Chapter Five

The Next Steps

As EvTEC entered its second year, a milestone in EvTEC's evolution was passed, marking the formal establishment of a new organization engaged in the verification of environmental technologies. This milestone is near the beginning and not the end of the evolutionary process. Based on the recommendations received from the workshop and associated information-gathering activities, EvTEC will continue to develop on many fronts, pursuing the goals of establishing EvTEC as an objective, credible source of information on technology verification, and as a flexible, effective path to the marketplace for beneficial technologies. Applying the recommendations developed by the workshop participants to improve the organization and delivery of EvTEC services is a key part of that growth and development process. Accordingly, since completion of the workshop, EvTEC has made substantial progress through the following activities:

EvTEC will continue to develop on many fronts, pursuing the goals of establishing EvTEC as an objective, credible source of information on technology verification, and as a flexible, effective path to the marketplace...

1 **Proceeding with technology verifications underway.** In addition to establishing the overall structure of EvTEC, several product evaluations have been initiated and others are soon to begin. These early projects are serving to refine the system, and demonstrate the value of the collaborative approach. We have already applied some of the recommendations from the workshop to enhancing our verification process. These actual applications of the process will help EvTEC to further fine-tune its approach while helping move specific technologies into the market. See Appendix D for case studies.

2 **Starting a series of group evaluations in partnership with other entities.** In these projects, we have formalized agreements with organizations that have specific problems which can be addressed with environmental technologies. In this group evaluation process, EvTEC develops a solicitation for technologies to address the particular need. The technologies are evaluated in parallel against a common

protocol developed by a technology evaluation panel in collaboration with the host organization. See the case studies in Appendix D.

3 **Developing a comprehensive outreach program.** Working with the EvTEC Advisory Council, we have developed a business plan designed to build awareness of the program, attract applicants, and create the basis for transition to a self-supporting operation.

4 **Creating a versatile communication system** for interaction among members of the Alliance as well as disseminating information to broader audiences. EvTEC has developed the core of this web-based system and has begun to use the system's capability to communicate with Alliance members.

5 **Working to expand contacts and build specific working relationships** as appropriate. In particular, we are pursuing strong working relationships with:

- **State government verification and environmental technology activities**
- **Private-sector verification activities, especially the ETV pilots**
- **Federal government agency programs**
- **Owner/operators in both the public and private sectors**
- **International linkages as appropriate**

Other activities underway include:

Continuing to build the Alliance as a network for collaboration. The essence of the EvTEC system is the involvement of a full spectrum of environmental stakeholders, and the Alliance is the basis of that activity. Additional key constituencies are being identified and invited to join the Alliance. We will continue to maintain the Alliance in a form that minimizes the resource requirements for participation but maximizes the value of that participation. The emphasis in the Alliance membership will continue to be on the "demand side", in order to avoid actual or perceived bias or conflict which could result from the involvement of "supply side" members, e.g., technology developers and marketers.

Developing specific additional mechanisms for involvement of Alliance members in EvTEC's verification activities. In combination with the Advisory Council, the membership of the Alliance will play a major role in the identification of experts in the many and varied fields of environmental technology; in the identification of innovative technologies; the recommendation of test and demonstration sites for verifications; and the dissemination of verification results that are of interest to their own constituencies.

Participating in clearinghouse activities to help the user community find the best information available regarding particular technologies and to guide new technology applicants to the most efficient program for their verification, and, as needed, to sources of funds. This will include working with private business organizations and government sources of funds as well as the other verification entities.

Continuing to gather the information necessary to understand the requirements of the environmental community, the obstacles faced and the procedures and practices in place to overcome barriers and respond to other needs. This will be achieved through input from the many collaborative participants in the process as well as taking additional surveys and conducting other information gathering activity as required.

Continuing to formalize coordination with EPA and other federal agencies (e.g., DOT, DOD, DOE) as well as state and local agencies, to respond to their requirements for technology evaluation, while avoiding unnecessary duplication of effort. Especially in times of government budget limitations and downsizing, the private-sector, collaborative services offered by EvTEC could be helpful to these agencies in fulfilling their missions.

To be successful ...over the long run... broad participation is an essential quality that must be maintained.

