Naval Facilities Engineering Systems Command

EXWC Engineering & Expeditionary Warfare Center

Strategies and Resources for Advancing Remediation Technology from R&D to Commercialization

Part 1: Technology Development
Part 2: Demonstration/Validation
Part 3: Technology Transfer Process

Kelsey Pauxtis-Thomas (NAVFAC EXWC)

Laura Kammel (NIEHS)

November 8, 2022

How Does FRTR Help with T2?

Updating Products

Using the June 2000 InfoBase update into a readable table as shown in prior slide to include each agencies:

- Technology Development
- Demonstration/Validation
- Technology Transfer Process

EPA 542-B-00-005
June 2000

Site Remediation Technology InfoBase: A Guide to Federal Programs, Information Resources, and Publications on Contaminated Site Cleanup Technologies

Second Edition

Prepared by the Member Agencies of the Federal Remediation Technologies Roundtable:

Federal Remediation Technologies Roundtable

U.S. Environmental Protection Agency
Department of Defense
    U.S. Air Force
    U.S. Army
    U.S. Navy
Department of Energy
Department of Interior
National Aeronautics and Space Administration
Tennessee Valley Authority
Coast Guard

How Does FRTR Help with T2?

Remedy Protectiveness and Climate Resilience in Site Cleanups: Policies, Guidance and Implementation Tools (NOV 2021)

Agency	Agency Overview	Relevant Plans, Policies & Directives	Implementation Reports and Tools
Department of Defense	Tackling the Climate Crisis; https://www.defense.gov/Spotlights/ Tack ling-the-Climate-Crisis/source/GovDelivery/ DoD Climate and Security Resources; https://climateandsecurity.org/resour ces/ u-s-government/defense/	Department of Defense Climate Risk Analysis; October 2021; https://media.defense.gov/2021/Oct/21/2002877353/-1/-1/0/DOD- CLIMATE-RISK-ANALYSIS-FINAL.PDF Department of Defense Climate Adaptation Plan; September 2021; https://media.defense.gov/2021/Oct/07/2002869699/-1/-1/0/DEPARTMENT-OF-DEFENSE-CLIMATE-ADAPTATION-PLAN-2.PDF DoD Directive 4715.21, Climate Change Adaptation and Resilience; August 2018; https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/do dd/47 1521p.pdf; pursuant to Executive Order 13653 reinstated by 2021 Executive Order 13990 2014 Climate Change Adaptation Roadmap; https://www.acq.osd.mil/eie/downloads/CCARprint_wForward_e.p df; undergoing update per 2021 National Defense Authorization Act (NDAA) Unified Facilities Criteria (UFC) FC 2-100-2, Installation Master Planning;September 2020; updates for energy and climate resilience and updatesto incorporate climate change effects, as required by 2021 NDAA; https://www.wbdg.org/FFC/DOD/UFC/ufc_2_100_01_2020.pdf Unified Facilities Criteria (UFC) 3-201-02, Landscape Architecture; UFC 3-201-01, Civil Engineering; UFC 1-200-02, HighPerformance and Sustainable Building Requirements; updates to incorporate climate change and climate resilience; https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc	DoD Installation Exposure to Climate Change at Home and Abroad; April 2021; https://media.defense.gov/2021/Apr/20/200262461 3/-1/-1/1/DOD-INSTALLATION-EXPOSURE-TO-CLIMATE-CHANGE-AT-HOME-AND-ABROAD.PDF; pursuant to 2021 Executive Order 14008 requirement for climate risk analysis DoD Climate Assessment Tool; https://media.defense.gov/2021/Apr/05/200261457 9/-1/-1/0/DOD-CLIMATE-ASSESSMENT-TOOL.PDF DoD Regional Sea Level Database; https://drsl.serdp-estcp.org/

• Anticipate • Innovate • Accelerate •

Other Innovative Technology Transfer Programs

- **US EPA & Clean-Up Information (**CLU-IN)
  - Office of Superfund Remediation and Technology Innovation
  - Technology pages →
  - Federal Remediation Technologies Roundtable
    - Decision Support Tools Matrix
    - Remediation Technologies Screening Matrix
      - **A user-friendly tool for screening potentially applicable technologies for a remediation project. The matrix allows you to screen 49 in situ and ex situ technologies for either soil or groundwater remediation. Variables used in screening include contaminants, development status, overall cost, and cleanup time. In-depth information on each technology is also available, including direct links to the database of cost and performance reports written by FRTR members.**
      - https://clu-in.org/remediation/

