Optimization of Remedial Actions at Navy Installation Restoration Sites

Karla Harre
NFESC

Tanwir Chaudhry
NFESC / Intergraph

Navy Environmental Restoration (ER)

- Mission – Protect human health and the environment while supporting the defense mission by ensuring continued use of lands necessary for military operation at active Navy sites
- Includes Installation Restoration (IR) and Munitions Response (MR) Programs
- Estimated greater than $4 billion needed to complete remediation at IR sites
- Improving remediation performance and cost effectiveness supports the DON's environmental and defense mission

Optimization – What Does It Mean?

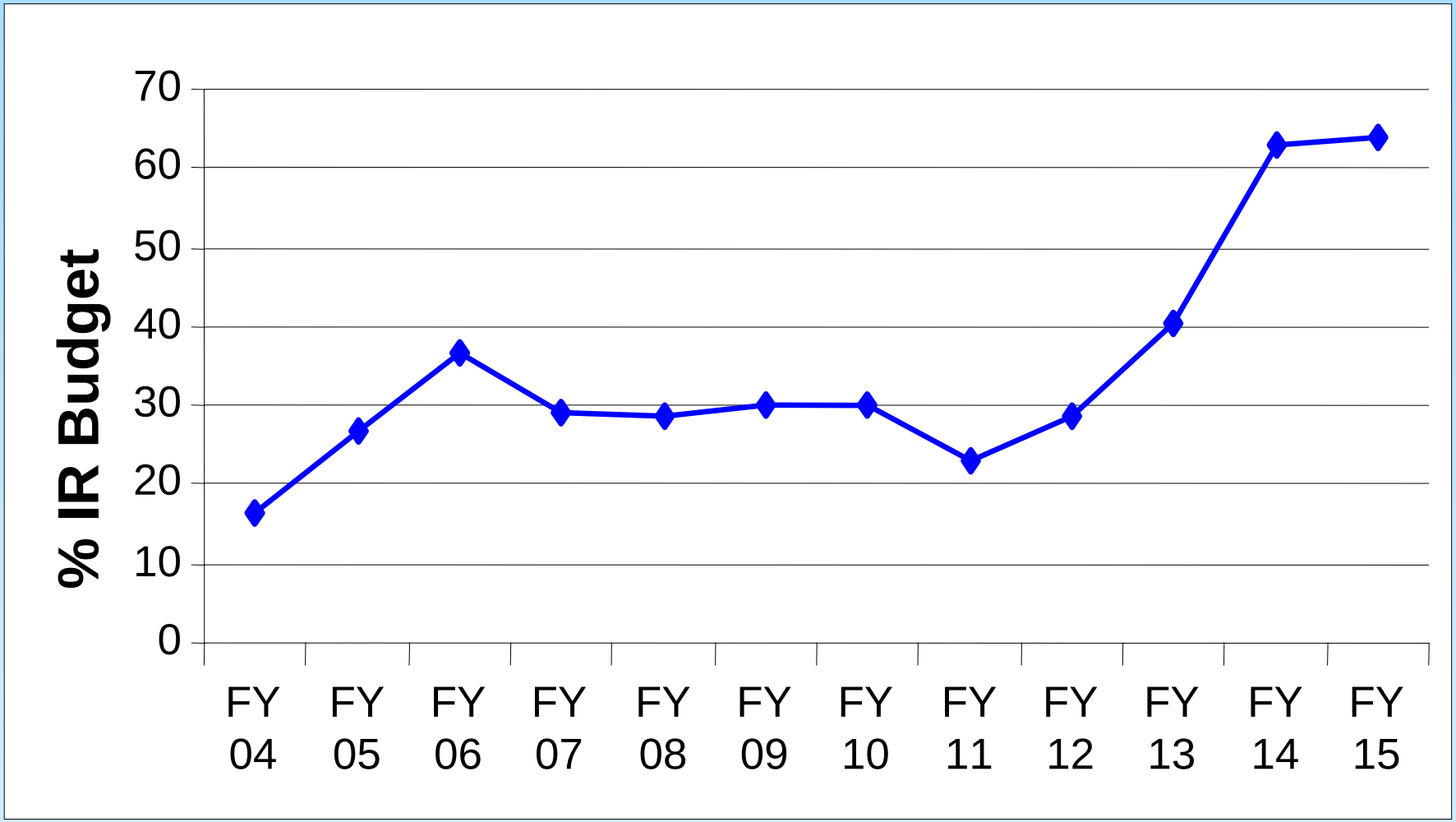
- Reaching response complete (RC) and site closeout (SC)
  - faster and more efficiently,
  - with reduced costs, and
  - better performing remedies
- How?
  - Upfront planning for the life-cycle of remedy
  - Iterative process, continual assessment, re-evaluation
  - Identifying improved or more appropriate remediation strategies
  - Controlling operating and monitoring costs