After the first year of development, EvTEC is now a fully operational verification center. As we complete the first round of technology evaluations and begin new ones over the next year, we will further progress toward our goal of becoming recognized as the source of objective, credible, and timely evaluations and the provision of a value-added service. To be successful in this goal over the long run, however, broad participation is an essential quality that must be maintained. Alliance members can help us achieve that success by staying involved and continuing to furnish feedback and advice, whether solicited or unsolicited. Their contributions will help assure the success of the system by:

- **Identifying the issues of most value to stakeholders**
- **Helping to prioritize those issues**
- **Assuring that proper expertise is involved in verifications through identifying participants for evaluation panels**
- **Identifying and providing access to high value communication methods**
- **Contributing to the general dialog on technology verification so that it remains responsive to the needs of the environmental community.**

This document describes an ambitious, but realistic, vision to guide the evolution of the EvTEC approach to environmental technology verification. In the dynamic, ever-changing world of environmental technology, this vision demands a constant effort of interaction, analysis, coordination, and improvement. The mix of participants, needs,

technologies, and audiences, will be constantly changing to respond to new challenges. The EvTEC verification program is designed to maintain the flexibility and responsiveness to work within that state of flux, recognize the changing conditions and evolve to keep pace and, within this changing environment, maintain a constant dedication to producing objective, credible, high-quality product verifications.

By working together with the broad range of stakeholders, EvTEC will continue to develop as a comprehensive, effective verification organization assisting in the acceptance and implementation of innovative environmental technology.

The stakeholders, particularly those represented through the Alliance, are the key to this continued development. Accordingly, we again invite your active involvement, and solicit suggestions regarding how we can continue to make EvTEC more useful to you.

Appendix A

Members of the EvTEC Advisory Council

The Advisory Council

The EvTEC Advisory Council is composed of a small group of senior officials from a cross section of the environmental community. The Council is designed to provide high- level policy guidance to the EvTEC staff with respect to operational aspects of EvTEC. Included are representatives from both the public and private sectors: federal, state and local governments, facility owners and operators, consulting engineers, the financial community, and public interest groups. The Council will not be involved in day-to-day management decisions or individual technology evaluations. The Council will assist in identifying program priorities and strategies to maximize the impact of EvTEC's activities, build appropriate organizational liaisons and collaborations, create a self-sustaining operation, and enhance the value of EvTEC services to the broad environmental community.

Advisory Council Members:

Ralph Cullison III
Chief, Environmental Services Division
City of Baltimore

Penelope Hansen
Director of Innovative Technology
U.S. Environmental Protection Agency

Tom Houlihan
Executive Director
Interagency Environmental
Technology Office

Walter Howes
President
EBI Capital Group

J. Peter Kissinger
Vice President
Civil Engineering Research Foundation
Director, Highway Innovative
Technology Evaluation Center

Richard Kuchenrither
Senior Partner
Black & Veatch

Mike Kupferman
Managing Director, Professional,
Educational and Technical Activities
American Society of Civil Engineers

Norma Lewis
Pilot Manager, ETV Program
U.S. Environmental Protection Agency

Phil Ludvigsen
Vice President, Technology Transfer
American Re-insurance Corp.

Dave Schlesinger
Director
Metropolitan Wastewater Department
City of San Diego

Benedict Schwegler
Executive Director,
Research and Development
Walt Disney Imagineering

James Seif
Secretary
Pennsylvania Department of
Environmental Protection

William Wallace
Senior Vice President
CH2M Hill Companies, Ltd.

Appendix B

Workshop Agenda

September 9-11, 1997 • Hotel Washington

Tuesday, September 9, 1997

RECEPTION 5:00PM-7:00PM

Welcoming Reception for
All Workshop Attendees

Wednesday, September 10, 1997

OPEN PLENARY SESSION 7:30AM-12:00PM

Registration and Continental Breakfast

8:30AM-9:00AM Welcome and Overview
Benjamin Schwegler
Chair, EvTEC Advisory Council
Executive Director, R&D
Walt Disney Imagineering

9:00AM-9:30AM Keynote Address
Henry Hatch
Chair, Civil Engineering Research Fdn.
Corporate Advisory Board
President and CEO
Fluor Daniel Hanford, Inc.

