



# Navy Strategy to Innovative Technology Implementation

Richard G. Mach Jr., P.E.



**“Our Goal is to  
Achieve  
Environmentally  
Protective Site Close-  
Outs At Least Cost.”**

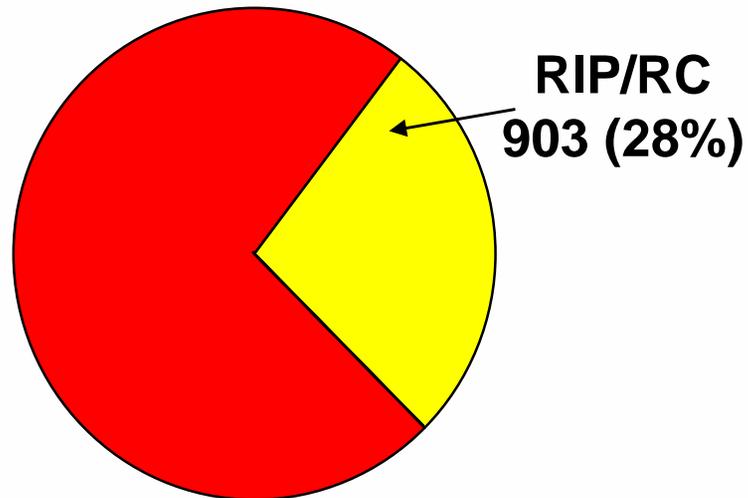
-The Honorable Robert B. Pirie, Jr.  
Former Assistant Secretary of the  
Navy Installation and Environment

