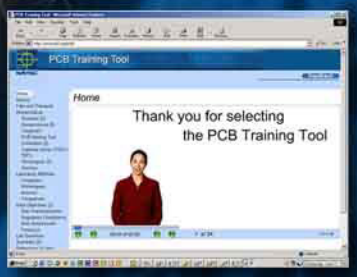
NAVFAC

TECHNOLOGY TRANSFER

T²

Five Year Program Plan for Environmental Restoration 2004-2008

Supporting the Navy's Efforts ***To Promote*** Innovative Solutions ***To Meet*** Environmental Challenges and ***To Reduce*** Cleanup Costs



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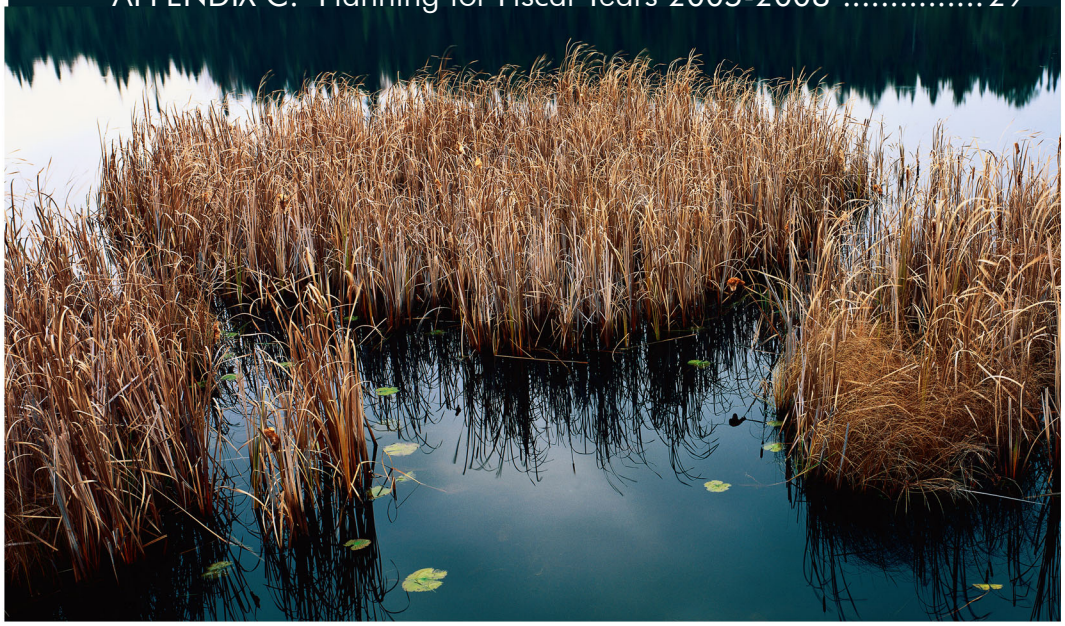


INTRODUCTION

The field of environmental restoration is constantly changing, with new developments, challenges, regulations, and discoveries emerging on a regular basis. The Naval Facilities Engineering Command (NAVFAC) has been exploring new and improved methods for technology transfer (T2) to increase knowledge about these changes within the Environmental Restoration community for the Navy.

> *"Technology transfer ensures Department of Defense (DoD) programs make the best possible use of national scientific and technical capabilities to enhance the effectiveness of DoD forces and systems."*
>
> DoD Directive 5535.3

In some cases, new environmental restoration technologies and approaches are readily discovered and adopted by Navy Remedial Project Managers (RPMs) and other end users. However, in most cases, the T2 process is much more involved and requires a strategic plan to overcome various regulatory, economic, organizational, and personal barriers to the use of new technologies.

T2 PROGRAM OBJECTIVES

- Build a world-class technology transfer program for the NAVFAC Environmental Restoration community
- Identify and address challenges faced by Navy RPMs in achieving successful and cost-effective environmental restoration
- Facilitate the transfer of lessons learned by one Navy RPM and/or Engineering Field Division/Activity for the benefit of the entire NAVFAC Environmental Restoration community
- Communicate information about recent advances and new innovations to leverage NAVFAC's investments in research and development
- Raise awareness of new technologies and approaches and overcome the barriers that restrict Navy RPMs from taking advantage of these new opportunities
- Use feedback mechanisms to measure customer satisfaction and to circulate knowledge and ideas

The development of a strategic plan is necessary to clearly define the T2 process and to outline key strategies for increasing the success of T2 efforts targeted for members of the NAVFAC Environmental Restoration community. The scope of this Five Year Program Plan is to

- Define the major environmental restoration challenges currently faced by Navy RPMs and other end users
- Outline the T2 process that will be used to enhance the prospects for successful technology transfer
- Describe the development of effective T2 mechanisms, including Web-based multimedia tools and other techniques for information exchange
- Detail the metrics that will be used to measure the performance of the T2 Program.

This Five Year Program Plan builds on a strong foundation of past T2 efforts conducted over the years by NAVFAC and lays out a general framework for future T2 efforts for fiscal years 2004 to 2008. The Five Year Program Plan outlines general strategies and approaches. Specific accomplishments from the past fiscal year (2003) are summarized in Appendix A. The proposed Work Plan for fiscal year 2004 and beyond isprovided in Appendix B. The proposed Work Plans for out-years are discussed in Appendix C.

MEETING ENVIRONMENTAL RESTORATION CHALLENGES

The Navy continues to be a leader among military components in fostering the development and use of "faster, more cost-effective, and more efficient technologies." The Department of the Navy's (DON's) environmental restoration mission is supported by NAVFAC's continued T2 efforts in this area. The T2 Program increases awareness of these new technological innovations and promotes understanding of new methods for improved performance or cost-effectiveness of the Installation Restoration (IR) Program.

> ***"While the Department of Navy continues to make progress cleaning up Installation Restoration Program sites, we are continuously looking for faster, more cost-effective, and more efficient technologies."***
>
> Department of the Navy
> Environmental Restoration
> Restoration Today Protects
> Readiness Tomorrow
> Fiscal Years 2003-2007

Navy RPMs who manage the cleanup efforts at IR Program sites face several major technical, economic, and regulatory challenges to achieving successful remediation and site closeout. These challenges need to be fully understood in order to further focus and enhance the value of the T2 Program for Navy RPMs and others in the NAVFAC Environmental Restoration community. This section summarizes the characteristics of Navy and Marine Corps IR sites and provides a preliminary analysis of the types of challenges that Navy RPMs face in achieving successful environmental restoration.

The cleanup of Navy and Marine Corps installations poses a major challenge because of the wide variety of activities conducted at these sites over the years and the fact that most of these installations are located in coastal regions near ecologically sensitive habitats. The environmental impacts from historic releases at Navy and Marine Corps sites can be characterized primarily by petroleum hydrocarbons in soil and groundwater, chlorinated solvents in groundwater, metals in soil and groundwater, and persistent contaminants in sediments.[1] It is estimated that more than $4.5 billion[2] will be needed to complete the remediation efforts at current Navy IR sites.

[1] National Research Council (NRC). 2003. Environmental Cleanup at Navy Facilities. National Academies Press, Washington, DC.

[2] Based on cost-to-complete (CTC)* data in NORM/CTC database. June 2003.

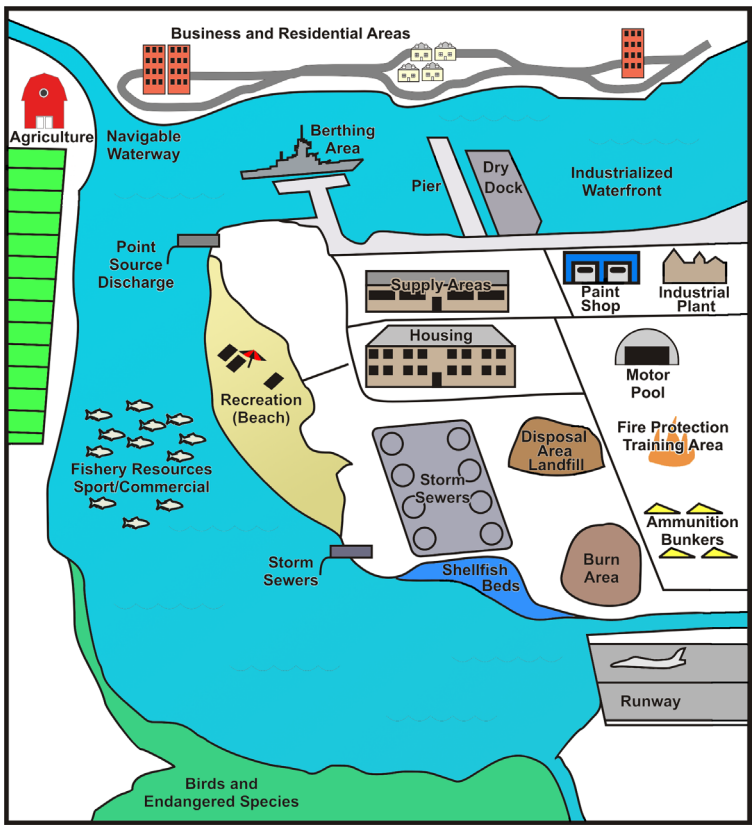


Figure 1. Schematic of Navy or Marine Corps Facility[3]

Figure 1 illustrates the types of activities that take place at Navy and Marine Corps installations. Most facilities provide a variety of support functions for aircraft, submarines, and ships. Waste management practices associated with these activities over the last several decades have resulted in the release of contaminants to soil, groundwater, sediment, and surface water. For example, petroleum hydrocarbons may have been released to soil and groundwater at leaking underground storage tank sites, tank farms, or former fire fighting training areas. Historic equipment cleaning and degreasing operations have led to chlorinated solvent releases to groundwater. In addition, sediment and surface water may have become contaminated through continuous releases or stormwater runoff with metals and persistent chemicals such as polycyclic aromatic hydrocarbons (PAHs) or polychlorinated biphenyls (PCBs). Other facilities at Navy and Marine Corps installations associated with past contaminant releases include municipal solid waste landfills, paint shops, plating shops, dry cleaners, and ordnance/firing ranges.[4] The majority of these releases occurred prior to the establishment of current environmental laws and resulted from accidental spills and/or commonly accepted waste disposal practices that are no longer acceptable today.