9:30AM-10:00AM CERF Case Histories in Technology
Peter Kissinger
Vice President, CERF
Director, Highway Innovative Technology Evaluation Center
George Kochanowski
President, ALLSIGN Products, Inc.

10:00AM-10:00AM Break

10:15AM-11:00AM Four Views on Technology Verification
Participants: EPA representative, consulting engineer, owner/operator, and state regulator

11:00AM-11:30AM The EvTEC Approach to Verification
William E. Kirksey
Director, EvTEC

11:30AM-12:00PM Feedback: Q&A Session

12:00PM-1:00PM Lunch

Wednesday, September 10, 1997

BREAKOUT SESSIONS 1:00PM-5:00PM

(Sessions will be repeated. Participants may select two topics.)

1:00PM-3:00PM 1st Breakout Session

1. Integrating the Alliance into the EvTEC Process
2. High Priority Problems/Technology Needs
3. Developing Useful Data and Information
4. Effective Communication of Evaluation Results

3:00PM-3:15PM Break

3:15PM-5:00PM 2nd Breakout

5:00PM Adjourn for the Day

Thursday, September 11, 1997

OPEN PLENARY SESSION 7:30AM-2:00PM

Continental Breakfast and Presentations

After an introductory overview, each breakout session leader will present the results of the previous day and receive feedback from the full group of attendees.

8:30AM-12:00PM Overview of Session

•Individual Breakout Reports Presented

•All participants rank results of each breakout

12:00PM-2:00PM Guest Luncheon Speaker

RADM David Nash
Chief of Civil Engineers
Naval Facilities Engineering Command
U.S. Navy

•Summary of Results
•Next Steps
•Adjourn

Appendix C

Additional Workshop Issues and Recommendations

Each of the four breakout topics was given in two sessions of approximately two hours each. All participants in these meetings were given an opportunity to present their suggestions and recommendations. The issues were then discussed and clarified, and "overlapping" ideas were consolidated. They were then voted using a "10/4" method, in which each breakout session participant was given 10 colored dots/votes. They were allowed to place up to 4 of these dots/votes on one of the items displayed. This allows weighting of votes and a consensus voting approach. The top recommendations from these sessions were then voted on by all workshop participants in the next day's plenary session. Results are shown in Chapter 3.

As can be imagined, with verification of innovative environmental technology as the overall theme of the workshop, and with representatives from many diverse segments of the environmental community, lively discussions were held in each of the breakout sessions on many different issues. The following describes some of the discussions held in the breakout sessions and lists some of the recommendations which were presented but not chosen by the breakout participants as their top recommendation choices. To faithfully capture the flavor of the sessions, there has been very little editing done to the statements recorded.

Breakout Topic #1: Integrating the Alliance into the EvTEC Process

In general the discussion included:

- **What is the EvTEC Alliance?**
- **How does the evaluation process work?**
- **Where does my organization 'fit-in' to the EvTEC program or individual evaluations?**
- **Don't want EvTEC to become a new bottleneck to acceptance of new/innovative technologies.**

- **Need for broad inclusion in the EvTEC program.**
- **How do you insure state/local regulators acceptance of results?**
- **Small and medium sized firms would benefit more than larger firms from performance claim verification.**

Additional recommendations which were discussed and considered, included:

"Look at attracting industry-driven rather than regulation-driven technologies."

"Develop list of incentives for businesses/vendors to undergo verification."

"Use Technology experts from EPRI to participate and identify technology needs."

"Ensure that most appropriate users/enablers are on panels."

"Set up electronic 'chat room' for alliance members."

"Keep EvTEC broad-based. Do not exclude technologies."

"The Alliance should promote reciprocity among states."

"Consider paying regulators to participate in meetings."

"EvTEC should develop a plan/'focus' for technology areas."

"Create formal partnerships with DOD labs to share information, do testing and evaluations."

"(Establish) review panel to evaluate EvTEC performance every 6 months."

"Integrate information age technologies into cleanup, site monitoring, etc., e.g., software to integrate field hardware."

"Let market/companies decide what should go through process. Avoid issue of 'how good' technology is relative to state/federal standards."