December 3, 1996

# Environmental Restoration Site Status

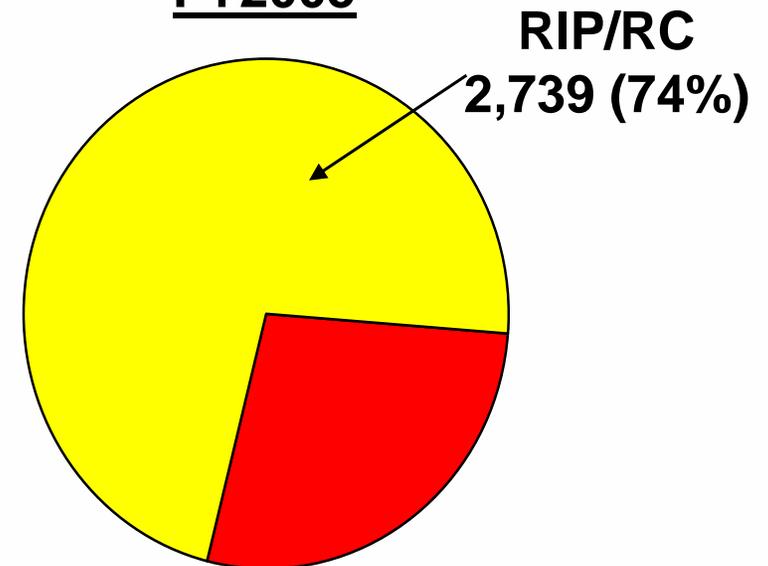


**Baseline**  
**Start of FY1996**



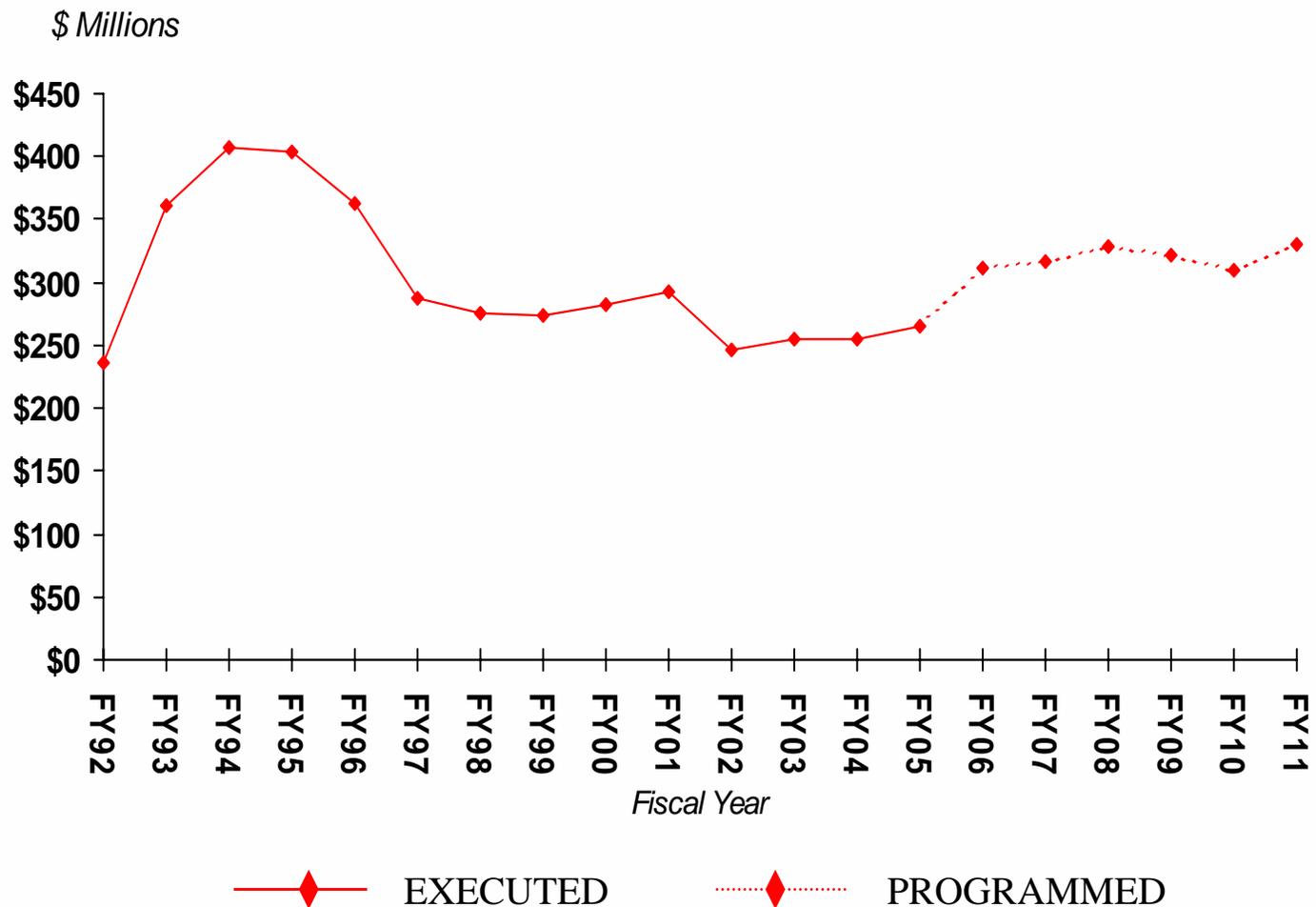
**3,256 Sites**

**Mid-Year**  
**FY2005**

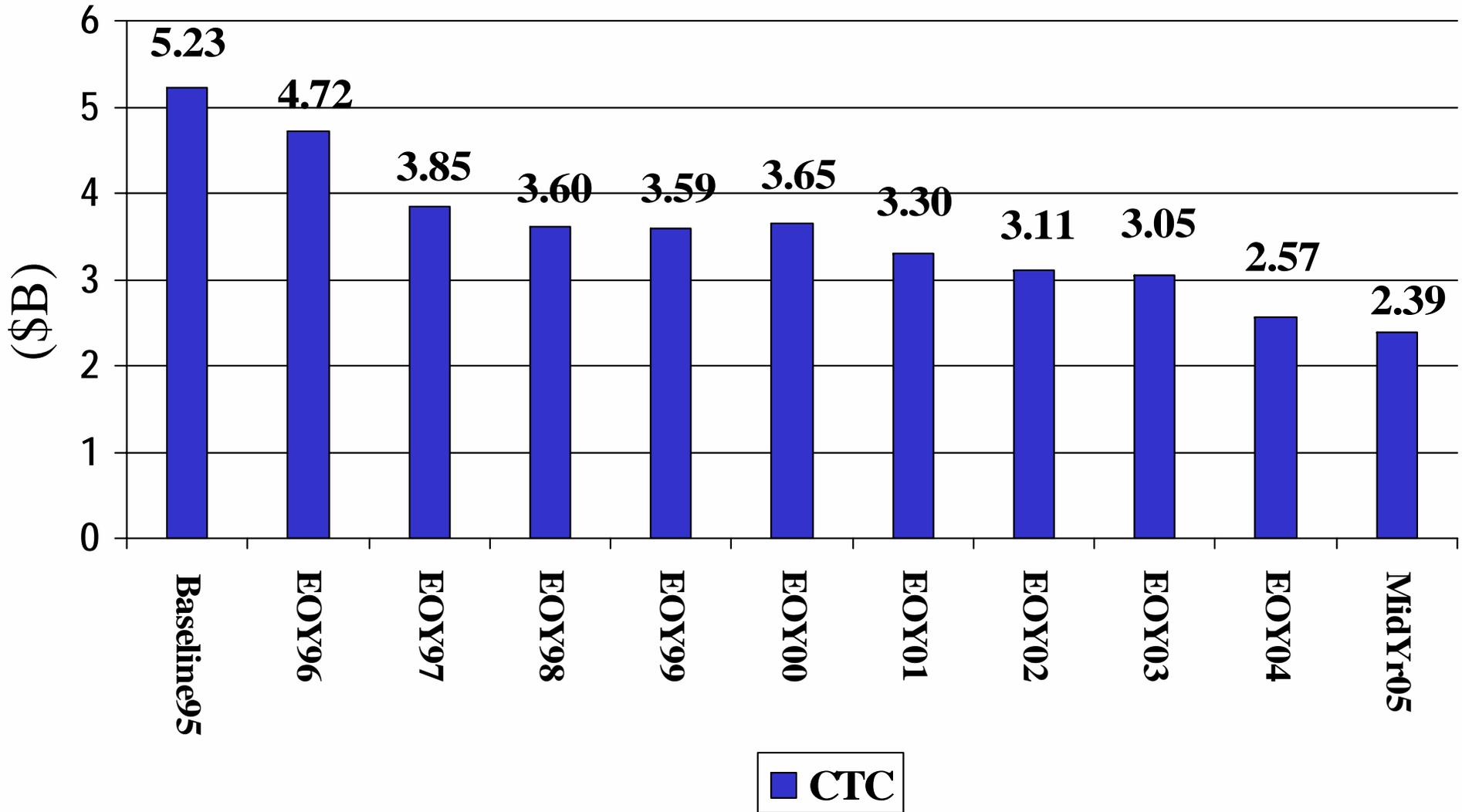


**3,713 Sites (FALL 04 3,699 sites)**

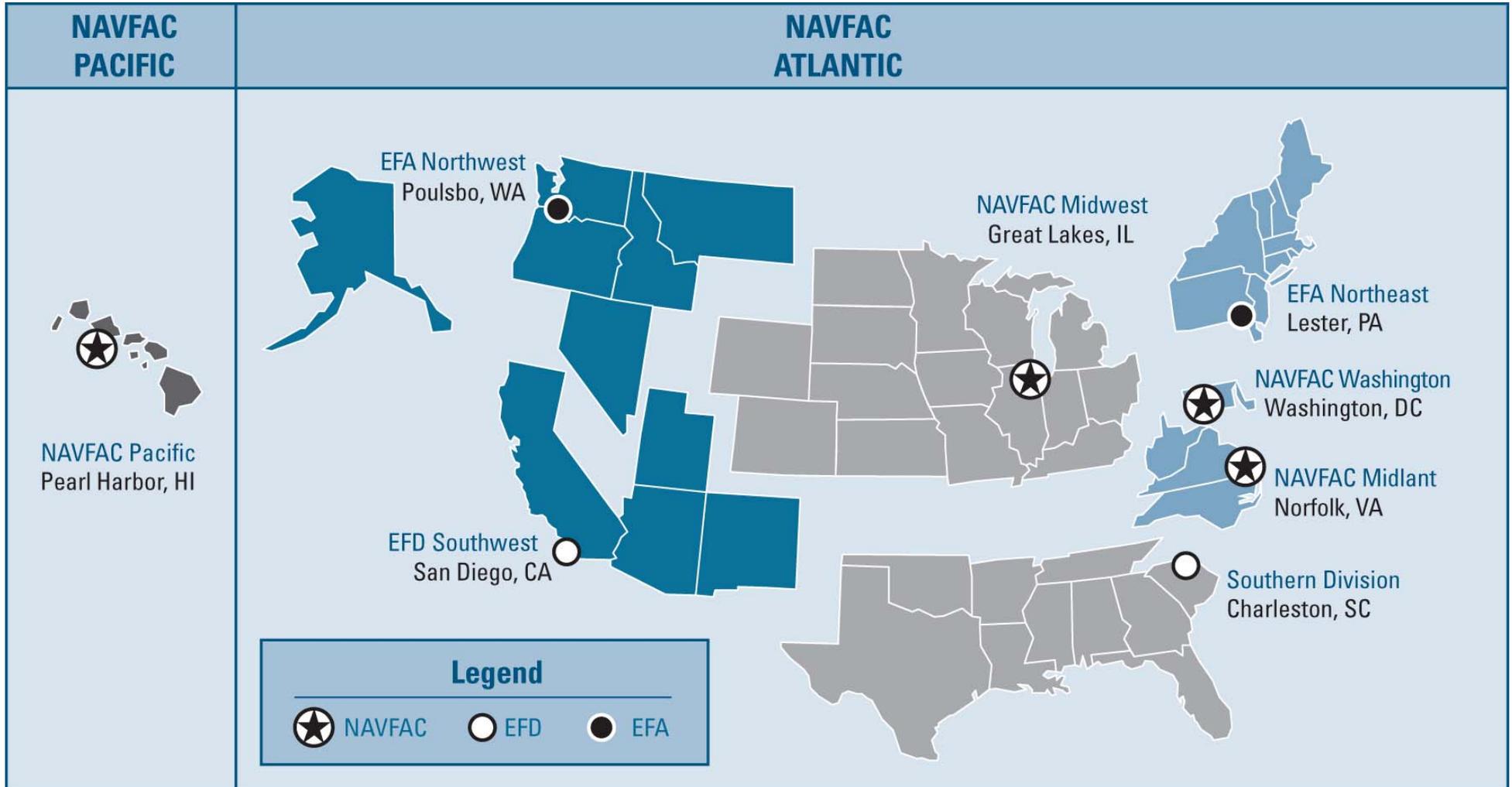
# Mid-Year FY05 ER,N Program Funding Profile