Other Innovative Technology Transfer Programs

- **Interstate Technology and Regulatory Council (ITRC)**
  - **State-Led working groups who help produce guidance's, documents, and training to expand technology knowledge.**
  - **Managed by a national non-profit the Environmental Council of States (ECOS)**
  - **Clearinghouse of information for state environmental commissioners to promote coordination in environmental management.**
  - **Examples of upcoming trainings include**
    - **Sustainable Resilient Remediation**
    - **Optimizing Injection Strategies and In Situ Remediation Performance**
    - **https://itrcweb.org/home**

Part 3: Technology Transfer (T2) Process

1 **NAVFAC T2 Program Overview**

2 T2 Program Process

3 T2 Methods

4 T2 Feedback

5 Conclusions

• Anticipate • Innovate • Accelerate •

NAVFAC T2 Program Overview

- The NAVFAC Technology Transfer (T2) Program supports information sharing to identify the Navy's Environmental Restoration Program (ERP) challenges and to promote the use of innovative and cost-effective solutions.

- The goal of the T2 Program is to communicate the latest information on research, technology innovations, and lessons learned from Navy case studies.

- Technical information is shared using several methods to reach the target audience of Navy Remedial Project Managers (RPMs) and other key ERP stakeholders.

If you would like to be added to the distribution list, send an e-mail to **EXWC_T2@navy.mil** to join.
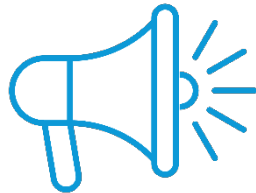
NAVFAC T2 Program Overview