Breakout Topic #2: High Priority Problems/ Technology Needs

In general the discussion included many different topics:

- **Market drivers for technologies (listed in Chapter 4)**
- **Obtaining leads on pressing technologies from existing sources such as DOD databases.**
- **Cost issues are big concerns, especially in remediation.**
- **Air issues are mainly driven by regulation.**
- **The success of technology itself has become an issue because of lower and lower detection limits.**
- **Problems with remediation result from contractors being asked to clean to extreme levels, e.g., cleaning brownfields to greenfield levels.**
- **Many low technology strategies are overlooked in favor of newer technologies.**
- **Public involvement is a key driver. Public wants to be involved.**
- **Information management and consolidation of services within utilities is important.**
- **Pump and treat technologies are becoming a thing of the past. Natural attenuation is a more economic measure. Monitoring will become a bigger and bigger field.**
- **Tried and true methods win out because of risk factors.**
- **Investment problems and cost of development are too great to get people to invest.**
- **People do not look to fund operating costs.**
- **Demanufacturing is a process which needs attention, particularly with respect to electronics.**
- **The implications of electric industry deregulation in terms of reduced funds for conservation and renewable programs.**

Additional suggestions and recommendations which were discussed and considered, included:

"Invest in evaluations that have more 'bang for the buck'."

"Look into demos attended by 6 or more states, looking at the same technology, and therefore likely to agree with other's data."

"Invest in technologies that will improve economics, recycle, reuse, etc."

"Invest in technologies that will last and have low maintenance costs to maintain."

"EvTEC role in federal technology transfer is important."

"Establish partnership with DOD (tri-service) labs for purposes of sharing information with the Alliance."

"Ask key stakeholders, i.e., state agencies, international organizations (UN, World Bank), for their highest priority technology needs."

"Identify groups of water and wastewater technologies for export, considering cost, ease of operation and maintenance."

"Integrate new digital technologies for field analysis, site characterization and initial monitoring."

For group evaluations: "On-line sensors/analysis" "Innovative odor/ volume control technologies" "Wet weather flows treatment technologies" "Innovative materials for collection (sewer) systems" "Innovative treatment and disposal of biosolids, e.g., sludge, municipal wastes" "In-situ monitoring of hydrocarbons" "In-situ remediation of polychlorinated organics" "Excess supply of collected recyclables, e.g., scrap tires"

"Reduction of long term monitoring costs at clean-up sites."

Breakout Topic #3 Developing Useful Data and Information

In general the discussion focused on defining terms and assuring that the evaluation product would be useful to its intended recipients. Other topics and suggestions included:

- **Important to get 'buy-in' from the community**
- **Many groups want access to pertinent information — with details available on demand.**
- **'Usefulness' is the key word in terms of what the customer is buying.**
- **Confidentiality of information is very important.**
- **Important to reduce technology risk to purchaser.**
- **Must address barriers to implementation, e.g., regulatory, site constraints**
- **Don't get caught in a standard format which may confine or restrain.**
- **Do we accept the 'black box' because it works, or are we interested in understanding it?**
- **Continuous performance of the technology is an important issue.**

- **Different technologies may have separate verification procedures in multiple states.**
- **Variabilities in effectiveness of technologies may depend on site specific characteristics.**

Other recommendations included:

"Both capital and O&M costs must be reported."

"Within bounds of confidentiality, solicit input for serious factors that must be considered."

"Must address composition of expert panel, their skill mix and make their credentials available and confirmed."

"Evaluation must be good enough to stand up in a court of law."

"Develop categories or boundaries including cost and range of usefulness."

"Define and involve evaluation panel in the beginning of developing the test protocols according to a broad stakeholder input."

"Establish a core of key stakeholders in the expert panel."

Topic #4 Effective Communication of Results

Discussions involved a wide range of topics:

- **How to avoid overlap /duplication of initiatives undertaken by other EvTEC partners?**
- **Need to transfer information from federal labs to the private sector**
- **Reciprocity among government entities is a key issue. Pivotal issue states are working with a focus on both permit issues and verification program.**
- **There should be communication about risks among stakeholders.**

Other recommendations included:

"Ask target market for best means of communicating."

"Because of resource limitations, process must be defined to establish priorities."

"For failures, do up at least an executive summary."

"Define the problem. Why is it a problem? What is the impact on

human health and environment? What is the economic impact? What is the state of the art?"