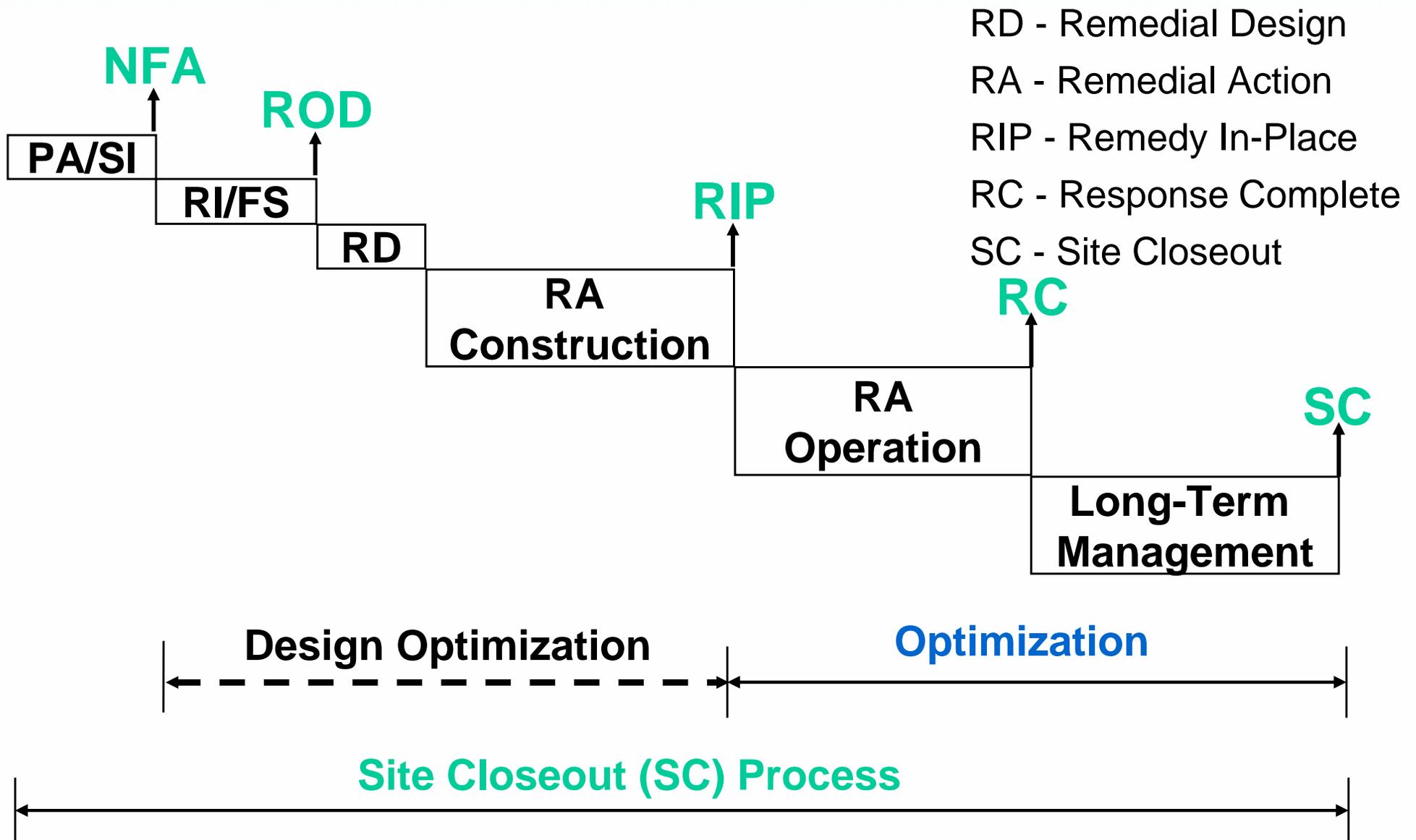
# ER,N IRP COST TO COMPLETE (Mid-Year FY 05)



# AORs for NAVFAC FECs and EFD/As



# Environmental Restoration Process Phases



# DON Optimization Policy



- **April 2004**
- **Required by NAVFAC for all remediation response actions**
  - Requirement to use three NAVFAC Optimization Guidance Docs
  - Requires HQ approval for all new P&T systems
- **3<sup>rd</sup> Party Evaluation**
  - In-House Technical Support or Independent Contractor
- **Track progress within NORM**
  - Recommendations from optimization study
  - Implemented Strategies
  - Results
  - Cost Savings – First year results show a \$11.9M return on investment

# Required Navy Guidance Documents



- **Navy Guidance for Optimizing Remedial Action Operation (RAO), April 2001**
- **Navy Guide to Optimal Groundwater Monitoring, January 2000**
- **Navy Guidance for Optimizing Remedy Evaluation, Selection and Design, April 2004**

# Applicability to Cleanup Phases



- **Feasibility Study and/or Engineering Evaluation/Cost Analysis**
  - **Record of Decision and/or Action Memorandum (Remedy Selection)**
  - **Remedial Design**
  - **Remedial and/or Removal Action Construction**
  - **Remedial/Removal Action Operation**
  - **Long Term Management**
- \* **RED** indicates specific phases requiring an optimization review.
- \* **BLUE** indicates other phases addressed in guidance documents.