The IR Program is designed to identify and clean up sites that were impacted by these historic hazardous substance releases in order to protect human health and the environment and to return valuable land for mission-essential use. Navy RPMs in charge of each IR site are required on an annual basis to input and/or update information on their site into the NORM/CTC database. The NORM/CTC database is a comprehensive compilation of data from all Navy and Marine Corps IR sites and represents a valuable source of data for analysis and interpretation and for focusing T2 efforts. The NORM/CTC database was queried to examine trends in the site status and budget, impacted media, and types of contaminants.

Site Status and Budget

The seven stages of the IR process are shown in Table 1. In general, each IR site moves through several, if not all, of these stages before site closeout is reached. The NORM/CTC database tracks the funding needed to complete work at each IR site. This budgetary estimate is known as "Cost-to-Complete" and is stored in the database according to the remaining phases that each site needs to undergo. As

[3, 4]Adapted from NRC, 2003. Environmental Cleanup at Navy Facilities. National Academies Press, Washington, DC.

Table 1. Summary of Site Status and Budget by Phase

Phase	Description	Sites	Total CTC Budget	Percent of CTC Budget
Phase 1	Preliminary Assessment and Site Inspection	315	$82,997,911	2%
Phase 2	Remedial Investigation and Feasibility Study	791	$416,973,262	9%
Phase 3	Design	514	$60,275,916	1%
Phase 4	Construction	864	$1,522,883,745	34%
Phase 5	Interim Remedial Action	338	$654,329,182	14%
Phase 6	Operation and Maintenance	707	$1,155,305,112	26%
Phase 7	Long-Term Management	940	$631,875,779	14%

shown in Table 1 and Figure 2, more than 75% of the remaining IR Program budget will be spent on the design, construction, and implementation of remedial actions and interim remedial actions. Because most sites have already progressed through the early stages of the IR process, the CTC budget for site characterization and other preliminary activities represents only 11% of the overall CTC budget. In addition, approximately 14% of the CTC budget is targeted for the long-term management of IR sites.

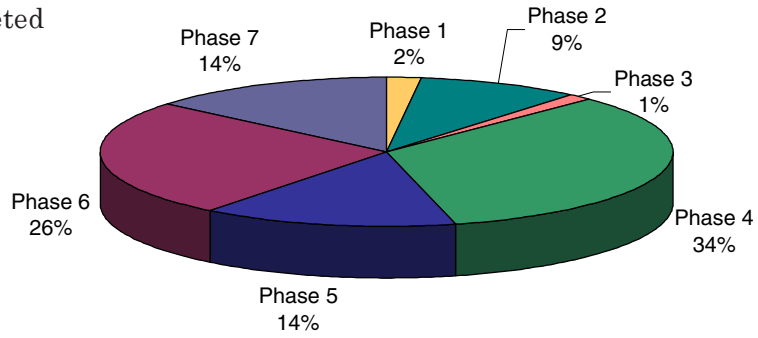


Figure 2. Cost-to-Complete Budget by Project Phase

In general, T2 efforts are intended to focus on the challenges RPMs face in the actual implementation of remedial actions and removal actions, including construction and operation and maintenance (O&M) activities. Long-term management (LTM) also appears to be an issue of growing concern. One challenge related to LTM is the accurate assessment of life cycle costs, which can be difficult because of the uncertainties in project duration and problems in precisely defining these costs.

Impacted Media

A variety of environmental media have been impacted at Navy and Marine Corps IR sites. Soil impacts represent over 45% of the total site count in the NORM/CTC database, closely followed by groundwater at 32%, sediments at 14%, and surface water at 9% (see Figure 3). These values can be further broken down into categories based on whether sediment and surface water remedial action objectives were for human health protection or ecological protection of fresh or marine environments (see Table 2).

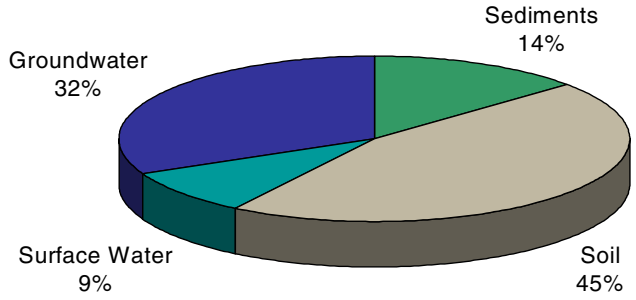


Figure 3. Impacted Media

In general, soil and groundwater issues tend to dominate the IR Program. However, sediment and, surprisingly, surface water issues do play a significant role at several IR sites. This preliminary

analysis does not include the budget associated with these impacted media. In general, sediment and surface water site investigation and remediation efforts would be more expensive than conventional soil and groundwater remediation efforts due to the complexity of remedial efforts in these media.

Table 2. Impacted Media by Site Count

Media	Site Count	Percentage of Sites
Groundwater	2,017	32.0%
Sediments (Fresh)	117	1.9%
Sediments (Human)	405	6.4%
Sediments (Marine)	336	5.3%
Soil	2,867	45.5%
Surface Water (Fresh)	156	2.5%
Surface Water (Human)	314	5.0%
Surface Water (Marine)	89	1.4%

Types of Contaminants

Soil, groundwater, sediment, and surface water at Navy and Marine Corps IR sites have been impacted by a large variety of contaminant types (see Table 3). Metals; petroleum, oil, and lubricant (POL); and volatile organic compounds (VOCs) represent the greatest number of impacted sites in soil. VOCs, metals, and semi-volatile organic compounds (SVOCs) represent the greatest number of impacted sites in groundwater. Metals and SVOCs are the most frequently detected contaminant group at sediment sites. Metals appear to be the primary contaminant group at impacted surface water sites.

Table 3. Contaminant Types by Site Count

Contaminant	Soil	Groundwater	Sediments	Surface Water
VOCs	893	842	98	57
SVOCs	892	619	149	51
Metals	1,156	620	274	116
Pesticides	362	141	98	29
PCBs	139	36	30	3
Asbestos	55	2	3	1
Ordnance	81	18	26	5
POL	909	575	67	32
RAD	93	22	14	6
Other	13	16	3	0

Note:
VOCs are volatile organic compounds
SVOCs are semi-volatile organic compounds
PCBs are polychlorinated biphenyls
POL is petroleum, oil, and lubricants
RAD is radionuclides

These data indicate that metals play an important role across all media; therefore, issues of metal background levels in the environment and other issues unique to metals should be an important focus for the T2 Program. It is also clear that PCBs, ordnance compounds, and radionuclides, although they are not present at a large percentage of sites, do represent a challenge at several Navy sites. In general, the T2 Program also could be focused on site characterization for these contaminant groups and remediation technologies applicable to the most important contaminant groups by media.

Figures 4 and 5 show the most frequently detected metals and organic contaminants, respectively, at Navy and Marine Corps sites across all media. This count does not take into account the toxicity of the compounds, which is a common driving force in setting cleanup levels and therefore in driving remediation costs.