In addition to these suggestions and recommendations from the Breakout Sessions, there were suggestions received on 'Feedback Forms' which had been distributed to the participants. These included:

"Consider doing site restoration demos at national test sites formed under the DOD ESTCP and SERDP programs."

"AEC, AFCEE and NFESC can provide 3rd party oversight of demonstrations."

"As a technology buyer I want to know 3 things: 1) cost and performance 2) cost 3) cost"

"If you ignore cost you do your customers an extreme disservice. They need to be cautious of the market driver."

"EvTEC should include cost (especially operations and maintenance costs) MUST be evaluated as part of the process. This info is critical to inform users/decision-makers."

"Don't reinvent the wheel! There is a lot of technology communication tools already developed — take advantage of them!"

Breakout Session 2 also reported a list of Market Drivers for Technologies which participants found to be useful in guiding the discussion:

- **Privatization of wastewater treatment and other public works**
- **Decreased regulation**
- **Public concerns and education**
- **Cost - "lean and mean"**
- **Realization that our water source is not infinite**
- **International markets**
- **Sustainable technologies**
- **Federal government contracting operations**
- **Utilities deregulation**
- **Improved monitoring - lower detection levels for contamination**
- **Risk of using certain technologies**

Appendix D

Case Studies

Case Study: Ice Ban Anti-Icing/ De-Icing Product

Innovation

Ice Ban is a liquid anti- and de-icer made from the concentrated residue of the fermentation and distillation of alcohols (ethanol) and other agricultural products. Testing of Ice Ban has shown it to be non-corrosive, non-toxic, water-soluble, and easy to handle and apply. It provides an environmentally-friendly alternative to chloride salt de-icers, which are known to corrode cars, streets and highways, and cause deterioration of water quality in lakes and rivers. It is also an alternative to other liquid de-icers such as ethylene glycol, which sometimes exhibits toxicity to aquatic organisms.

Ice Ban can be applied as a straight liquid, but it is most often mixed with road salt and/or sand, for anti/de-icing of roadways. Salt is less corrosive when mixed with Ice Ban, and using road salt mixed with Ice Ban allows a much lower quantity of salt to be used. Ice Ban's cost is competitive with road salt.

Background

CERF's Innovation Centers have convened two Technical Evaluation Panels for Ice Ban. EvTEC's evaluation plan for Ice Ban will focus on its potential environmental impacts, while Ice Ban's performance as an anti/de-icer is being evaluated under the Highway Innovative Technology Evaluation Center (HITEC). The collaborative evaluation process of the Innovation Centers allows Ice Ban to reach a large number of potential clients with one set of demonstrations. The market for highway de-icers is a state-by-state and county-by-county decision-making process. The Innovation Centers provide an independent, credible source of information with capability to disseminate the results broadly across the market.

Ice Ban is a Florida corporation that has acquired the patented rights for use of several agricultural by-products for use in anti/de-icing agents. Ice Ban's primary supplier of raw material is Minnesota Corn Processors (MCP), based in Marshall, MN. MCP provides corn stillage and steepwater for the manufacture of Ice Ban; these products have also been sold for years as an additive for agricultural feed.

MCP performs product testing to ensure that the pH, solids content, and chemical content of Ice Ban are within their quality control limits. A number of independent laboratories have also tested Ice Ban to analyze its corrosiveness, biodegradability, toxicity, effects on metals, and other physical and chemical properties.

Ice Ban is on the market and is currently being used in several states across the country, including New York, Nebraska, Colorado, Washington, Kentucky, and Minnesota. Anecdotal field evidence suggests that Ice Ban, either applied as a liquid or mixed with road salt, has excellent de-icing properties and works at lower temperatures than road salt alone. Users have noticed no noticeable, visual effects on water quality or roadside vegetation. Additionally, independent laboratory testing has indicated that it is highly soluble, biodegradable, nontoxic to aquatic organisms, and exhibits low corrosivity.