# New P&T Policy Language



Any plans to install new pump and treat systems on Navy and Marine Corps installations requires approval from Headquarters (HQ) at the Naval Facilities Engineering Command (NAVFAC). This requirement applies to all “pump and treat” systems (remedial and removal actions) where groundwater is removed from the subsurface by pumping or other means, treated above ground in any way, and discharged in any way (i.e. off site disposal, sewer systems, re-injected, etc.). In order to receive the NAVFAC HQ approval, the IR Manager shall forward a summary of the site background, the conceptual site model (CSM), the remedial action objectives, a listing of the technologies screened for the site, a summary of the alternatives analysis, and a statement of why “pump and treat” is the most appropriate technology to be used at the site, including a life cycle cost analysis (net present value and total site cost) and exit strategy. NAVFAC HQ will provide a written approval/dis-approval response to the IR Manager based on review of this submittal.

# New P&T Requirements



- **1998 – DoD P&T evaluation determined cleanup goals rarely being met**
- **DON policy requires ALL appropriate technologies be evaluated in FS**
- **HQ approval required to validate that P&T would be the most effective technology before remedy selection**
- **DON policy does not prohibit P&T**
- **DON fiscally responsible to install cost effective, protective remedies**



Round:  Phase:  Study Review Conducted By:

Save

Cancel

Study End Date:  End Date Description:  Study Cost in Dollars:

Pot Cost Avoid:  Pot Implementation Cost:  Pot CTC Increase:

Act Cost Avoid:  Act Implementation Cost:  Act CTC Increase:

**Study Description Details:**

A 3rd party contractor study was conducted to provide an independent evaluation of the remediation strategy. Draft FS preferred remedy for groundwater was chemical oxidation for source area and MNA for polishing. Soil remedy was excavation and disposal. NORM CTC was \$5.5 million based on P&T (\$5 million) and soil excavation and disposal (\$0.5 million). See attached report for additional information about the study.

**Recommendations of Study:**

Study recommended changing draft FS remedy from chemical oxidation to in situ bioaugmentation & biostimulation, followed by MNA for polishing – estimated cost \$2 million. Study agreed with soil remedy - excavation and disposal at \$0.5 million. CTC reduced from \$5.5 million (2005 estimate) to \$2.5 million, including soil and groundwater remediation.

**Actions Taken on Recommendations:**

Proceeded to ROD with biostimulation and bioaugmentation followed by MNA for groundwater, and soil excavation and disposal. Proceeded to design. Cost avoidance is entirely from changing the remedy.

**Points of Contact:**

Name	Phone	Email
RPM		
XYZ Corp POC		

Add New

Edit

Delete

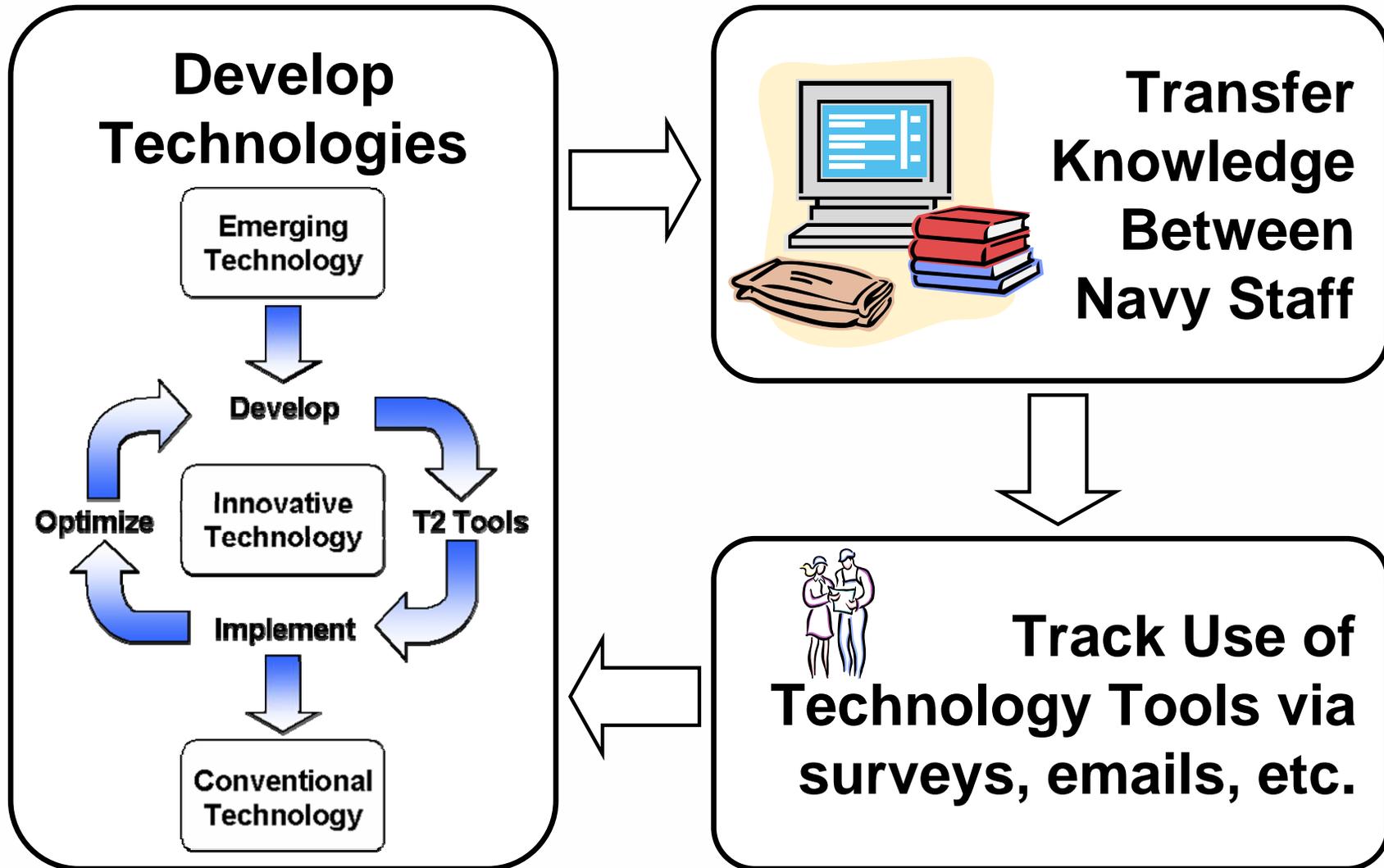
# Optimization Investments and Results



<b>Funding Source</b>	<b>Optimization Study Funding Spent to Date</b>	<b>Potential Cost Avoidance from Optimization Recommendations</b>	<b>Cost to Implement Optimization Recommendations</b>	<b>Cost Avoidance to Date</b>	<b>Total Savings Due To Optimization Efforts to Date</b>
ER,N	\$11.8M	\$128.0M	\$28.3M	\$63.1M	\$ 23.0M
BRAC	\$ 4.7M	\$ 64.2M	\$ 6.7M	\$ 0.3M	\$-11.1M
TOTAL	\$16.5M	\$192.2M	\$35.0M	\$63.4M	\$ 11.9M

Includes a total of 308 sites, 214 ER,N and 94 BRAC.