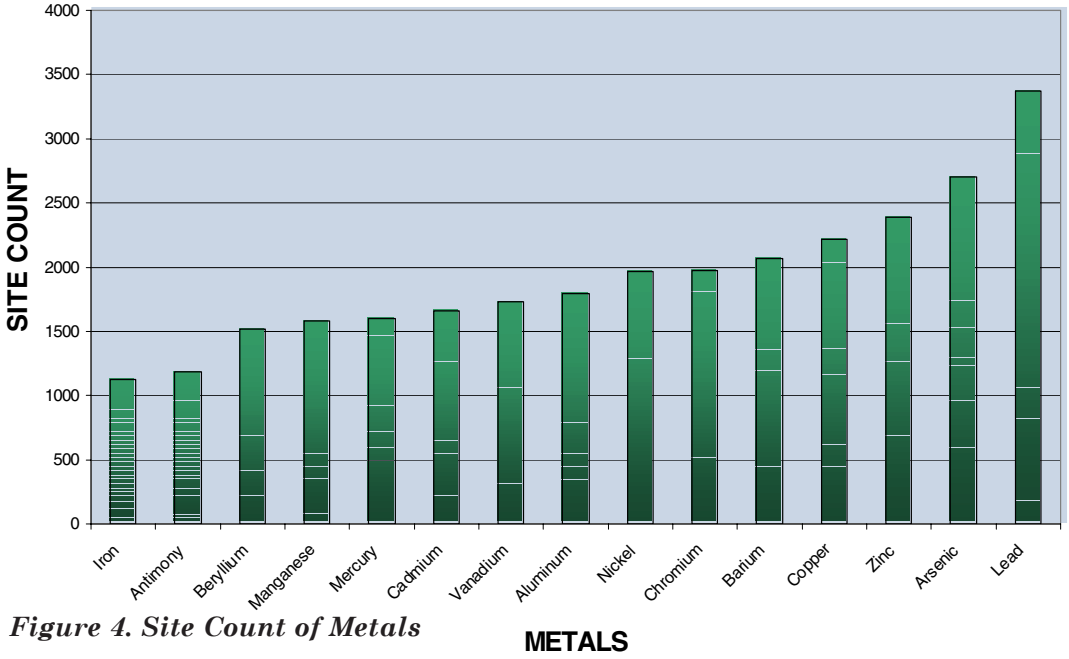


Figure 4. Site Count of Metals

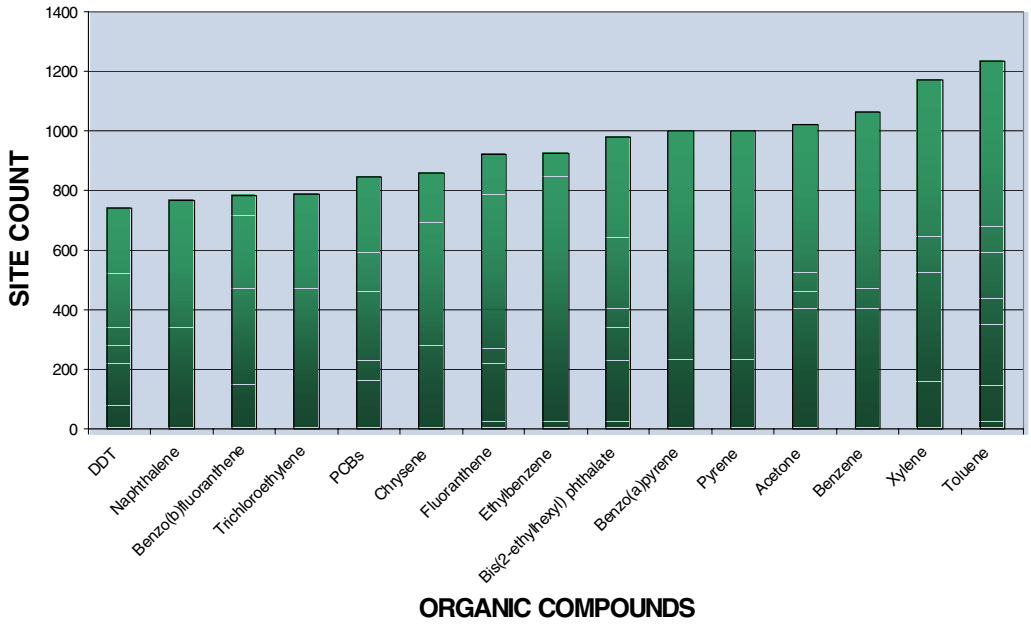


Figure 5. Site Count of Organic Compounds

ENVIRONMENTAL RESTORATION CHALLENGES

Navy RPMs managing the cleanup efforts at sites under the IR Program face several challenges to achieving successful remediation and site closeout. Below are some observations about these challenges in relation to site status, media type, and contaminant type that will be used to focus and develop future T2 tools:

Site Status

- There is a growing recognition in the environmental industry of the need to control the rising costs of remediation projects and of the technical limitations to remediation effectiveness. Over 75% of Navy funds are budgeted for designing, constructing, and operating remedial actions and interim remedial actions. T2 tools will focus on methods for incorporating optimization as early in the IR process as possible to help control project costs and improve system performance. T2 tools also will focus on innovative technologies that can help reduce costs or meet other project-specific objectives.
- Approximately 34% of Navy funds are budgeted for the construction of remediation systems. For technologies selected as T2 topics, the tools will highlight life-cycle design considerations and other optimization strategies to reduce project capital and installation costs.
- Numerous economic risks are related to implementing any remediation project, including cost growth, project delays, and significant scope changes over time. T2 tools will summarize information on innovative remediation technologies related to their applicability, advantages and disadvantages, and lessons learned at other Navy sites. This information will help reduce the risk and uncertainty in full-scale applications of the given technology.

Media Type

- Activities conducted at IR sites have led to a variety of types of impacted media and combinations of impacted media. This tends to increase the complexity and cost of remedial efforts. T2 tools will focus on promoting the use of innovative and cost-effective technologies for soil, groundwater, sediments, and surface water. The primary focus will be on technologies for impacted soil and groundwater because these sites represent over 77% of IR sites.
- Several Navy installations are located in coastal regions or near other ecologically sensitive habitats. This also tends to increase the complexity and cost of remedial efforts. T2 tools will be selected to focus on unique considerations for coastal sites, such as sediment remediation, environmental forensics in urban watersheds, ecological risk, and related topics.

Contaminant Type

- Activities conducted at IR sites have led to a variety of types of contaminants and combinations of contaminants. T2 tools will be developed for the most important groups of contaminants at Navy sites. These tools will provide information on the basic chemistry, fate and transport, risk assessment, and regulatory and remediation issues related to these contaminants.
- Several chemical and physical properties of contaminants can limit the effectiveness of their removal or in situ destruction. For example, the removal or in situ destruction of VOCs and SVOCs in groundwater can be limited by properties such as a given contaminant's solubility, volatility, and biodegradability. The unique properties of metals and their presence in the background environment also pose a challenge to site cleanup. T2 tools will address ways to anticipate typical contaminant behavior that may impact system performance and site closeout.

ENHANCING THE T2 PROCESS

The process of technology transfer encompasses both the transition of a new technology from the developer to the end users and also the ultimate acceptance and use of that technology by the end user. This section provides an overview of technology transfer concepts and technology transfer legislation and requirements. A new enhanced T2 process is also defined for NAVFAC's Environmental Restoration T2 Program.

> *Technology transfer is "the intentional communication (sharing) of knowledge, expertise, facilities, equipment, and other resources for application to military and nonmilitary systems."*
>
> DoD Directive 5535.3

Technology Transfer Concepts

The first step of the technology transfer process is the development of a new technology or the modification of an existing technology. The second step involves a period of transition when early adopters and others help the new technology to break through various regulatory, economic, organizational, and personal barriers to its use. The final step involves the widespread use and acceptance of the technology. In general, a technology has not been successfully transferred unless it has been accepted and used by the targeted end users. Figure 6 illustrates these T2 concepts.

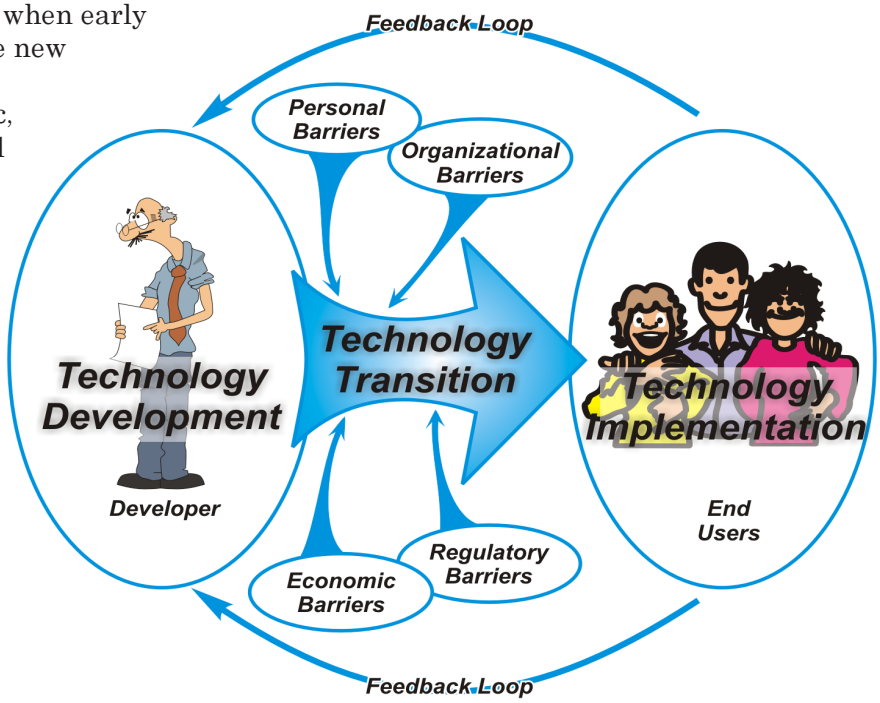


Figure 6. Technology Transfer Concepts

Step 1: Technology Development.
The development of new technologies is often based on the perceived need or demand for a given product by a targeted group of end users or consumers. In general, technology transfer will be more successful when the developer considers the ultimate end users and their specific requirements as early in the design and development process as possible. An effective feedback loop is therefore needed to understand the end user's specific requirements.

TECHNOLOGY DEVELOPMENT

An **Emerging Technology** is a new technology that currently is undergoing bench-scale testing, in which a small-scale version of the technology is tested in a laboratory.

An **Innovative Technology** is a technology that has been field-tested and applied to a hazardous waste problem at a site, but lacks a long history of full-scale use. Information about its cost and effectiveness may be insufficient to support prediction of its performance under a wide variety of operating conditions.

A **Conventional Technology** is a technology for which cost and performance information is readily available. Only after a technology has been used at many different sites and the results have been fully documented is that technology considered conventional.

http://www.clu-in.com

Step 2: Technology Transition.
There are often several regulatory, economic, organizational, and personal barriers to the use of new technologies or methodologies. In some cases, new technologies are readily discovered and adopted by a large number of end users because of the great magnitude of the need for a new approach. However, in most cases, the T2 transition process is much more complicated. "Early adopters" or those eager to test new technologies often play a valuable role in the technology transition process and help to push technologies to overcome common barriers to their widespread use. This group plays a major role in the success of technology transfer because it can offer direct advice on the advantages and limitations of a new technology and can therefore influence the choices and actions of those around them.

Step 3: Technology Implementation.
Once others receive positive feedback from early adopters, they may become interested in implementing a new technology or approach themselves. This final step involves the movement of a new technology from a development setting to a larger group that ultimately accepts and uses that technology. The T2 process is not entirely complete at this stage, but continues on as the development of a new technology often leads to new demands by the end user that require further technological research and development (R&D).

Technology Transfer Legislation and Requirements

The United States Congress passed a series of laws to encourage federal laboratories and other government entities to make technology transfer and commercialization a key component of their R&D activities. The Stevenson-Wydler Technology Innovation Act of 1980, as amended by the Federal Technology Transfer Act of 1986, requires all federal laboratories to develop active programs for technology transfer "by which existing knowledge, facilities, or capabilities developed under federal R&D funding can be utilized to fulfill public and private needs."

In response to this and other legislation, the DoD issued Directive 5535.3 on May 21, 1999. Under this directive, NAVFAC has a responsibility for establishing and implementing a technology transfer program. Directive 5535.3 describes the DoD policy on domestic technology transfer programs and instructs DoD to promote T2 through a variety of activities.

T2 Process for Environmental Restoration

This Five Year Program Plan facilitates and promotes T2 efforts by defining the T2 process to be used within the NAVFAC Environmental Restoration community. Figure 7 illustrates the proposed overall T2 process. This process will involve the participation of key players, opinion leaders, and other early adopters to enhance T2 efforts within the NAVFAC Environmental Restoration community.