Benefits to be gained by the EvTEC evaluation process

- **The EvTEC evaluation report on the environmental impact of Ice Ban, in conjunction with the HITEC report on its performance as a de-icer, will document the product's performance at several demonstration sites across the country.**
- **Wide dissemination of test results will reach multiple markets much more quickly than otherwise possible.**
- **Ice Ban will be able to showcase the report as a source of credible information for their potential customers, who can use the conclusions in the report as a basis for making purchasing decisions.**
- **Test results showing superior environmental performance for Ice Ban could help set new standards by which to judge de-icing products.**

Case Study: Group Evaluation-Stormwater Best Management Practices, A WSDOT/EvTEC Collaborative Effort

Innovation

A wide variety of new technologies have been developed for the purpose of reducing the pollution from stormwater runoff. To provide a basis for assessing these technologies, the Washington State Department of Transportation (WSDOT) has initiated an extensive testing program, and established a collaboration with EvTEC to verify the performance of innovative stormwater Best Management Practices (BMP) under field operating conditions.

In particular, WSDOT is establishing a Stormwater BMP test facility to evaluate innovative technologies for use in controlling and treating highway stormwater runoff in an "ultra urban" situation where space is limited, most surfaces are paved, and property values are high. The program will create a regional stormwater research facility that can produce results useful nationally.

EvTEC will operate the evaluation program as an independent, non-profit verification center so that results are produced that can be used by public works agencies nationwide. EvTEC's role will include recruiting and identifying expert panelists from around the country, developing evaluation plans, overseeing the testing, and reporting findings.

Background

Water quality is a key issue to the State of Washington and highway runoff is an important contributor to water pollution, particularly in urban areas. There are a variety of devices on the market that promise varying degrees of treatment of runoff waters but little comparative data exist. The issues that WSDOT faces are very similar to those experienced by all states and many of the devices on the market are nationally distributed. Therefore, much can be gained from an approach that considered the issues from a national perspective and tests, and presented results in a manner that would have broad application.

EvTEC brings this broader focus to the WSDOT program. The WSDOT program was created primarily to address the needs of the State of Washington; however, involvement from other parts of the country will

benefit Washington through the involvement of additional expertise and resources, and the attraction of a wider variety of technologies. The opportunity to reach widespread markets with one series of tests also makes the program attractive to those who own the technologies.

EvTEC involvement will provide national benefits as well. The Phase II National Pollutant Discharge Elimination System (NPDES) requirements will significantly impact every state DOT and most local public works agencies. The results of the WSDOT program, by providing data which can be used as a basis for responding to those requirements, will help identify the most cost-effective approaches to stormwater management. All types of BMP technologies are of interest, even though the initial focus is on the "ultra-urban" situation.

WSDOT has designed a test facility for the ultra-urban BMP tests to be constructed at the site of a major outfall from Interstate 5 into Lake Union in the City of Seattle. Lake Union is identified as the highest priority in Seattle's National Pollutant Discharge Elimination System (NPDES) Stormwater Management Plan.

The Application of the EvTEC Evaluation Process

This case study is a classic example of the EvTEC "group evaluation" process. In this type of program, EvTEC works with a public agency or other organization that has a specific environmental problem that could likely be addressed by a number of potential technologies. In a group evaluation, as described in Chapter 4, EvTEC assembles an expert panel to draft a protocol and then recruits as many technologies as possible for a side-by-side evaluation against the common protocol.

Benefits from an enhanced evaluation process

- **The program is specifically designed to allow public agencies to participate in testing the latest state-of-the-art treatment methods and answer the key questions regarding the performance of these technologies.**
- **The panel is designed to provide broad regulatory involvement throughout the evaluation process, so that data produced acceptable for making purchasing decisions in a wide variety of jurisdictions.**
- **The verification program is a collaborative effort, involving multiple organizations and experts from a variety of jurisdictions and disciplines.**
- **The resulting information will be shared nationwide so that it can be used widely as a basis for implementation decisions.**
- **This approach allows technology owners a cost-effective means to demonstrate their technologies in a program that will have high visibility to key markets and decision-makers.**

Case Study: ThermoEnergy STORS/ NitRem/ARP Wastewater Treatment Technologies

Innovation

ThermoEnergy uses a radically new approach to wastewater treatment. The ThermoEnergy wastewater treatment technologies are designed to reduce the volume of wastewater sludges and decrease excessive levels of nitrogen in wastewater effluent. There are three distinct technologies employed by the ThermoEnergy process. They include:

- the Sludge-To-Oil Reactor System (STORS), designed to convert wastewater sludge into a burnable fuel oil
- the Nitrogen Removal process (NitRem), a noncatalytic hydrothermal process designed to convert organic and inorganic nitrogen into nitrogen gas, carbon dioxide, and water; and
- the Ammonia Recovery Process (ARP), which uses a proprietary resin system to remove ammonia from wastewater and convert the nitrogen-rich backwash into a commercial-grade fertilizer.