# Technology Transfer (T2) Overview



# NAVFAC T2 Program Approach



- Detailed in the NAVFAC T2 Five Year Plan
- 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 at other FECs
- Approach
  - Program seeks two-way information exchange
  - Technical content driven by RPM needs
  - Coordinate T2 needs with NAVFAC Workgroups, especially ARTT
  - Use Web-based tools for easy access and updates
  - Periodic reporting of milestones and T2 feedback

# Technology Transfer Mechanisms



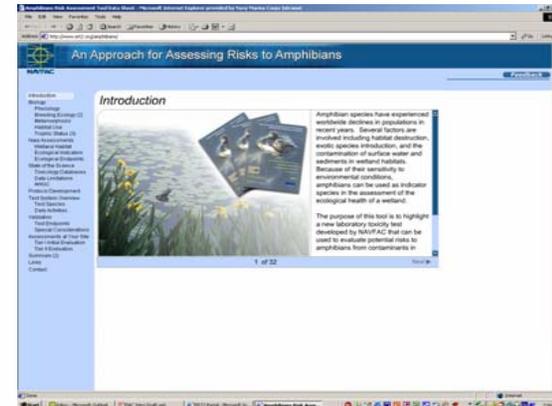
- **NAVFAC Environmental Restoration & BRAC Website:**  
*<http://enviro.nfesc.navy.mil/erb>*
- **Web-Based Training Tools**
- **T2 Email Updates**
- **RPM Newsletter Articles**
- **Brochures**
- **Guidance Documents**
- **Cost and Performance Reports**
- **Training Courses**
  - **RITS - Twice per year at each FEC location since 1996**
  - **CECOS and other Workshops**
- **Navy and Marine Corps Cleanup Conference**

# Technology Transfer Tools



## ■ New Generation T2 Tools

- ◆ Web-based
- ◆ Multimedia (video, audio, animations, Web links)
- ◆ Interactive with user
- ◆ Template and database driven
  - Easily updated
  - Accommodates retrofit for past T2 tool content (like TDS)
- ◆ E-mail updates



# Technology Transfer Tools ([www.ert2.org](http://www.ert2.org))



- Amphibians Risk Assessment
  - Benthic Flux Sampling Device
  - Biodegradation of DNAPL Through Bioaugmentation
  - Environmental Background Analysis
  - In Situ Chemical Oxidation
  - DCE Stall
  - DNAPL Detection and Characterization
  - MTBE
  - Nanoscale Zero Valent Iron
  - Passive Diffusion Sampler
  - Perchlorate
  - Polychlorinated Biphenyls (PCBs)
  - Permeable Reactive Barrier (PRB)
  - Degradation of Ordnance Constituents in Marine Sediments
  - Encapco Stabilization
  - In Situ Reactive Zone (IRZ)
  - ONR Sediment Investigation
  - Pulsed Elemental Analysis with Neutrons
  - Charleston Web Portal
- Coming Soon!**
- Groundwater Sampling
  - Chemical Fingerprinting
  - Direct Push
  - Electrical Resistive Heating
  - Optimization

# Annual T2 Survey



Annual T2 Survey tracks RPM satisfaction and suggestions to focus T2 Program on current and impending needs

The screenshot shows a web browser window titled "T2 Survey Form - Microsoft Internet Explorer provided by Battelle". The address bar shows "http://www.ert2.org/T2Survey/". The page content includes the NAVFAC logo and the title "TECHNOLOGY TRANSFER PROGRAM ANNUAL SURVEY 2004".

**1 Please identify your professional affiliation.**

NAVFAC     Contractor     Other DoD     Regulator     Other

If Other, Please Specify:

**2 What resources do you use to obtain the latest information on cleanup technologies? (SELECT TOP THREE CHOICES)**

1st Choice:

2nd Choice:

3rd Choice:

If one of the choices is "Other" [Please Specify]:

**3 Have you viewed any of the following technology transfer products in the past year? (SELECT ALL THAT APPLY)**

NAVFAC Environmental Restoration BRAC Web Site	<input type="checkbox"/>
NAVFAC Guidance Documents	<input type="checkbox"/>
NAVFAC Technology Transfer (T2) Email Updates	<input type="checkbox"/>
NAVFAC Web Training Tools	<input type="checkbox"/>

The browser status bar at the bottom shows "Done" and "Internet".

# NAVFAC Workgroups



- **Alternative Restoration Technology Team (ARTT)**
- **Cost To Complete (CTC) Workgroup**
- **Munitions Response Workgroup**
- **Risk Assessment Workgroup (RAW)**
- **Optimization Workgroup**
- **Geographic Information System (GIS)/Data Management Workgroup**