Types of T2 Resources Prepared by NAVFAC

T2 Emails

Articles

Brochures

Fact Sheets

Technical Reports

Case Study Reports

Tools and Check Lists

Guidance

Part 3: Technology Transfer (T2) Process

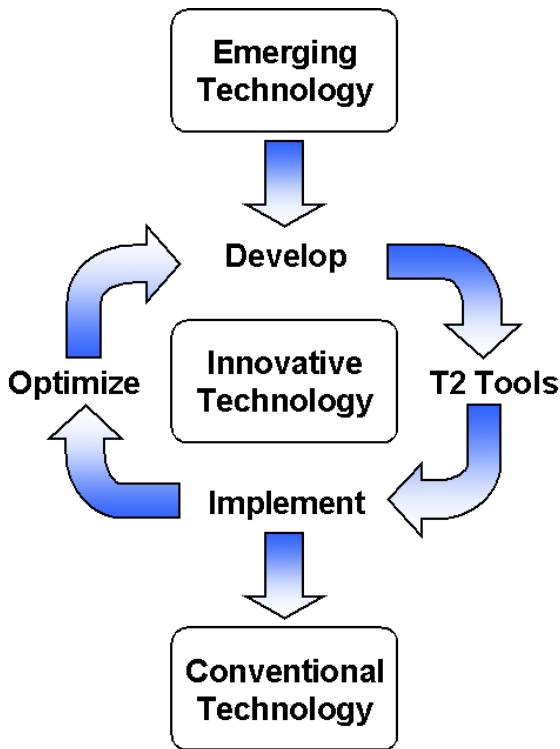**1** NAVFAC T2 Program Overview

2 **T2 Program Process**

3 T2 Methods

4 T2 Feedback

5 Conclusions
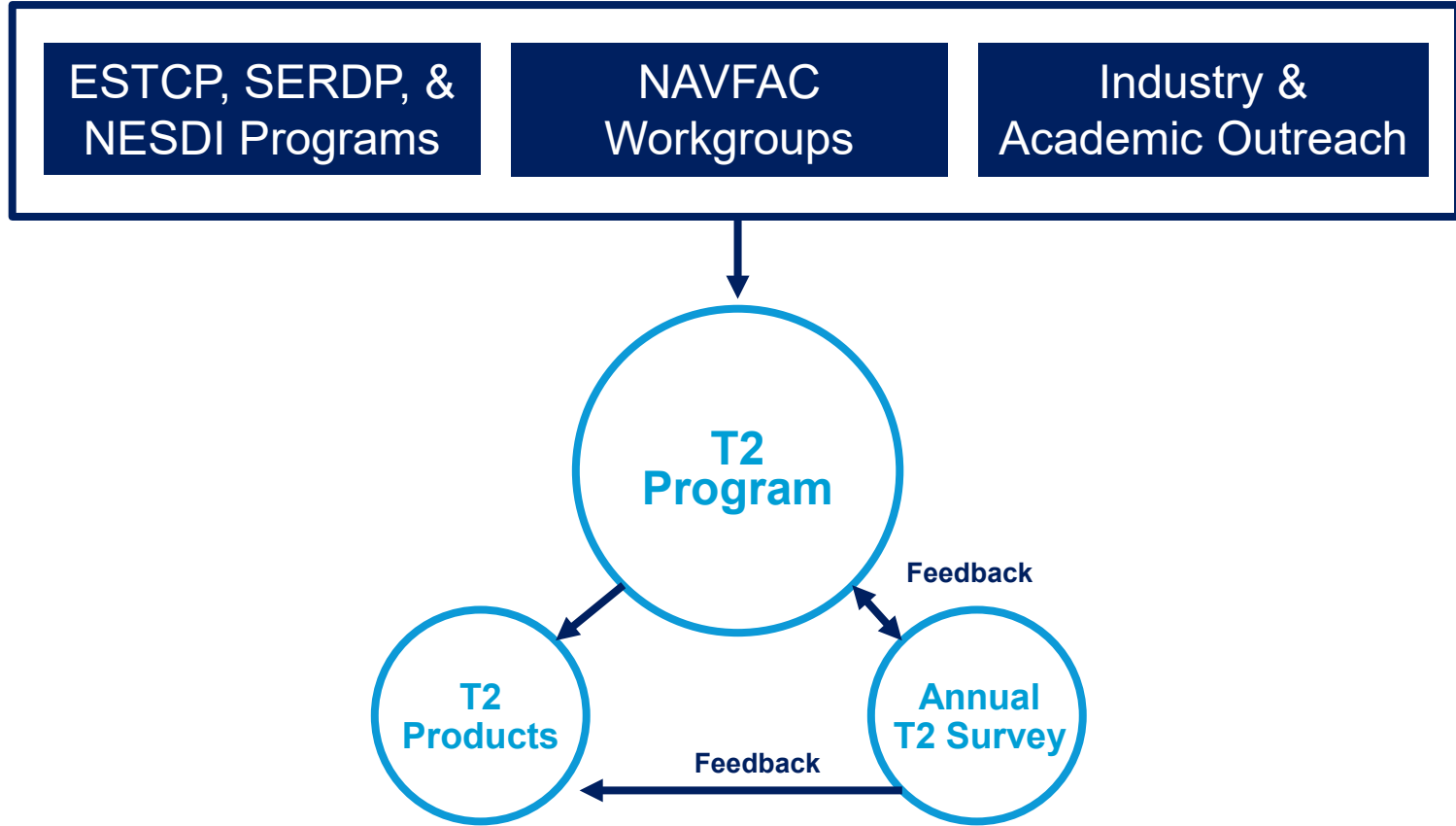
NAVFAC T2 Program Process

Objectives

- Transfer information on new technology developments and Navy-sponsored research
- Provide information on cost saving strategies for site cleanup
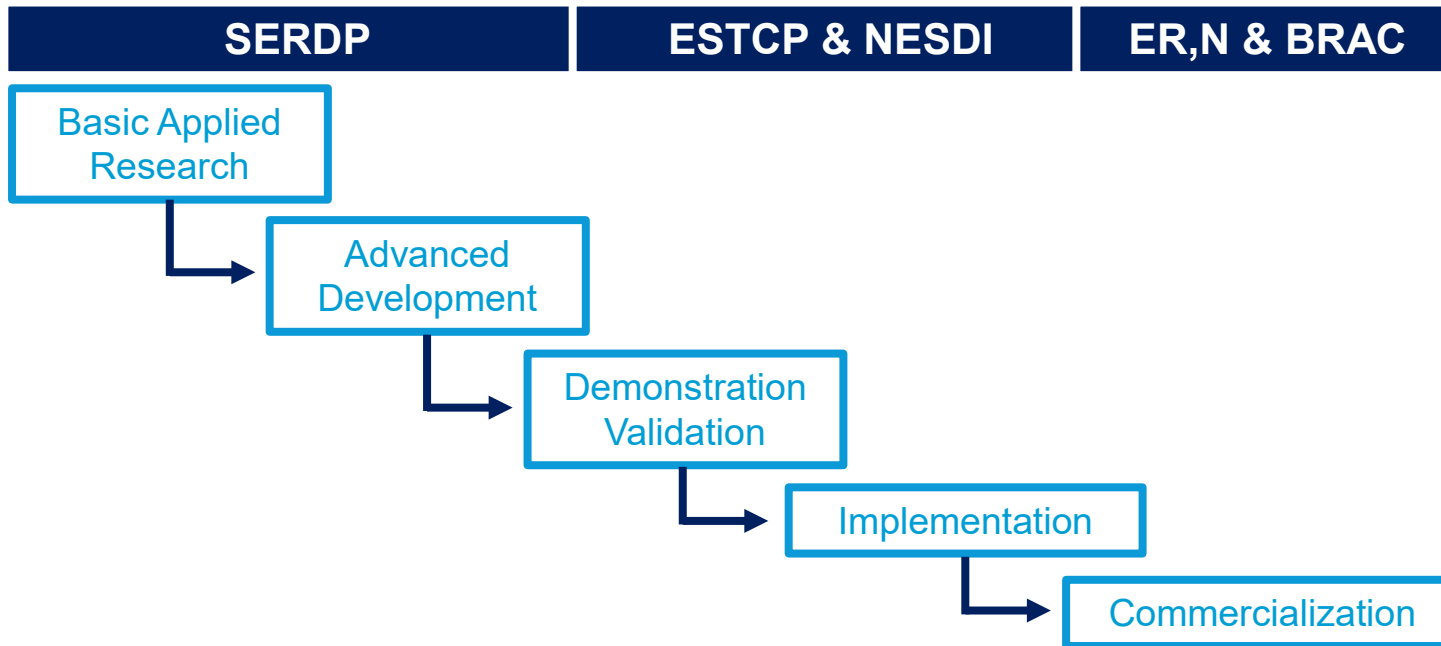- Share lessons learned between RPMs