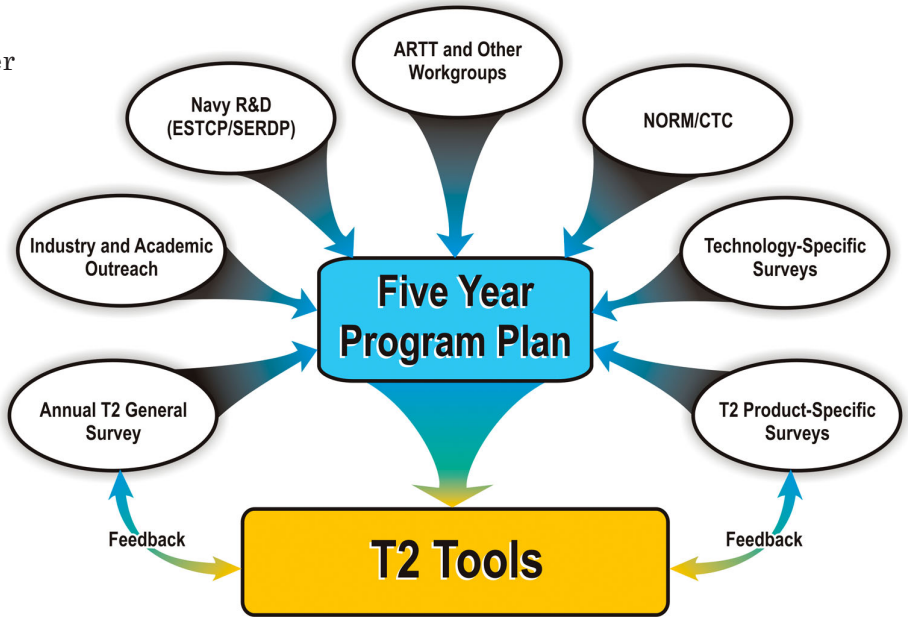


Figure 7. T2 Process[5]

The T2 Program will gather applicable and appropriate information from personnel within NAVFAC technical workgroups and Navy R&D programs. It will also gather information on overall IR Program trends directly from Navy RPMs through their inputs into the NORM/CTC database. The T2 Program will also consider input regarding the latest advances being made by industry and academic leaders in the field. In addition, new feedback mechanisms are proposed to directly survey Navy RPMs and others to improve understanding of end user requirements. All of this input will then be synthesized into updates to the Five Year Program Plan and the writing of the next Fiscal Year's Work Plan.

NAVFAC Technical Workgroups.
NFESC plans to focus the T2 process on engaging the Alternative Restoration Technology Team (ARTT) and other NAVFAC technical workgroups. Table 4 provides a list of active NAVFAC workgroups and their stated missions. Partnerships with the ARTT and other NAVFAC workgroups are likely to be very productive and informative for the T2 Program. A distinct focus will be applied to collect information related to Navy RPM needs and potential challenges or barriers currently being addressed by the given workgroup. This source of feedback also is likely to produce interesting case studies, new contaminants of

[5] The Annual T2 Survey, the Technology-Specific Surveys, and the T2 Product-Specific Surveys are described in the section on measuring T2 program performance.

Table 4. Active NAVFAC Technical Workgroups

Group Name	Mission
Alternative Restoration Technology Team (ARTT)	Promotes the use of innovative technologies to save time and money.
Remedial Action Operation/Long Term Management (RAO/LTM) Optimization Workgroup	Supports Navy RPMs and their contractors in the optimization of RAO/LTM activities.
Risk Assessment Workgroup (RAW)	Facilitates the application of risk assessment policies and works to achieve protection of human health and the environment.
Ecological Risk Technical Assistance Team (ERTAT)	Promotes consistent, technically sound, and cost-effective ecological risk assessments
Administrative Records Management System (ARMS) Workgroup	Investigates, develops, and implements the automated administrative records management system for EFA/Ds.
Geographic Information System (GIS) Workgroup	Develops Navy-wide practices for the use of GIS for data collection, storage, and analysis.
Cost-to-Complete (CTC) Workgroup	Promotes sound cost-estimating practices.

interest, new regulatory challenges, and new technical approaches to site assessment, remediation, and closure. Suggestions for T2 topics will be discussed at ARTT meetings. These suggested topics will be compiled by the T2 Program Manager, and T2 product proposals will be developed for ARTT review.

DoD-Funded R&D Programs.
Table 5 lists programs that benefit from DoD R&D funding such as the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP). In addition, internal R&D efforts at NAVFAC are typically conducted under Broad Agency Announcements (BAAs) and the YO817 Program. The Navy has a vested interest in transferring information about the new technologies and methodologies developed under these programs to the entire NAVFAC community. These DoD-funded R&D programs typically produce case studies and emerging technologies that either appear to be beneficial or are found to be too immature or impractical for full-scale application. Personal contacts with program managers and principal investigators will be conducted to derive the information that is most suitable for distri-

Table 5. DoD-Funded R&D Programs with Navy Participation

DoD-Funded Program	Mission
SERDP	Improves mission readiness through environmental research to resolve environmental problems.
ESTCP	Promotes innovative, cost-effective environmental technologies through demonstration and validation at DoD sites.
BAA	Identifies a wide range of innovative environmental technologies and methodologies that are new, are innovative, advance the state-of-the-art, or increase knowledge or understanding of environmental issues.
YO817	Provides efficient, cost-effective, and environmentally compliant solutions for Navy shoreside operations.

bution throughout NAVFAC at the time. This feedback will likely be in the form of project documentation, reports, and presentations for a given demonstration project. The Statements of Need developed by SERDP and ESTCP on an annual basis will also be considered and incorporated in the T2 process.

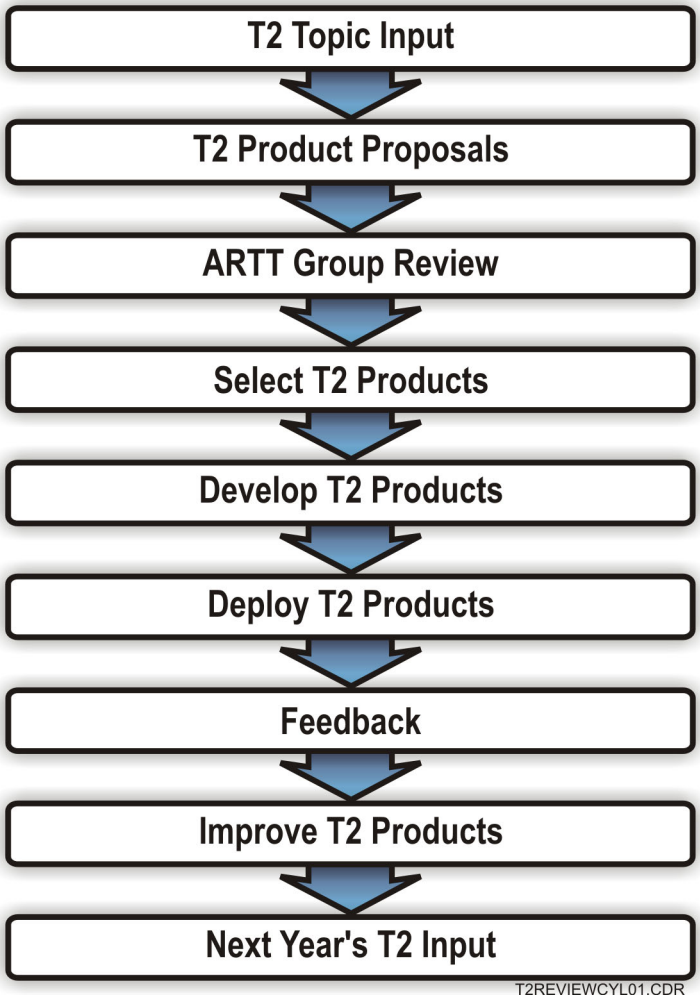
NORM/CTC Database.
The NORM/CTC database will be evaluated on an annual basis to track trends in the Navy IR Program and therefore identify typical challenges faced by Navy RPMs at these sites. The NORM/CTC database is a comprehensive compilation of data from all Navy and Marine Corps IR sites. The data are updated on an annual basis by Navy RPMs and others directly involved at each site. This database represents a valuable source of data for analysis and interpretation for focusing T2 efforts. The results of the first analysis of this data for T2 efforts were discussed in the section of this document that describes meeting environmental restoration challenges.

Industry and Academic Outreach.
It is proposed that industry and academic outreach be conducted on an annual basis to receive new and creative input for the T2 Program. This outreach will consist of a literature search of recent articles and issues covered in the latest leading professional journals in remediation, environmental engineering, and other relevant fields. It will also include an annual review of the proceedings and workshop topics at several major environmental conferences. This information will provide an opportunity for the Navy to benefit from lessons learned and technologies developed beyond the Navy's direct experience. This information will be summarized in the proposed work plans for future years.

Feedback Surveys.
Use of new Web-based multimedia training tools has allowed the recent development of online feedback surveys to solicit information directly from Navy RPMs or other end users. The new feedback mechanisms proposed include an Annual T2 Survey, T2 Product-Specific Surveys, and Technology-Specific Surveys that will be implemented to improve understanding of end users' needs and opinions. The feedback information from these surveys will be used to customize future T2 products and to improve existing T2 products. The survey data will be processed and presented to ARTT and other NAVFAC workgroups for discussion. More specific information on the content and use of feedback surveys is provided in the section on measuring T2 program performance.

Five Year Program Plan Synthesis.
The information gathered from the above sources will be synthesized and evaluated for inclusion into an updated Five Year Program Plan and into the next fiscal year's Work Plan. The partnerships and meetings mentioned above will produce lists of potential T2 topics, case studies, and additional points of contact. The feedback surveys will contain quantitative data and comments from Navy RPMs and others on their interest in and satisfaction with the T2 Program. This new input and content will be processed, synthesized, and incorporated into the T2 Program documentation. Representatives from NAVFAC's T2 Program will draft a proposed list of new topics for the next fiscal year. T2 product proposals will then be created for a narrowed list of ten or more selected topics that have the greatest ranking and/or highest level of interest. Examples of these T2 product proposals are provided in Appendix B for fiscal year 2004. NAVFAC headquarters, ARTT, and other NAVFAC workgroups will then review the

proposals. These product proposals will be approved, revised, and/or discontinued as part of the annual review and approval process for the Five Year Program Plan and the next Fiscal Year Work Plan.