# Cost & Performance Reports



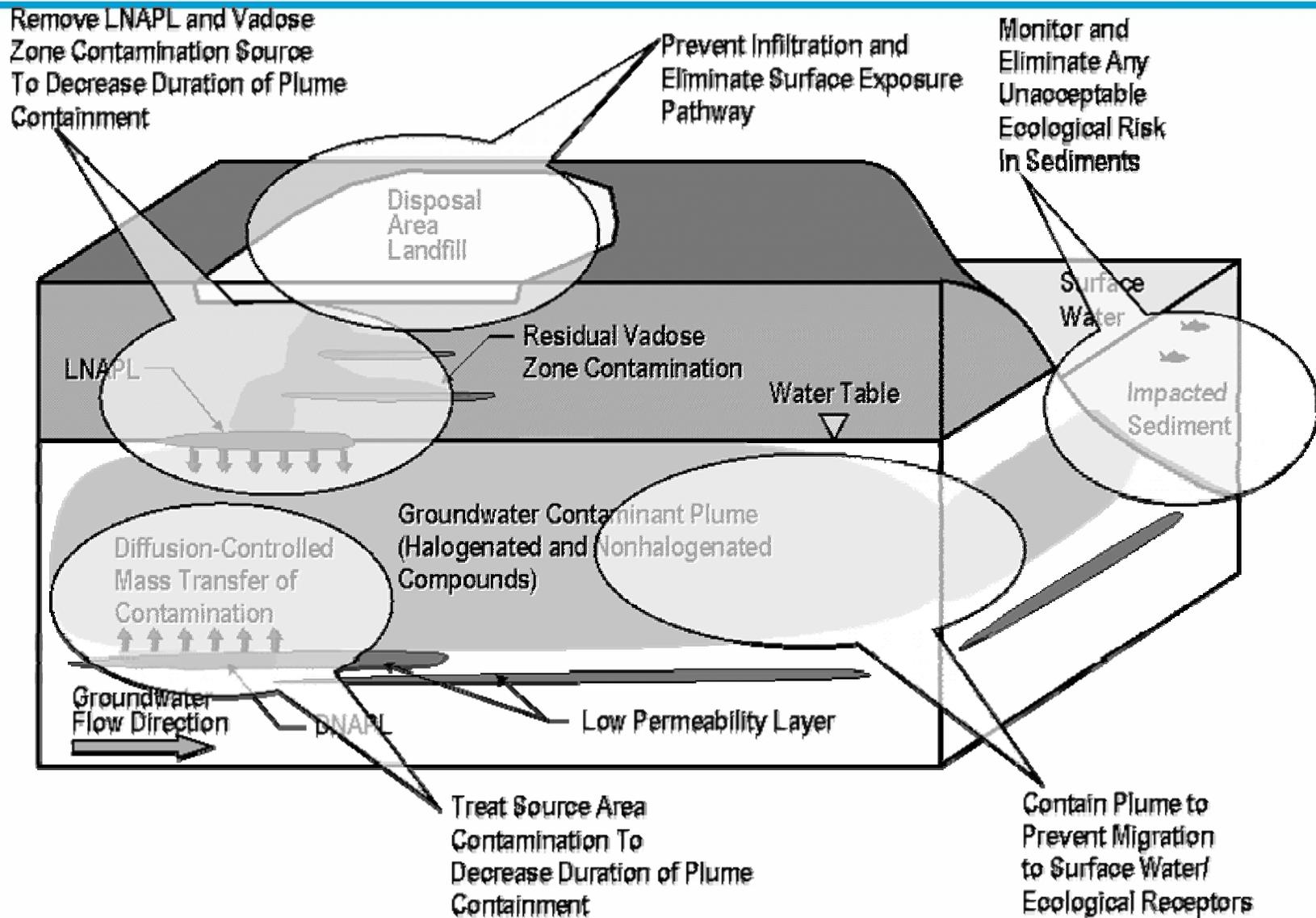
- **ARTT is focusing on ensuring that cost and performance data collected during future technology applications can be used for making meaningful comparisons**
- **Similar technologies applied at different sites**
  - E.g., ZVI applications at 3 Navy Sites (Hunters Point Shipyard, NAS Jacksonville, NAES Lakehurst)
- **Different technologies applied at similar sites**
  - E.g., 3 technologies (persulfate application, vegetable oil sequestration, and ZVI) at NAS North Island
- **Effort to standardize data reported in NAVFAC cost & performance reports in order to make apples to apples comparisons**

# NAVFAC Approach to DNAPL Sites

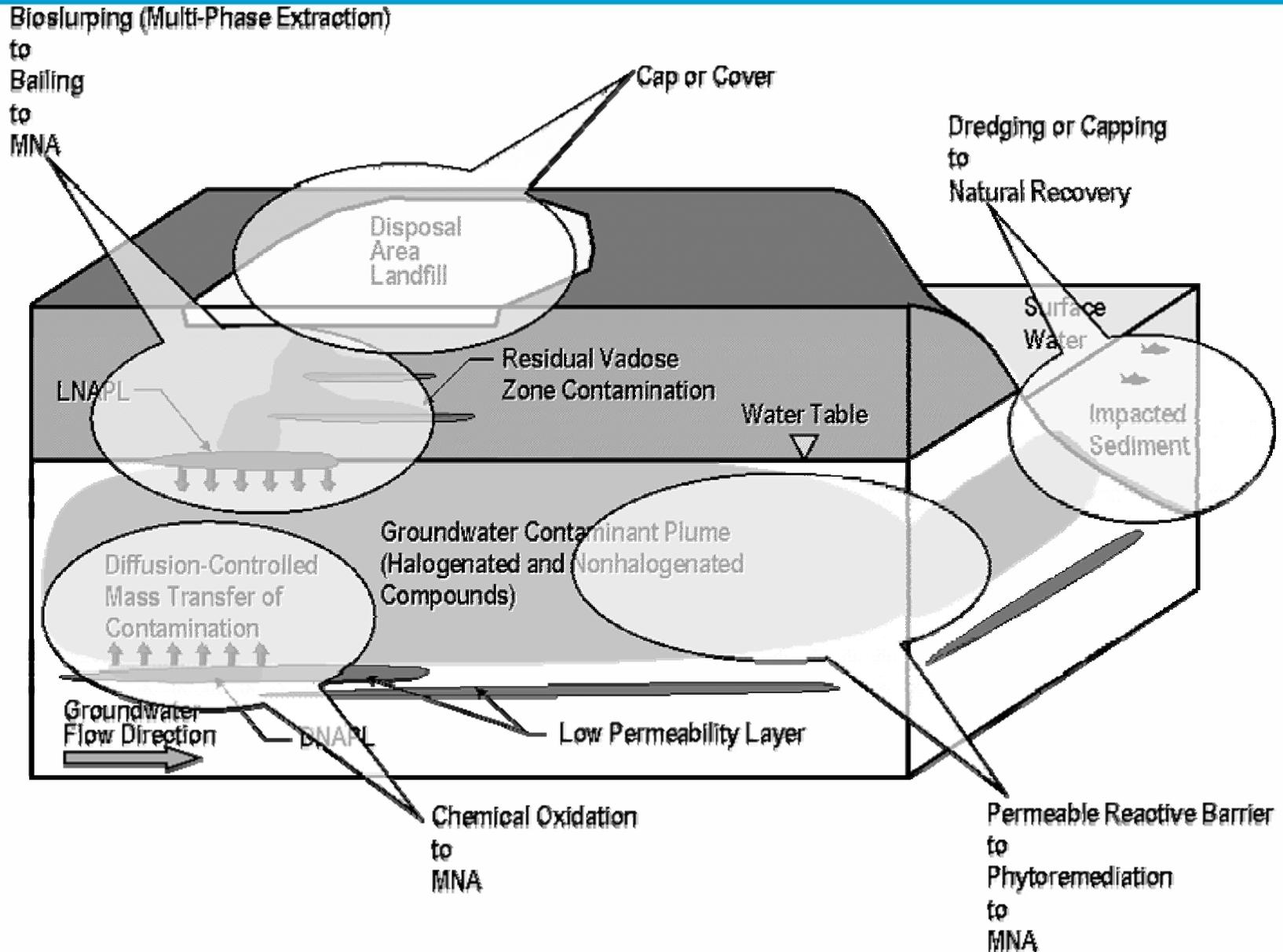


- **Identify Target Treatment Zones and Remedial Action Objectives for each zone**
- **Use “Treatment Trains” to address each zone**
  - Multiple remedial technologies over time
  - Multiple remedial technologies over various locations for the same contaminant and/or media.
  - Several different unit processes within a single remediation system.
- **Set Performance Objectives for each technology considering limitations**
- **Establish an Exit Strategy and Continue to Optimize**
  - Plan to stop, modify, or change a particular technology based on the achievement of performance objectives