Sludge and excessive nutrient loading (i.e., nitrogen and phosphorus) are important areas of concern for cleaning domestic and industrial wastewater. All three technologies are non-biological treatments and are less sensitive than traditional wastewater treatment technologies to fluctuations in wastewater influent parameters.

These technologies show significant promise as innovative, cost-effective means of treating wastewater; however, it is a significant departure from conventional practice. This obviously creates substantial barriers to reaching the intended market. ThermoEnergy applied to the EvTEC program to help overcome those barriers. By building on two preplanned demonstrations (described below) of these technologies, EvTEC is able to conduct a cost-effective, independent evaluation that will help establish the credibility of the technology.

Background

ThermoEnergy, in partnership with Battelle Pacific Northwest Laboratories (technology developer) and Foster Wheeler Corporation (design firm), has developed a system to retrofit an existing wastewater treatment facility with the STORS/NitRem, NitRem, and/or ARP technologies. The Department of Energy (DOE) has been involved and has funded a portion of

the STORS research since the early 1980's. Full-scale tests of the technology have been ongoing since 1988.

In the first demonstration, ThermoEnergy will install the ARP at a wastewater treatment plant in Staten Island, N.Y. The process will operate for 12 weeks under an evaluation plan, developed by an EvTEC expert panel. ThermoEnergy is also participating in a nitrogen removal study with New York City's Department of Environment (DEP) and the requirements of this study were incorporated in the EvTEC expert plan.

The second demonstration, STORS/NitRem testing, will take place in San Bernardino Valley Water District in California, beginning in mid-1998. A full-scale plant will be constructed and tested for approximately 12 months. This project is being co-funded by ThermoEnergy and the United States Environmental Protection Agency (EPA). The EvTEC panel will produce a separate evaluation plan for this project.

The Application of the EvTEC Evaluation Process

EvTEC has assembled a broad-based panel of expert stakeholder composed of treatment plant owner-operators, industry associations, consulting engineers, private industry wastewater interests, academia, and public interests. These panelists are knowledgeable regarding wastewater treatment plant needs, and well-known among their peers. This panel drives the evaluation process, asking the questions that potential buyers, regulators, operators need to have answered before a technology can be applied in practice. These questions and any associated issues become the basis for the evaluation plan.

Benefits to be gained by an enhanced evaluation process

- **Panel members are technically knowledgeable and respected sources of reference for their peers.**
- **An EvTEC evaluation report will provide an independent, credible assessment of the technology's performance to help users assess the technology and make informed purchasing decisions.**
- **The testing is conducted under actual field conditions, documenting to fully assess the practicality and effectiveness.**
- **The evaluation process will provide an unbiased, independent assessment of the viability of the technologies as alternatives to the standard treatment processes for sludge management.**

The panel has developed an evaluation plan (test protocol) which uses the two planned demonstrations of the technology as a basis for assessing the performance of ThermoEnergy's technologies. The panel will oversee the testing, the analysis of the results, and the preparation of separate evaluation reports documenting the performance of each of the technologies.

Civil Engineering Research Foundation
1015 15th Street NW Suite 600
Washington DC 20005-2605
Tel 202.842.0555
Fax 202.789.2943
Web www.cerf.org
Email evtec@cerf.org

CERF is an independent, nonprofit 501(c)(3) organization created by the American Society of Civil Engineers (ASCE) and headquartered in Washington, D.C. CERF began operation in 1989 to bring together diverse groups within the civil engineering community to "*facilitate, integrate, and coordinate*" common solutions to complex research challenges facing the civil engineering profession. CERF operates innovative technology evaluation centers in the areas of highways, public works, the environment, and buildings to help the design and construction industry expedite the transfer of innovation into practice.