Approach

- Technical content driven by RPM needs
- Coordinate T2 needs with NAVFAC Workgroups
- Program seeks two-way information exchange
    - Stakeholder input is key:
        - SERDP/ESTCP
        - Navy Environmental Sustainability Development to Integration (NESDI) Program
        - NAVFAC Workgroup Needs
        - T2 Survey Feedback
- Periodic reporting of milestones and T2 survey results
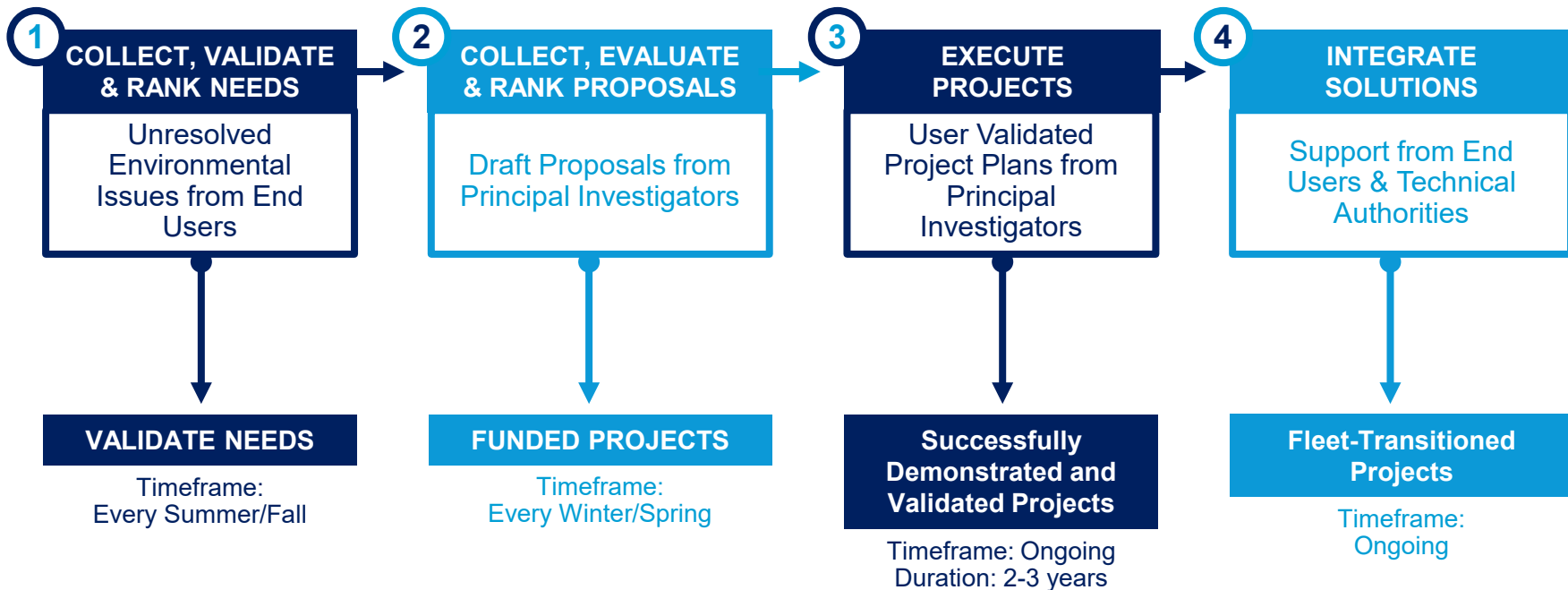
NAVFAC T2 Program Process

| ESTCP, SERDP, & NESDI Programs | NAVFAC Workgroups | Industry & Academic Outreach |

T2 Program

T2 Products

Annual T2 Survey

Feedback

Feedback

NAVFAC T2 Program Input and Feedback (NERP, 2018)

T2 Program Process: SERDP/ESTCP Input

SERDP	ESTCP & NESDI	ER,N & BRAC

Basic Applied Research → Advanced Development → Demonstration Validation → Implementation → Commercialization