# Target Treatment Zones and Remedial Action Objectives



# Treatment Trains



# Performance Objectives Per Technology



**Performance Objectives:**

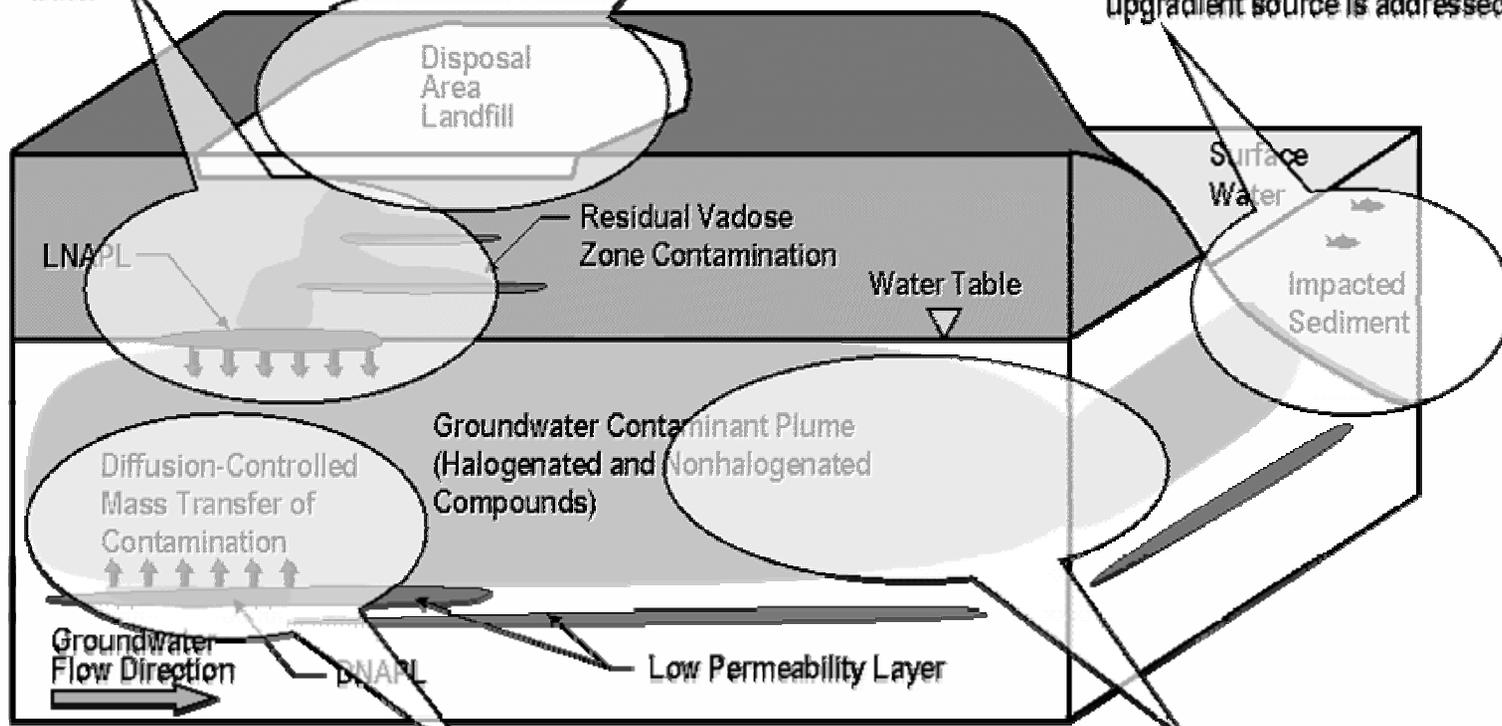
1. Remove LNAPL to the extent practicable
2. Operate while cost effective by considering other components of treatment train and ability of MNA to reduce contaminant levels that are above risk-based levels at surface water

**Performance Objectives:**

1. Minimize infiltration of contaminants
2. Eliminate Surface Exposure

**Performance Objectives:**

1. Monitor for natural recovery. If natural recovery is ineffective, remove or cap sediments exceeding risk based criteria after upgradient source is addressed.