DEVELOPING EFFECTIVE T2 MECHANISMS

The transfer of information about a new technology or improved methodology is predominantly a process of communication. Communication mechanisms can take many forms including the printed word, formal instruction, personal interaction, conferences, and the mass media. Several T2 mechanisms are proposed in this document to effectively communicate new information to Navy RPMs and others within NAVFAC's Environmental Restoration community.

> ***"Communication is a key element in the transfer process. If a new product is available, but the public is not made aware of it, the technology will never reach its intended market. Transfer requires human intervention for a technological innovation to become part of a larger system."***
>
> Johnson et al.,
> "Expanding the Content
> Base of Technology Eduation"
> *Journal of Technology Education*
> 8:2, 1997

This Five Year Program Plan outlines a broad range of T2 products that will promote interaction with end users and encourage information exchange with technology developers. These T2 mechanisms include multimedia training tools such as contaminant-specific tools, technology-specific tools, Web data sheets, and case studies. Frequent e-mail updates on pertinent T2 topics are planned, along with enhancements to the existing NAVFAC Environmental Restoration Web site. Other T2 mechanisms used in the past will be continued as appropriate, such as guidance documents, RPM Newsletters, journal articles, brochures, and other products.

Many of the T2 tools proposed in this document employ multimedia, Web-streaming features. Web-based multimedia tools are interactive and also have greatly enhanced functionality for the user. As discussed in the section on measuring T2 program performance, these tools can also facilitate immediate feedback from users. However, it should be noted that personal interaction among professionals is still necessary to develop relationships and to promote open communication. Therefore, this new generation of Web-based tools is meant to enhance, but not replace, valuable face-to-face interactions such as Remediation Innovative Technology Seminars, IR Conferences, and other direct T2 discussions among NAVFAC community members.

IMPROVED COMMUNICATION

The new T2 mechanisms will enhance communication within the NAVFAC community as follows:

- Enhance the opportunity for information exchange using animated graphic art, video, audio, rotating pictures, as well as text and hypertext Web links
- Help Navy RPMs and others to assimilate relevant facts and to understand new technologies and/or methodologies
- Provide a succinct listing of the relative advantages and disadvantages of a new technology or methodology and a comparison to existing practices
- Help to address and overcome barriers related to the implementation of a new technology and/or methodology
- Accommodate rapid updates as technologies change and discoveries are made
- Increase the circulation of knowledge and ideas among all NAVFAC RPMs and EFDs/EFAs

Multimedia Training Tools

Web-streaming multimedia tools provide enhanced opportunity for NAVFAC to exchange information using animated graphic art, video, audio, pictures, as well as text and hypertext Web links. Information is often more effectively retained when it is consumed using multiple senses, and Web-based training can help to accommodate individual learning characteristics by disseminating information using pictures, video, sound, and text formats. These Web-based multimedia tools can also be easily updated and revised quickly as new information becomes available on a given topic. The general types of multimedia training tools proposed are discussed below.

Contaminant-Specific Training Tools.
Multimedia tools can be generated to address issues specific to certain high-priority contaminants found at Navy and Marine Corps IR sites. These tools will provide information on the basic chemistry, fate and transport, risk assessment, regulatory, and remediation issues related to these contaminants. The PCB Training Tool is the first tool of this type to be developed and sets the standard for showcasing the capabilities available to NAVFAC for future tool development. This tool was favorably received from the participants in the internal Navy review: constructive comments on the tool were accompanied by many

WEB-STREAMING TOOL DEVELOPMENT

The following describes the development and deployment of Web-streaming tools:

Web-streaming tools are accessed through a Web browser by simply clicking on a link with an appropriate title. The Web-based tool will then load into a memory buffer and quickly begin presenting the information to the user in the formats appropriate for the specific topic. Templates have been developed that interact with an underlying database containing electronic files that store the appropriate pictures, audio, text, and graphics. These files are retrieved from the database by the template at the appropriate time and sequence, as presented by the tool.

The specific technical content of the tool will be structured to follow an instructive and informative flow of thought. The more complex ideas and topics will be explained in a manner that is readily understandable and accessible to the user. The technical content for the tool can be generated using information from a previously existing source or generated just for the tool itself.

The technical content is used to build a "screenplay" of various forms of media and text. The screenplay is then divided into work sets for enhanced graphics, audio, video, and animations. Finally, all the parts are assembled into a database in the sequence defined by the screenplay. A computer program application is then used to select a template and populate it with the predefined media content. The program also generates a sidebar menu to facilitate user navigation of the tool.

positive remarks expressing the agreed benefit of sharing technical information using multimedia tools over the Web. In general, these Web-based training tools will provide in-depth information and take a half hour to review.

Technology-Specific Training Tools.
Multimedia tools can be generated to address new technologies or improvements to existing technologies that may reduce costs or provide other benefits at Navy and Marine Corps IR sites. These tools will provide background information on the technology, its general applicability to different media and contaminants, ways to overcome barriers to its use, its relative advantages and limitations compared to existing approaches, its typical costs, and other pertinent information. The technology-specific tools will be good candidates for the use of animated graphics and video clips showcasing unit processes or system installation in action. In general, these Web-based training tools will provide in-depth information and take a half hour to review.

Web Data Sheets.
Web Data Sheets (WDS) will provide a brief summary or overview of information relevant to a given environmental restoration topic. The WDS will include about the same quantity and depth of information previously presented in Technical Data Sheet, but with enhanced capabilities. WDS can include animated figures, video clips, audio streams, and live links to Web pages for additional information, regulatory guidance, vendor sites, and guidance documents. In general, WDS will provide introductory information and take fifteen minutes or less to review.

Case Studies.
The experiences gained by Navy scientists, engineers, risk assessors, and managers during the execution of an innovative technology or methodology can benefit other NAVFAC professionals who are facing similar technical challenges. Often case studies or histories are presented at conferences, workshops, or are published in professional journals. All of these forms of distribution are limited

by either the media format, the ability to reach the broad target audience, or both. Web-based case studies presented with pictures, video of actual working processes, interviews with experienced practitioners, and text will be available to any Navy RPM for review at any time. These multimedia Web sites will be prepared to convey the challenges negotiated, lessons learned, and beneficial experiences from case studies at Navy sites selected by the ARTT or others from each EFD/A.

E-mail Updates

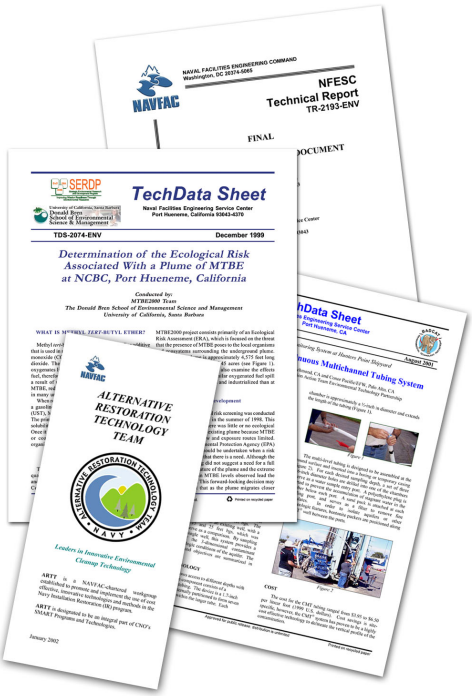
E-mail updates that contain news and announcements relevant to the T2 Program will be sent out on a frequent basis. This e-mail will provide direct links to new Web tools and provide other relevant information about the T2 Program status.

NAVFAC Environmental Restoration Web Site

The NAVFAC Environmental Restoration Web site is a very cost-effective route to transfer information and hard copies of guidance documents and other products to the NAVFAC environmental community. Improvements to this Web site are currently underway to enhance its design and functionality for use by Navy RPMs. This Web site will continue to act as a library for the valuable information generated by past NAVFAC R&D work and will also provide a portal for Navy RPMs to the latest information on NAVFAC R&D efforts.

Other T2 Products

It is likely that there will be applications, venues, or topics for which conventional printed media are the best option. Hard copy T2 products will still be available for production for any appropriate application. In the past, these tools have included



- Guidance Documents
- Technical Data Sheets
- Success Stories
- Journal Articles
- RPM Newsletter Articles
- Conference Presentations
- Conference Posters
- Technology Brochures.

Furthermore, when it is determined that a previously produced document has increased in importance, interest, or applicability, that technical content can be utilized to develop a Web-based tool on that topic. Additions, animations, revisions, and updates then can be applied without reproducing the document in its entirety.

MEASURING T2 PROGRAM PERFORMANCE

> *"The highest reward for good work is the ability to do better work."*
>
> Elbert Hubbard
> (1856–1915)

Because it takes time for new technologies to be developed, adopted, and widely implemented, it is sometimes difficult to track the success of T2 efforts over a short period of time. However, it is important to identify intermediate metrics and performance measures that can be used to track the initial success and/or limitations of T2 efforts.

An important part of the implementation of this Five Year Program Plan will be ongoing efforts to measure the performance and success of T2 efforts on environmental restoration topics. A variety of performance measures will be used to enhance the accountability and value of the T2 Program and to help to make necessary improvements over time.

Several new techniques for feedback data collection have recently been developed, including the Annual T2 Program Survey, T2 Product-Specific Surveys, and Technology-Specific Surveys and Assessments. The feedback surveys will be implemented online, providing a timely and efficient method for continually improving the T2 Program. In addition, the information gathered from these surveys and other performance metrics will help to satisfy the NAVFAC community's interest in tracking the overall effectiveness and soundness of the T2 approach. Each of these new feedback methods is discussed below in more detail.

T2 PERFORMANCE MEASURES

- Usage statistics for the Web-based training tools
- Number of sustained subscribers to the T2 e-mail distribution list
- Degree of NAVFAC interest and satisfaction based on the Annual T2 Program Survey
- Degree of NAVFAC interest and satisfaction based on T2 Product-Specific Surveys
- Tracking of cost avoidance, time savings, or other benefits from the implementation of new or improved technologies based on Technology-Specific Surveys or Assessments.