DoD/DON ERP Research & Development Structure (NERP, 2018)

T2 Program Process: NESDI Input

1 — COLLECT, VALIDATE & RANK NEEDS
Unresolved Environmental Issues from End Users

2 — COLLECT, EVALUATE & RANK PROPOSALS
Draft Proposals from Principal Investigators

3 — EXECUTE PROJECTS
User Validated Project Plans from Principal Investigators

4 — INTEGRATE SOLUTIONS
Support from End Users & Technical Authorities

VALIDATE NEEDS
Timeframe: Every Summer/Fall

FUNDED PROJECTS
Timeframe: Every Winter/Spring

Successfully Demonstrated and Validated Projects
Timeframe: Ongoing
Duration: 2-3 years

Fleet-Transitioned Projects
Timeframe: Ongoing

NESDI Program Management Process (NESDI, 2021)

T2 Program Process: NAVFAC Workgroups

- NAVFAC Workgroups
  - Established to identify and address ERP technical challenges
  - Representatives from NAVFAC HQ, ER Manager Lead, EXWC, and RPMs from each NAVFAC Field Engineering Command (FEC)

- NAVFAC Workgroup Contributions
  - Sharing of best practices
  - Identifying lessons learned
  - Developing NAVFAC guidance
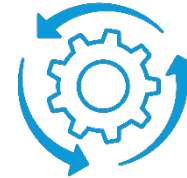 - Providing input on key topics to the T2 Program

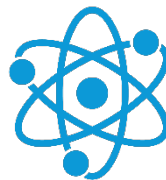# T2 Program Process: NAVFAC Workgroups

Emerging Contaminant (EC) Workgroup

Naval Installation Information Solution (NIRIS) Workgroup

Optimization and Technology Innovations (OTI) Workgroup

Munitions Response (MR) Workgroup

Radiological Workgroup

Sediment Workgroup

Part 3: Technology Transfer (T2) Process

1 NAVFAC T2 Program Overview

2 T2 Program Process

3 **T2 Methods**

4 T2 Feedback

5 Conclusions

NAVFAC T2 Methods: Summary

- **NAVFAC Environmental Restoration & BRAC Websites**
  - ERB Web Site
  - Internal SharePoint
  - Social Media (LinkedIn & YouTube)
- **T2 Program Products**
  - Fact sheets, technical reports, guidance
  - Tools (SiteWise) and checklists
- **Newsletters**
  - Monthly T2 e-mail updates
  - ERB Garden newsletter articles (internal to Navy)
- **Webinars**
  - Open Environmental Restoration Resources (OER2) Webinar Series
    - Open to public; covers remediation practices, tools, technologies, and ways to improve efficiency
  - TIPS Forum (internal to Navy)
- **In-Person Training Events**
  - Remediation Innovative Technology Seminar (RITS)
  - Remedial Project Manager Training Event
  - Civil Engineer Officer School (CECOS) Environmental Restoration Training Classes

01 | ERB WEB SITE

02 | T2 PROGRAM

03 | NEWSLETTERS

04 | WEBINARS

05 | SEMINARS

06 | RPM TRAINING EVENT

07 | CECOS CLASSES

NAVFAC T2 Methods: RITS

REMEDIATION INNOVATIVE TECHNOLOGY SEMINAR (RITS)

- Held once per year at each FEC to provide training on innovative technologies and guidance updates

- 2-day seminar, 6 topics (3 per day)

- Topics identified by the RITS Team, ER Managers, and NAVFAC Workgroups

- Ongoing program for 20+ years

- In-person classroom training allows in-depth topic coverage

- Direct connection to subject matter experts (SMEs)

- Live demonstrations of technologies

- Average attendance = 250 per year
  - ~45% Contractor
  - ~40% Navy RPMs
  - ~15% Regulators and Other Stakeholders

Part 3: Technology Transfer (T2) Process

1 NAVFAC T2 Program Overview

2 T2 Program Process

3 T2 Methods

4 **T2 Feedback**

5 Conclusions

NAVFAC T2 Feedback

NAVY ER TRAINING AND OUTREACH			
NAVFAC Workgroups	RITS (Seminars)	OER2 (Webinars)	T2 Products (Fact Sheets)