**Performance Objectives:**

1. Mass reduction in source area
2. Operate while cost effective

**Performance Objectives:**

1. Monitor and prevent migration of contaminants to surface water that are above risk-based levels

# What is Meant by a “Right” Technology?



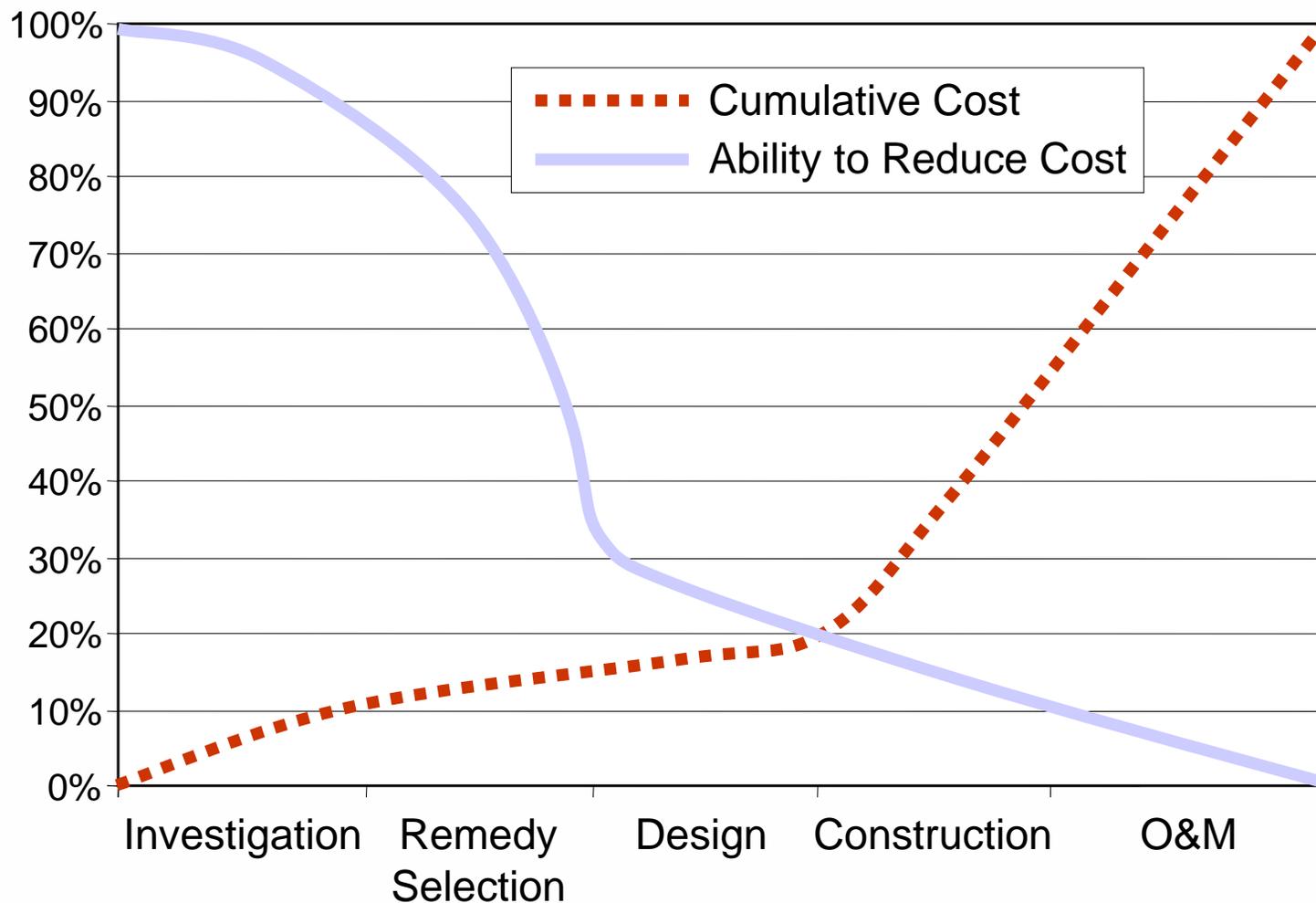
- **A right technology either reduces life-cycle cost or reduces risk of the overall remedy compared to not using this technology**
- **Project cost increases when eliminating a right technology**
- **In most cases, there are multiple right technologies used as**
  - **Treatment trains sequentially over time;**
  - **Treatment trains simultaneously as part of a single treatment process; or**
  - **Used in different target treatment zones**

**RIGHT = MOST APPROPRIATE**

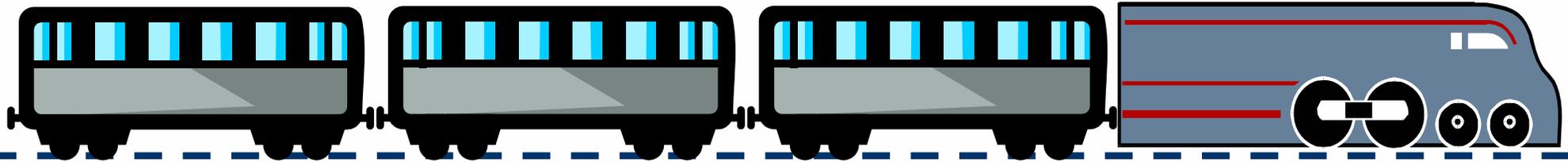
# Importance of Selecting "Right" Technologies



## Project Cost and Ability to Reduce Cost versus Project Phase



# Use Treatment Train Concept to Expand Applicable Technologies

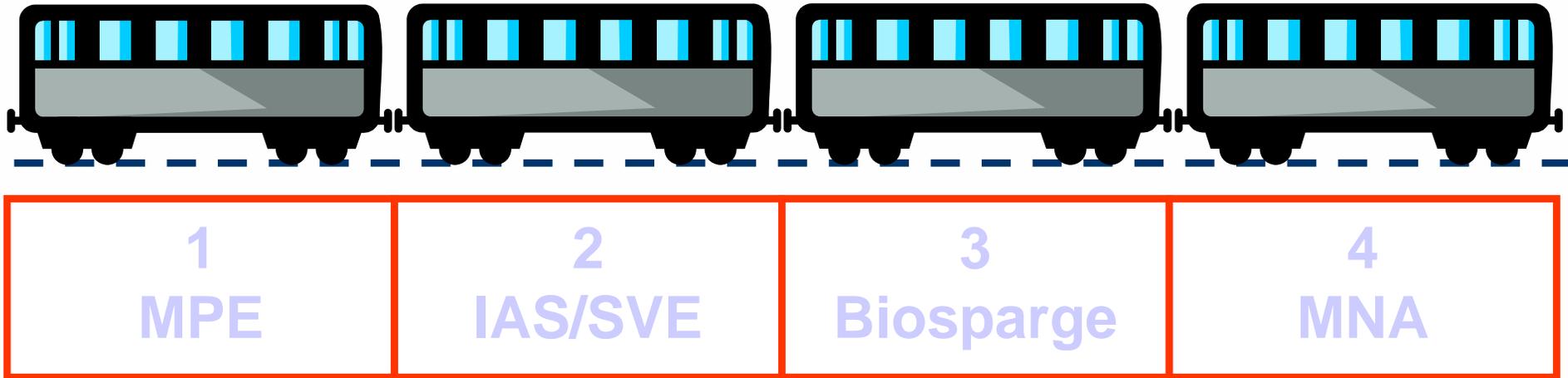


- **Sequential operations over time:** Allows a technology to be used for a particular phase that would otherwise not be appropriate or cost effective for cleanup start to finish
- **Multiple unit processes in a single treatment system:** Allows a technology to be used for a particular COC that would otherwise not be appropriate or cost-effective for all contaminants
- **A single technology will rarely achieve a protective site closeout at the least cost**

# Treatment Train Example



## In Situ Technologies Operating Sequentially



- Initially: Could Eliminate in situ air sparging (IAS) and biosparge because of risk of spreading free phase product
- Affects on remedy: Operate multi-phase extraction (MPE) during non-cost effective conditions or use other less cost-effective technology

- **Navy wants to implement “Right” Technologies**
- **Nano technologies offer opportunities to be the “Right” Technology for some sites**
- **Need more performance data to optimize use of Nano**
- **Need to address potential concerns that would prematurely eliminate Nano technologies from consideration**

**THAT IS WHY WE ARE HERE!!!**

# Questions?