Annual T2 Program Survey

An annual Web survey will be developed and used to gather information directly from Navy RPMs and others on their overall interest in and satisfaction with the T2 Program. The survey topics and questions will be reviewed before submittal to ensure the value and appropriateness of the level of information to be gathered. The review process will include the NAVFAC T2 Program Manager and a select group of reviewers, who together will ensure that the questions developed are not trivial and will produce quality data and affect decisions positively . The results of this survey will be used to guide the T2 Program and to ensure that it remains focused on useful and relevant environmental restoration topics.

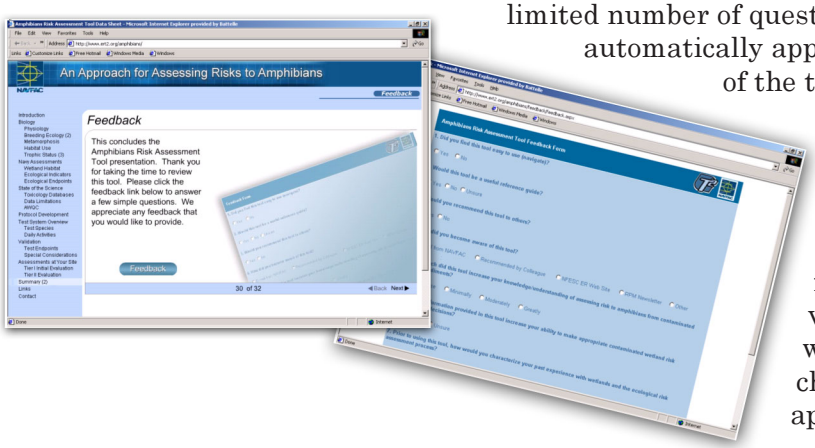
The Annual T2 Program Survey will collect the following type of information:

- Overall awareness of the T2 Program
- Overall interest in and quality of T2 products
- Usefulness of T2 products for professional development
- Specific recommendations for improving the T2 Program
- Suggestions for future topics, including new policies, regulations, technologies, and other topics.

These data can be efficiently gathered online, stored in a database application, and then quickly analyzed to drive decisions within the T2 Program. Effective use of these data will ensure that timely adjustments to the T2 Program are made so that the program remains an essential mechanism for ensuring that latest advances are understood and utilized to the Navy's benefit.

T2 Product-Specific Surveys

Web surveys also will be developed for major T2 products. For the Web-based training tools, the survey will consist of an immediate feedback form provided to users upon their completion of the tool. The objective of this survey will be to obtain a few key responses from most of the users of the tool. Therefore, the survey will be designed to be very short, prompting the user to answer only a limited number of questions. A link to the survey will automatically appear as the user reaches the end of the tool and the user can decide whether or not to provide feedback at this point. This approach is intended to assist in maximizing the number of respondents. In addition, data from the product-specific surveys will be used to indicate when updates, revisions, or changes to a given product are appropriate.



The T2 Product-Specific Survey will collect the following type of information:

- Initial reactions of users on the functionality of the tool
- Perceived improvements in knowledge and understanding of the subject area
- Perceived value of the tool as an information source or reference guide
- Suggestions for future topics, including new policies, regulations, technologies, and other topics.

Technology-Specific Surveys

Web surveys can be used to track the interest of Navy RPMs in and use of specific new technologies and/or methodologies. These surveys also will be used to understand the various regulatory, economic, organizational, and personal barriers that may restrict Navy RPMs from taking advantage of new technical opportunities.

These Technology-Specific Surveys will consist of an e-mail with an introduction to the survey topic and a statement to encourage active participation. The e-mail will contain an embedded hyperlink to an online survey software application. For example, a survey was developed recently to query Navy RPMs about their use and understanding of passive diffusion bag samplers to improve long-term groundwater monitoring activities.

Specific questions for the survey will be developed on a project-by-project basis. However, it is anticipated that the Technology-Specific Survey will collect the following type of information:

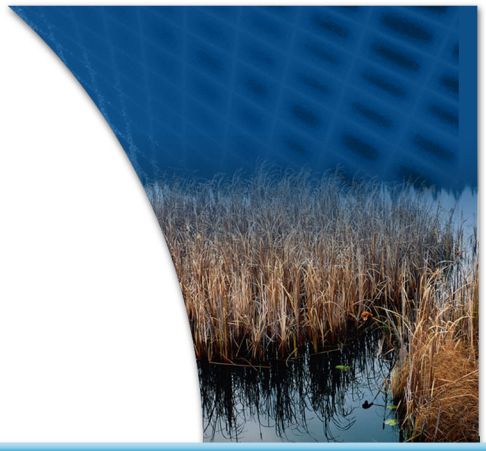
- Perceived need for more knowledge/understanding of the target technology/methodology
- Impacts of relevant T2 products on the decision making process surrounding the target technology/methodology
- Identified regulatory, economic, organizational, or personal barriers to implementation of the new technology or methodology
- Identified cost avoidance, time savings, or other benefits that can be linked to use of the new technology or methodology.

Technology-Specific Assessments

Another more in-depth approach will be the completion of a Technology-Specific Assessment for certain target technologies and/or methodologies. This assessment will be similar to the Cost Avoidance Reports completed in the past by NAVFAC, but will employ a new methodology for gathering and analyzing cost avoidance data.

This assessment will include a "market analysis" of the target technology and/or methodology specific to the Navy marketplace. It will include a description of the technology, the targeted end users, the size and growth in the use of the technology, barriers to its use, and benefits from its use, including cost avoidance, time savings, or other advantages. The source of technology implementation and cost data will be NORM/CTC, targeted Navy RPM surveys, and project-specific documentation such as Feasibility Studies, Records of Decision, Independent Government Estimates, and/or project files.

The NAVFAC T2 Program Manager and a select group of reviewers will select a limited number of new technologies or improved methodologies to undergo this more in-depth assessment process.



CONCLUSIONS

> ***"The Installation Restoration Program remains committed to protecting human health and the environment, providing safe places for our military and civilian personnel to live and work, and remaining good neighbors."***
>
> Robert D. Reilly, Jr.
> Rear Admiral, U.S. Navy
> Director, Environmental Readiness Division
> Office of the Chief of Naval Operations

The DON's environmental restoration mission is supported by NAVFAC's continued T2 efforts to assist Navy RPMs in understanding new technological developments and improved methods for enhancing the performance and cost-effectiveness of the IR Program. In order to support this mission, this Five Year Program Plan establishes the following major improvements to the T2 Program:

1. Improved knowledge and tracking of the challenges faced by Navy RPMs
2. Consensus-building among Navy stakeholders through an enhanced T2 process
3. Greater T2 product flexibility, distribution, ease of revision, and variety
4. Greater accountability through solicited feedback from Navy RPMs, ARTT, and others.

The first improvement will be accomplished through an annual analysis of trends in the IR Program using NORM/CTC and other relevant data sources. The second improvement will be accomplished by collaboration among representatives from the NAVFAC T2 Program, NAVFAC headquarters, ARTT, and other NAVFAC workgroups to provide input for the T2 products to be produced for each fiscal year. The third improvement will be achieved by developing Web-based T2 tools with animated graphics, video, audio, text, and hypertext links. The fourth improvement will be achieved by the use of surveys and e-mail exchanges, as well as focused solicitation for input from the targeted end users through personal conferences. These program improvements will facilitate the circulation of technical knowledge throughout the NAVFAC Environmental Restoration community and maximize the benefit from lessons learned by one for all.

APPENDIX A

RESULTS FROM FISCAL YEAR 2003

Results from Fiscal Year 2003

This report summarizes preliminary results from the Technology Transfer (T2) Program for Fiscal Year 2003. This report was prepared for the Naval Facilities Engineering Command (NAVFAC) under the Naval Facilities Engineering Service Center (NFESC) Contract No. N47408-01-D-8207, Task Order No. 0049. The following section summarizes the T2 products that have been produced for Fiscal Year 2003. This report also provides the preliminary results for measuring T2 Program performance through the use of feedback surveys and the tracking of end user statistics.

1.0 T2 Products for Fiscal Year 2003

Table 1 lists the T2 products that have been created for Fiscal Year 2003. This fiscal year marks the first time that Web-streaming multi-media tools have been used to provide enhanced opportunity for NAVFAC to exchange information using animated graphic art, video, audio, pictures, as well as text and hypertext Web links. As part of the T2 Program for Fiscal Year 2003, the initial software development and web programming was completed in order to implement these new multi-media tools. The work completed in Fiscal Year 2003 lays a strong foundation for future T2 efforts and the creation of future multi-media T2 products. As part of the creation of T2 tools for Fiscal Year 2003, various templates have been developed to enhance user interaction and understanding of the material. Once a template is developed, it can be applied to any future Web-based tool, as well as previously developed tools that may need improvement or enhancement. Some of the templates that have been developed for the T2 tools in Fiscal Year 2003 are as follows:

- Text Rollovers
- Rotating Graphics
- Text Links
- Hyperlinks
- 3-D Graphics
- Animated Graphics
- Interactive Charts and Graphs
- Interactive Tables
- Interactive Flow Charts
- Streaming Video
- Video Tracking Bar
- Voice Over

It should also be noted that the following T2 products have been moved to Fiscal Year 2004 to accommodate the schedule for field implementation of the projects and/or to address delayed funding for the research and development efforts for Fiscal Year 2003:

- Environmental Fate and Effect of Underwater Ordnance
- Biodegradation of Dense Non-Aqueous Phase Liquids (DNAPL) Through Bioaugmentation of Source Areas (ESTCP Project Number CU-0008)
- In-Situ Catalytic Groundwater Treatment Using Pd Catalysts and Horizontal Flow Treatment Wells (ESTCP Project Number CU-0012)