TARGET AUDIENCE	
Navy RPMs and FECs	Navy Contractors

FEEDBACK	
Web Site Analytics	T2 Survey Feedback
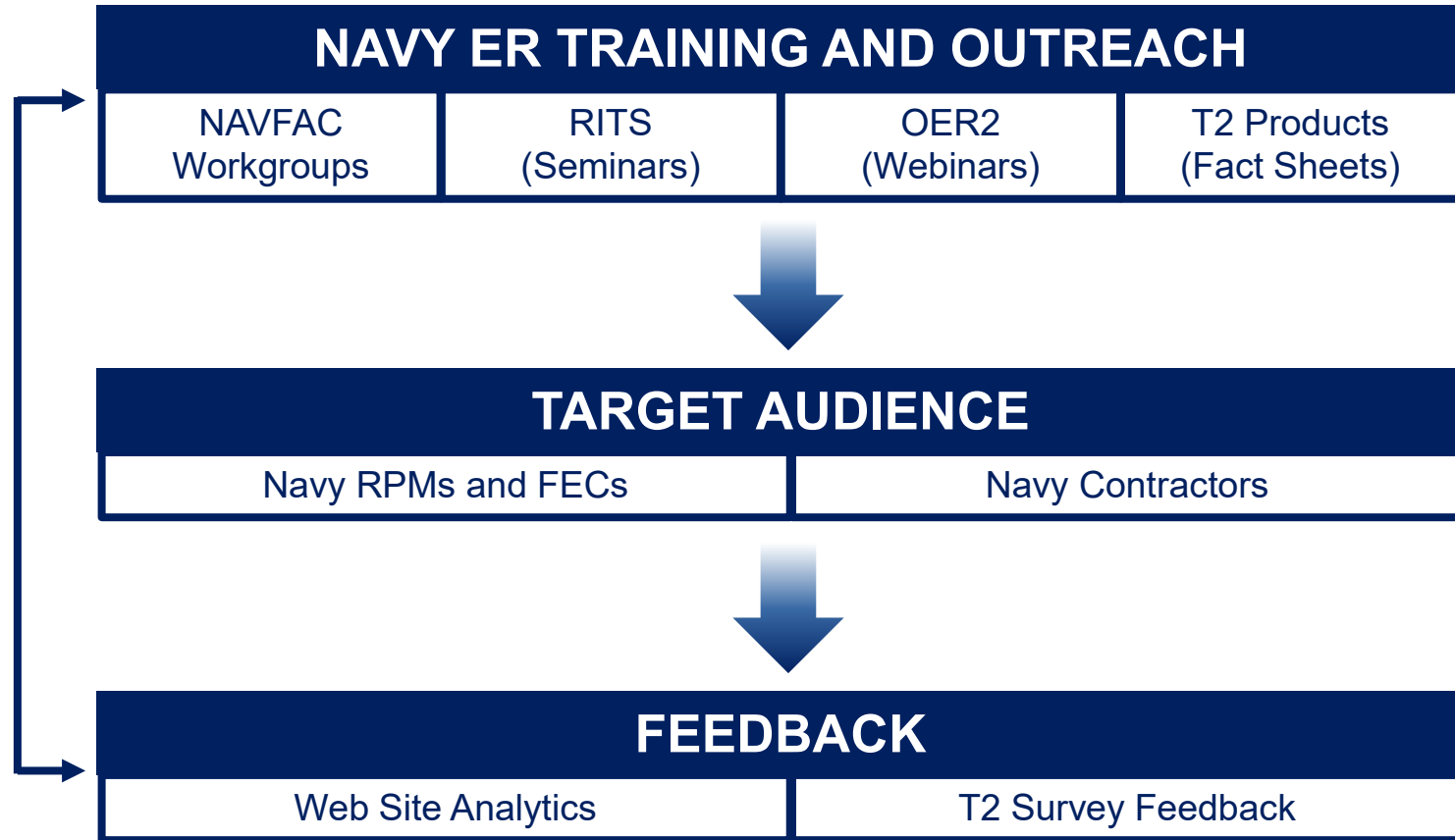
NAVFAC Annual T2 Survey

- Issued online and at RITS
- Purpose of T2 survey
  - Obtain RPM feedback on current and future ER needs
  - What are the latest challenges faced at ER sites?
  - What best practices have been applied?
  - What innovations have been adopted?

Feedback on T2 Formats from Survey

Technology Transfer Formats

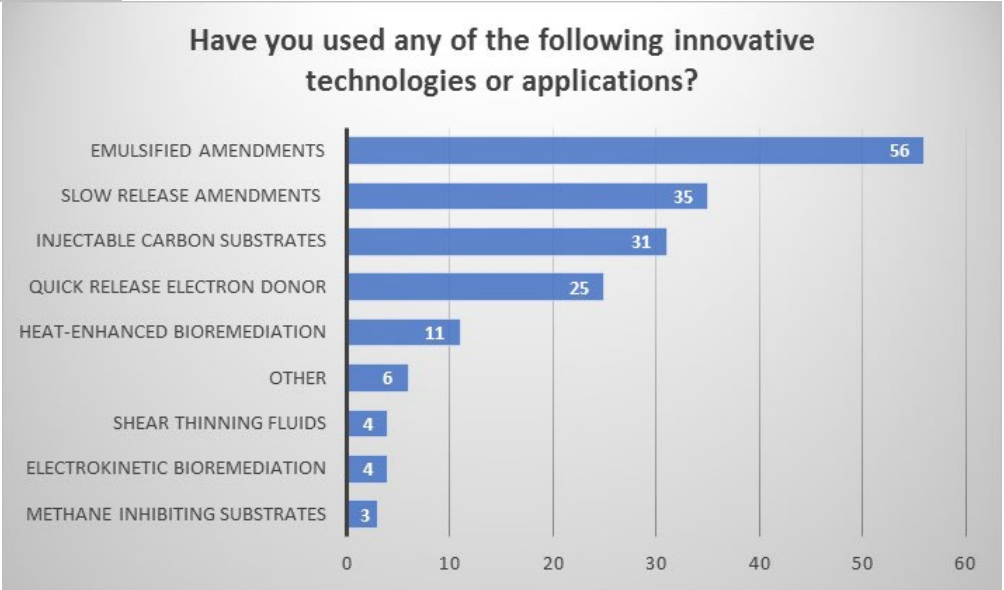| Format	Value
WEBINARS (E.G., OER2)	107
SEMINARS (E.G., RITS)	97
POLICIES AND GUIDANCE	95
FACTSHEETS	86
E-MAIL UPDATES	83
TECHNICAL REPORTS	75
GOVERNMENT WEB SITES	68
CONFERENCES	63
WHITE PAPERS	58
NEWSLETTERS	41
JOURNAL ARTICLES	28
VENDOR WEB SITES	28
NAVFAC BUSINESS MANAGEMENT SYSTEM	14
SOCIAL MEDIA (E.G., LINKEDIN, BLOGS)	13
COST AND PERFORMANCE REPORTS	11
VIDEOS	9
OTHER	4
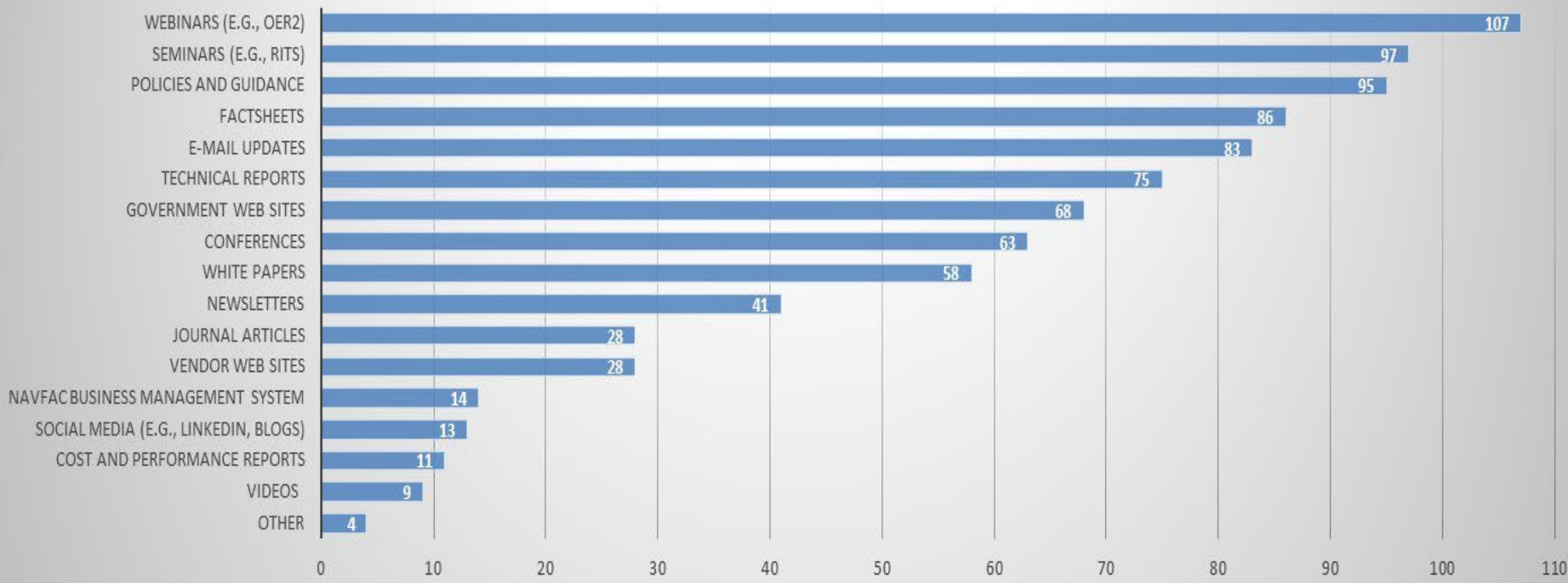
Example T2 Survey Results: Technologies
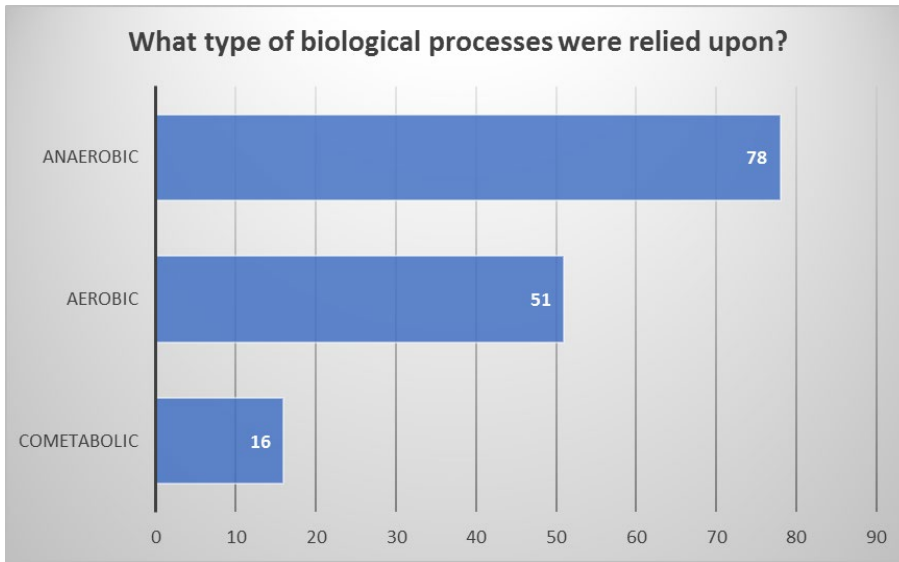
**T2 Survey Results for Bioremediation**