Table 1. T2 Products for Fiscal Year 2003

Product	Title	Release Date
Web Data Sheets	Degradation of Ordnance Constituents in Marine Sediments	4th Quarter 2003
	Encapco Data Sheet	4th Quarter 2003
	Implementation of ONR Harbor Processes	4th Quarter 2003
	IRZ Data Sheet	4th Quarter 2003
	PCB Data Sheet	4th Quarter 2003
	Perchlorate Groundwater Cleanup Technologies	4th Quarter 2003
	PRB Data Sheet	4th Quarter 2003
Web Training Tools	Amphibians Training Tool	3rd Quarter 2003
	DNAPL Detection and Characterization Tool	3rd Quarter 2003
	MTBE Training Tool	4th Quarter 2003
	PCB Training Tool	1st Quarter 2003
	Perchlorate Groundwater Cleanup Technologies	4th Quarter 2003
	PRB Training Tool	4th Quarter 2003
Case Studies	Naval Weapons Station Charleston Innovative Technologies Web Page	4th Quarter 2003
Email Updates	Email update for the PCB Training Tool, Amphibians Training Tool, and DNAPL Detection and Characterization Tool.	June 2003
RPM Newsletter Articles	Pressure-Driven Bioventing Demonstrations	Spring 2003
	Updated T2 News; Encapco Soil Stabilization	Summer 2003
	Evaluation and Performance of Costs Associated with Anaerobic Dechlorination; Coastal Contamination Migration Monitoring; Implementation of ONR Harbor Processes; Enhanced Natural Attenuation;	Fall 2003
Other Journal Articles	Coastal Contamination Migration Monitoring	4th Quarter 2003
Training Courses	90-Minute CECOS Training Course on Remedy Selection	3rd Quarter 2003
	Monitored Natural Attenuations Course Assistance	4th Quarter 2003
Feedback Surveys	Diffusion Sampler Survey	4th Quarter 2003
	Fiscal Year 2003 General T2 Survey	4th Quarter 2003

2.0 Feedback Survey Results for Fiscal Year 2003

The use of new Web-based, multi-media training tools has allowed the recent development of on-line feedback surveys to solicit information directly from Navy Remedial Project Managers (RPMs) and others. The new feedback mechanisms implemented include an Annual T2 General Survey, T2 Product Specific Surveys, and Technology Specific Surveys. These feedback surveys were implemented to improve understanding of end users' needs and opinions. The feedback information from these surveys will be used to customize future T2 products for Fiscal Year 2004 and to improve the existing T2 products from Fiscal Year 2003.

2.1 Annual T2 General Survey Results

An annual Web survey was developed and released to gather information directly from Navy RPMs and others on their overall interest in and satisfaction with the T2 Program. The results of this survey will be used to guide future T2 Program efforts and to ensure that it remains focused on useful and relevant environmental restoration topics. The results from this survey are provided in Table 2.

2.2 T2 Product Specific Survey Results

Each T2 Web tool includes a feedback form with general questions about the tool itself, as well as several specific questions pertaining to the content of each tool. The results of the feedback forms are immediately stored into a database and the results are uploaded into a feedback report. Each tool has its own feedback report which is updated on a real time basis and can be queried and viewed at any time. The comments and results received from the feedback forms will be used to improve future tools and to guide decisions for future T2 topics.

2.3 Technology Specific Survey Results

Web surveys were also used to track Navy RPMs interest in and use of specific new technologies and/or methodologies. These surveys help NAVFAC to better understand the various regulatory, economic, organizational, and personal barriers that may restrict Navy RPMs from taking advantage of new technical opportunities. The results of the Diffusion Sampler Survey are provided in Table 3.

Table 2. Annual T2 Survey Results

Question #	Question	Responses
1	**Have you viewed any of the following recently developed NAVFAC T2 products? (SELECT ALL THAT APPLY)**	
	PCB Training Tool	9/29
	Amphibians Risk Assessment Tool	6/29
	DNAPL Detection and Characterization Tool	5/29
	Special Report on DON Groundwater Pump and Treat Systems	4/29
	Guidance for Environmental Background Analysis (Volume I. Soil or Volume II. Sediment)	6/29
	Guide for Planning and Conducting Sediment Pore Water Toxicity Identification Evaluations (TIE)	1/29
	Other, [Please Specify]	0/29
	None	13/29
1A	**If you haven't viewed any of these new T2 products, please let us know the most significant reasons? (SELECT ALL THAT APPLY)**	
	Not enough time to review these products	5/12
	Not aware of the existence of these products	6/12
	Topics are not relevant to my current projects	2/12
	Not interested in T2 products	1/12
	Other [Please Specify]	0/12
1B	**How effective were the NAVFAC T2 products that you've recently reviewed at providing technical information?**	
	Very Effective	5/16
	Effective	9/16
	Minimally Effective	0/16
	Not Effective	0/16
	Not Sure	2/16
2	**What are the general types of resources that you use to obtain information on current cleanup technologies? (SELECT ALL THAT APPLY)**	
	Email Alerts	15/28
	Conferences	13/28
	Guidance Documents	10/28
	Journal Articles	4/28
	Newsletters	9/28
	Peer Group Discussions	8/28
	Training Seminars	15/28
	World Wide Web	13/28
	Other – Contractors, Technical Seminars/Forums, Experience	3/28

Table 2. Annual T2 Survey Results

Question #	Question	Responses
3	**What do you see as your greatest barrier to using innovative technologies? (SELECT ALL THAT APPLY)**	
	Technology Complexity	4/25
	Performance Risk	10/25
	Lack of Regulatory Acceptance	13/25
	Lack of Public Support	4/25
	Lack of Field Demonstration Data	8/25
	Uncertainty Related to Project Costs	18/25
	Other, [Please Specify]	0/25
4	**Which of the following T2 products would best assist you in overcoming these barriers? (Check those that apply)**	
	NAVFAC T2 Email Updates	10/25
	NAVFAC ERB Web Site	4/25
	NAVFAC Guidance Documents	12/25
	NAVFAC Web Training Tools	12/25
	Remediation Innovative Training Seminars (RITS)	15/25
	Technical Expert Assistance	14/25
	Journal Articles	5/25
	RPM Newsletter Articles	5/25
	Other, [Please Specify]	0/25
5	**What are the primary learning objectives that you consider important in T2 products? (SELECT ALL THAT APPLY)**	
	Increases professional knowledge	22/24
	Helps to reduce project costs	15/24
	Helps to reduce project duration	11/24
	Facilitates the sharing of lessons learned at other Navy sites	13/24
	Provides information about new remediation technologies	17/24
	Provides information about new site characterization approaches	9/24
	Provides information on emerging contaminants	7/24
	Provides information on recent advances and research	9/24

Table 2. Annual T2 Survey Results

Question #	Question	Responses
7	**In which phase of the Installation Restoration program would you like to receive more technical assistance provided through T2 products? (Rate your top two choices)**	
	Preliminary Assessment and Site Inspection	5/25
	Remedial Investigation and Feasibility Study	12/25
	Design	9/25
	Construction	4/25
	Interim Remedial Action	11/25
	Operation and Maintenance	2/25
	Long Term Management	4/25
8	**Which media would you most like to see as the focus of future T2 products?**	
	Groundwater	10/25
	Sediments	9/25
	Soil	5/25
	Surface Water	1/25
9	**Rate the top three contaminants that pose the greatest challenge to cleanup and closure at your sites?**	
	Volatile organic compounds (VOCs)	12/25
	Semivolatile organic compounds (SVOCs)	10/25
	Metals	11/25
	Pesticides	3/25
	Polychlorinated biphenyls (PCBs)	7/25
	Asbestos	2/25
	Ordnance	5/25
	Petroleum, oil, and lubricants	4/25
	Radionuclides	5/25
	Other, [Please Specify] – DNAPL, Perchlorate, MTBE	3/25
10	**How many years of professional experience do you have in the environmental restoration field?**	
	1 to 3	2/25
	>3 to 7	4/25
	>7	19/25

Table 2. Annual T2 Survey Results

Question #	Question	Responses
11	**What is your overall level of satisfaction with the NAVFAC Technology Transfer Program?**	
	Very Satisfied	3/23
	Satisfied	13/23
	Neutral	5/23
	Dissatisfied	2/23
	Very Dissatisfied	0/23
12	**Please select one of the following that best characterizes your job function/organization:**	
	Navy RPM/RTM	18/25
	NAVFAC Supervisor/Team Lead	5/25
	Other Department of Defense (DoD) Personnel	1/25
	Regulator	0/25
	Contractor	0/25
	Other, [Please Specify] – Business Line Manager, BRAC Environmental Coordinator	2/25

Table 3. Diffusion Sampler Survey

Question #	Question	Responses
1	**Have you previously worked or are you currently working on a site where diffusion samplers are being used?**	
	Yes	13/45
	No	32/45
3	**In which stage of your project are/were diffusion samplers being used? SELECT ALL THAT APPLY**	
	Remedial Investigation	6/12
	Feasibility Study	2/12
	Remedial Action Operations	4/12
	Long Term Management	5/12
	Other – Interim Removal Action (2), Post-ROD pre design investigation	4/12
4	**How would you rate your experience with regulatory acceptance of diffusion samplers at your site(s)? PLEASE CHECK ONE**	
	Very Easy	2/11
	Easy	2/11
	Not Difficult	6/11
	Difficult	1/11
	Very Difficult	0/11
5	**How would you rate the ease of using diffusion samplers? PLEASE CHECK ONE**	
	Very Easy	1/11
	Easy	5/11
	Not Difficult	5/11
	Difficult	0/11
	Very Difficult	0/11
6	**How would you rate the technical quality of the sampling results obtained from diffusion samplers? PLEASE CHECK ONE**	
	Very High	0/11
	High	7/11
	Moderate	4/11
	Low	0/11
	Very Low	0/11

Table 3. Diffusion Sampler Survey

Question #	Question	Responses
7	**What is the anticipated annual cost avoidance for your site due to the use of diffusion samplers over conventional methods? PLEASE CHECK ONE**	
	<= $5,000	2/11
	$5,001-$10,000	0/11
	$10,001-$50,000	2/11
	$50,001-$100,000	0/11
	>$100,000	0/11
	Not Sure	7/11
8	**Did you attend the autumn 2000 Remediation Innovative Technology Seminar (RITS) on diffusion samplers?**	
	Yes	16/38
	No	22/38
9	**Have you reviewed any of the following technology transfer products related to diffusion samplers? SELECT ALL THAT APPLY**	
	NAVFAC Tech Data Sheet	8/18
	USGS User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers (2001)	10/18
	ITRC Diffusion Sampler Web Page	9/18
	ITRC Internet Training Courses	1/18
	ITRC Diffusion Sampler Resource CD	1/18
	Other [Please Specify] – EPA Guidance, USGS Water-Resources Investigation	2/18
10	**Which of the following products would you most like to see highlight more up-to-date information about diffusion samplers?**	
	Guidance Document on Recent Advances	20/34
	Web Training Tool	10/34
	On-Site Training Seminar	8/34
	Web-Based Training Course	12/34
	Other [Please Specify] – Fact Sheet or RPM News Article	1/24
	Not Interested	6/34