Example T2 Survey Results: Technologies

Use of Innovative Site Characterization & Remedial Technologies

- Site Characterization
    - Agree to Strongly Agree
    - 81% improved CSM
    - 78% reduced cleanup footprint

- Remedial Technologies
    - Agree to Strongly Agree
    - 74% reduced mass
    - 63% reduced remedial timeframe

Key Point: Innovative Technologies Have Improved CSMs and Remediation

The innovative technology improved the conceptual site model (CSM)

- Strongly Agree 70%
- Agree 11%
- Somewhat Agree 13%
- Disagree 3%
- N/A 3%
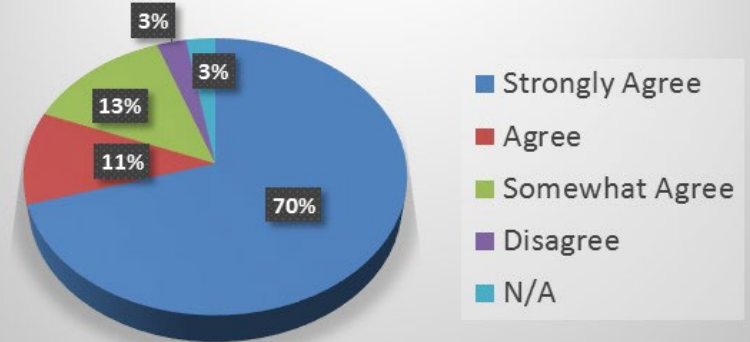
The innovative remedial technology reduced contaminant mass
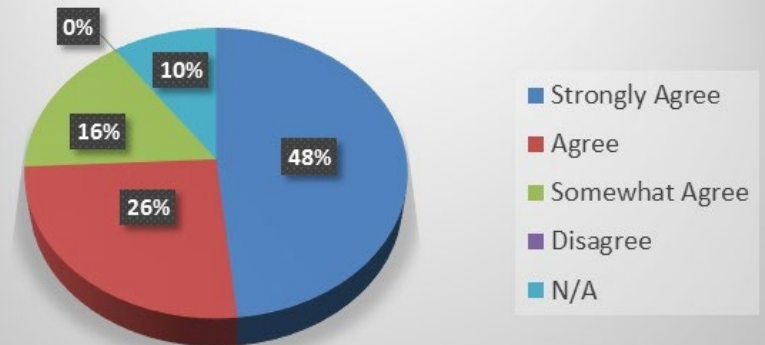
- Strongly Agree 48%
- Agree 26%
- Somewhat Agree 16%
- Disagree 0%
- N/A 10%

Part 3: Technology Transfer (T2) Process

1 NAVFAC T2 Program Overview

2 T2 Program Process

3 T2 Methods

4 T2 Feedback

5 **Conclusions**

Conclusions

- Visit the NAVFAC ERB Web Site at:
  www.exwc.navfac.navy.mil/go/erb
- Join the NAVFAC ERB LinkedIn Showcase page