Table 3. Diffusion Sampler Survey

Question #	Question	Responses
11	**Have you used any of the following additional technology transfer resources sponsored by the Department of Defense? SELECT ALL THAT APPLY**	
	Federal Remedial Technologies Roundtable (FRTR)	4/21
	Interstate Technology Regulatory Council (ITRC)	14/21
	Defense Environmental Network Information Exchange (DENIX)	14/21
	Interagency DNAPL Consortium (IDC)	1/21
	Remediation Technologies Development Forum (RTDF)	2/21
	Other [Please Specify] – USGS Guidance	1/21
12	**Have you reviewed any of the following technology transfer products from the Federal Remediation Technologies Roundtable (FRTR) Program? SELECT ALL THAT APPLY**	
	The Remediation Technologies Screening Matrix	8/14
	The Field Sampling and Analysis Technologies Matrix	7/14
	FRTR Remediation Case Studies	5/14
	FRTR Site Characterization and Monitoring Case Studies	4/14
	Remediation System Optimization Information	5/14
	Other [Please Specify]	0/14

APPENDIX B

PROPOSED ACTIVITIES FOR FISCAL YEAR 2004

NAVFAC Technology Transfer Work Plan for Environmental Restoration in 2004

This Work Plan summarizes the technology transfer (T2) products proposed for Fiscal Year 2004. This report was prepared for the Naval Facilities Engineering Command (NAVFAC) under the Naval Facilities Engineering Service Center (NFESC) Contract No. N47408-01-D-8207, Task Order No. 0049. The review and approval of this Work Plan is an important step in the T2 process for Fiscal Year 2004. The following sections discuss the proposed T2 products for Fiscal Year 2004.

1.0 Schedule for Fiscal Year 2004

Table 1 lists the proposed T2 products for the Fiscal Year 2004 T2 Program. The specific topics and schedule for each T2 product will be determined in consultation with NFESC's T2 team lead based on input from Navy stakeholders.

2.0 Product Proposals for Fiscal Year 2004

The following subject areas are proposed for the development of technology transfer products in Fiscal Year 2004:

- DCE/VC Stall[1]
- In Situ Chemical Oxidation[2]
- Diffusion Samplers
- Energetics
- Benthic Flux Sampling Devices

The remaining T2 topics will be determined by the NAVFAC T2 team lead based on input from Navy stakeholders. Product proposals were prepared for each of the above topics. Each product proposal summarizes the overall learning objectives of the T2 products as discussed below:

The learning objectives for the DCE/VC Stall Web Training Tool are as follows:

- Review the anaerobic dechlorination process for the degradation of chlorinated organic compounds.
- Explain the phenomenon of DCE/VC stall and discuss potential reasons that it occurs.
- Discuss the techniques used to address DCE/VC stall such as the addition of electron donor compounds, the addition of electron shuttle compounds (humic acid), and other methods.

The learning objectives for the In Situ Chemical Oxidation Web Training Tool are as follows:

- Focus on advancements made in chemical oxidation technologies to date.

[1] A Web Data Sheet on DCE/VC Stall will be completed to complement and summarize information presented in the October 2003 Remediation Innovative Technology Seminars (RITS). The DCE/VC Stall Web Data Sheet will then be enhanced and updated into a Web Training Tool with Navy ESTCP case studies in the 4th quarter of 2003.

[2] A Web Data Sheet for In Situ Chemical Oxidation will be completed to complement and summarize information presented in the October 2003 RITS. A product proposal is pending more information.

- Present various chemical oxidants and injection schemes, along with advantages and disadvantages and what site-specific conditions would be suitable for their successful application.
- Discuss what factors to consider in selecting chemical oxidation, selecting a suitable application method, design and monitoring of system performance.

The learning objectives for the Diffusion Sampler Web Training Tool are as follows:

- To describe the scientific principles behind the use and operation of diffusion samplers.
- To provide information on the advantages and limitations of diffusion samplers versus conventional groundwater monitoring techniques during long term monitoring.
- To document the use of diffusion samplers at Navy sites and to facilitate the sharing of this information with other Navy stakeholders.

The learning objectives for the Energetics Web Training Tool are as follows:

- To describe the EOD TECHDIV's application of the Pulsed Elemental Analysis with Neutrons (PELAN) system to the 257,000 lbs of ordnance shapes at the former NSWC White Oak. NSWC White Oak is managed by NAVFAC EFA Chesapeake.
- The purpose of the system is to rapidly identify the bulk load within a shape (i.e., whether there is or isn't an energetic load) via gamma backscatter readings.

The learning objectives for the Benthic Flux Sampling Device (BFSD) Web Training Tool are as follows:

- To describe the BFSD and its use for quantifying the exchange rate of contaminants and other biochemical compounds across the sediment-water interface.
- To discuss the need for BFSD data and its use in evaluating the risks posed by in-place sediment contamination.
- To provide information on system operation and costs and to provide information from example case study sites where the BFSD was implemented.

Table 1. Description of Technology Transfer Products for 2004

T2 Product	Description
Web Tools	Ten (10) T2 Web Tools will be prepared to convey technology lessons learned, challenges negotiated, beneficial experiences, and costs.
Web-Based Case Studies	Four (4) interactive Web pages will be developed that highlight unique site challenges that were overcome, methodologies used, or innovative technologies deployed. These Web pages will be similar to the Charleston Web page developed for Southdiv in Fiscal Year 2003. These Web pages are intended to convey lessons learned, challenges negotiated, and beneficial experiences from Navy Installation restoration services. The projects to be highlighted will be selected from each EFD/A's representative on the ARTT Workgroup.
T2 Email Updates	Six (6) T2 email updates will be developed and distributed approximately every other month to the entire NAVFAC clean-up team. These Email Updates provide direct links to new T2 Web Tools and other T2 program information. In addition, the ARTT and other NAVFAC workgroups can use the Email Updates to distribute and publicize up-to-date technical information, NAVFAC guidance, and Navy/DoD policies.
RPM Newsletter Articles	Four (4) RPM Newsletter articles will be written to raise awareness of current NAVFAC research projects and/or new topics of interest. In particular, these RPM Newsletter articles will highlight the newest and latest technologies currently under development and demonstration in the ESTCP/SERDP program. This effort is intended to publicize to Navy RPMs regarding the latest technology research.
Tech Transfer News	A T2 News page will be developed for each quarterly RPM Newsletter. T2 News is a brief update on recently released guidance documents, policies, and other topics. T2 news is typically one page in length with 3 to 4 news items.
Tech Transfer Surveys and Feedback	The T2 Program will include on-going efforts to measure the performance and success of the various T2 Products. This will be accomplished using three different approaches. The first approach is an Annual Survey that measures awareness, satisfaction, and interest in the overall T2 Program and products. The second approach will be a Technology Specific Survey like the Diffusion Sampler Survey released in Fiscal Year 2003. The third approach is immediate feedback forms embedded within the Web-based T2 tools.
Cost and Performance (C&P) Reports	The use of C&P reports can help Navy RPMs overcome barriers such as performance risk and the uncertainty related to project costs. Five (5) C&P reports will be prepared to facilitate comparison to conventional technologies and to help to improve remedy selection.
Cost Avoidance Reports (CAR)	Five (5) CARs will be developed and will include a description of each technology, the targeted end users, the size and growth in its use, barriers to its use, and benefits to its use including cost avoidance and time savings.
ERB Technical Content Update	The technical content to be updated and new topic pages to be developed will be specified by the NFESC T2 team lead based on input from the ARTT and other Navy stakeholders

APPENDIX C

PLANNING FOR FISCAL YEARS 2005-2008

Planning for Fiscal Year 2005 - 2008

This report summarizes the planning efforts that will take place for the Technology Transfer (T2) Program for Fiscal Years 2005 to 2008. This report was prepared for the Naval Facilities Engineering Command (NAVFAC) under the Naval Facilities Engineering Service Center (NFESC) Contract No. N47408-01-D-8207, Task Order No. 0049. The following sections discuss the extended project schedule and planning for topics or subject areas for 2005 to 2008.

1.0 Extended Schedule for Fiscal Years 2005 to 2008

Table 1 lists the proposed long-term schedule for planning activities for Fiscal Years 2005 to 2008.

Table 1. Extended T2 Program Schedule for Fiscal Year 2005 to 2008

Milestone	Description	Date
Navy Input FY05	Navy Stakeholders Confer to Propose T2 Topics for FY05	3rd Quarter 2004
FY05 Work Plan	Draft T2 Workplan for FY05	June 2004
FY 05 Start	FY05 Activities Begin	1 October 2004
Navy Input FY06	Navy Stakeholders Confer to Propose T2 Topics for FY06	3rd Quarter 2005
FY06 Work Plan	Draft T2 Workplan for FY06	June 2005
FY 06 Start	FY06 Activities Begin	1 October 2005
Navy Input FY07	Navy Stakeholders Confer to Propose T2 Topics for FY07	3rd Quarter 2006
FY07 Work Plan	Draft T2 Workplan for FY07	June 2006
FY 07 Start	FY07 Activities Begin	1 October 2006
Navy Input FY08	Navy Stakeholders Confer to Propose T2 Topics for FY08	3rd Quarter 2007
FY08 Work Plan	Draft T2 Workplan for FY08	June 2007
FY 08 Start	FY 08 Activities Begin	1 October 2007

2.0 Product Proposals for Fiscal Years 2005 to 2008

The specific product proposals for each year will be developed as part of that year's Work Plan. The topics will be generated from a variety of sources as summarized by the Five Year Program Plan including the following:

- NAVFAC Workgroup Input
- NORM/CTC Database Review
- Statement of Needs from the Strategic Environmental Research and Development Program (SERDP)
- Statement of Needs from the Environmental Security Technology Certification Program (ESTCP)
- Industry and Academic Outreach
- Annual T2 General Survey Results and Other Survey Results