NAVFAC Goals for Optimizing Remedial Actions

- Develop policy to require optimization
- Develop guidance illustrating optimization approaches
- Track/report the effectiveness of optimization efforts
- Minimize/eliminate use of P&T
- Develop procedures for documenting site closeout
- Provide RPM training on these requirements

RAO/LTMgt as % of DON IR Budget

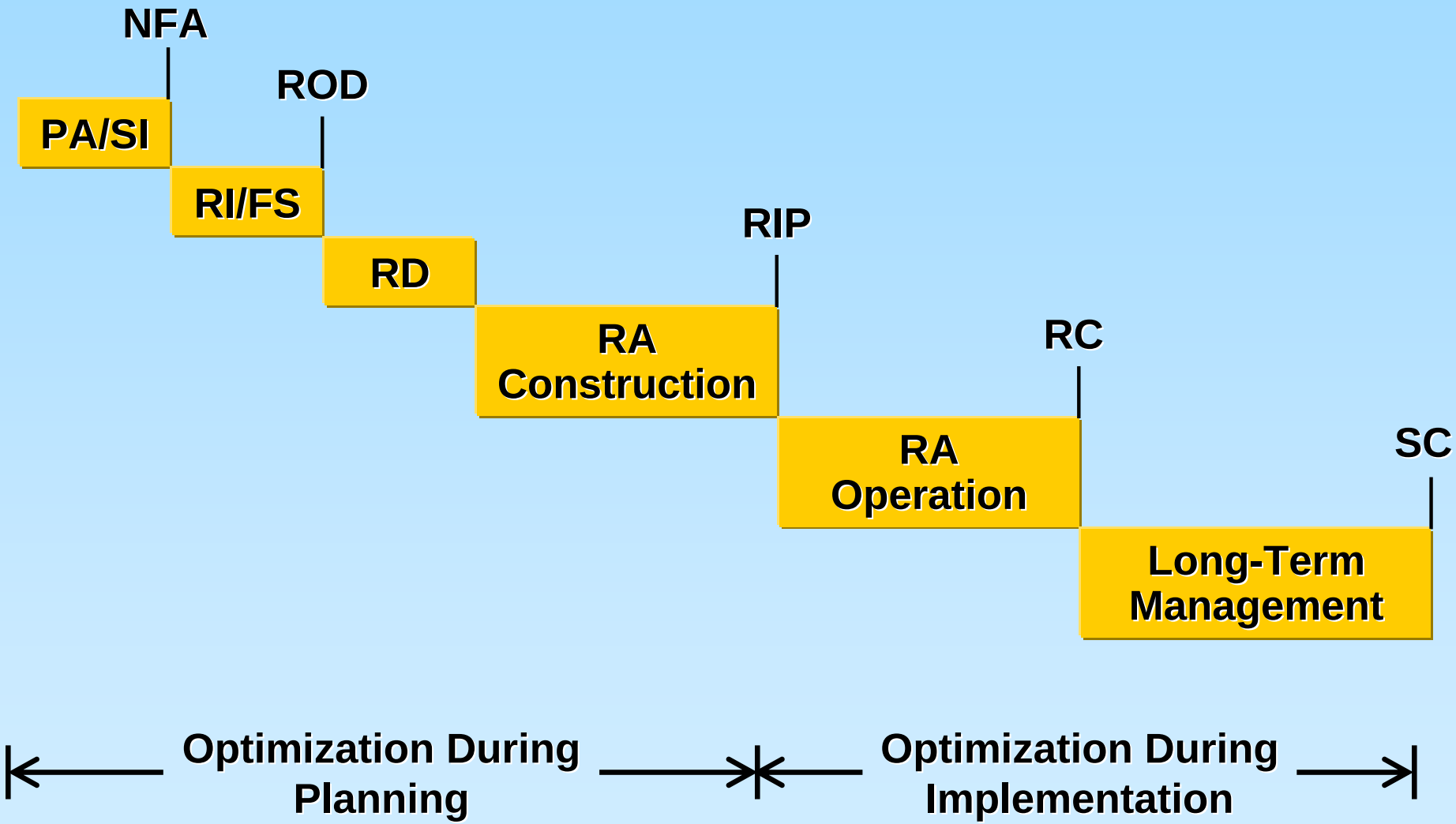
(ER,N + BRAC) (NORM Data September 2003)



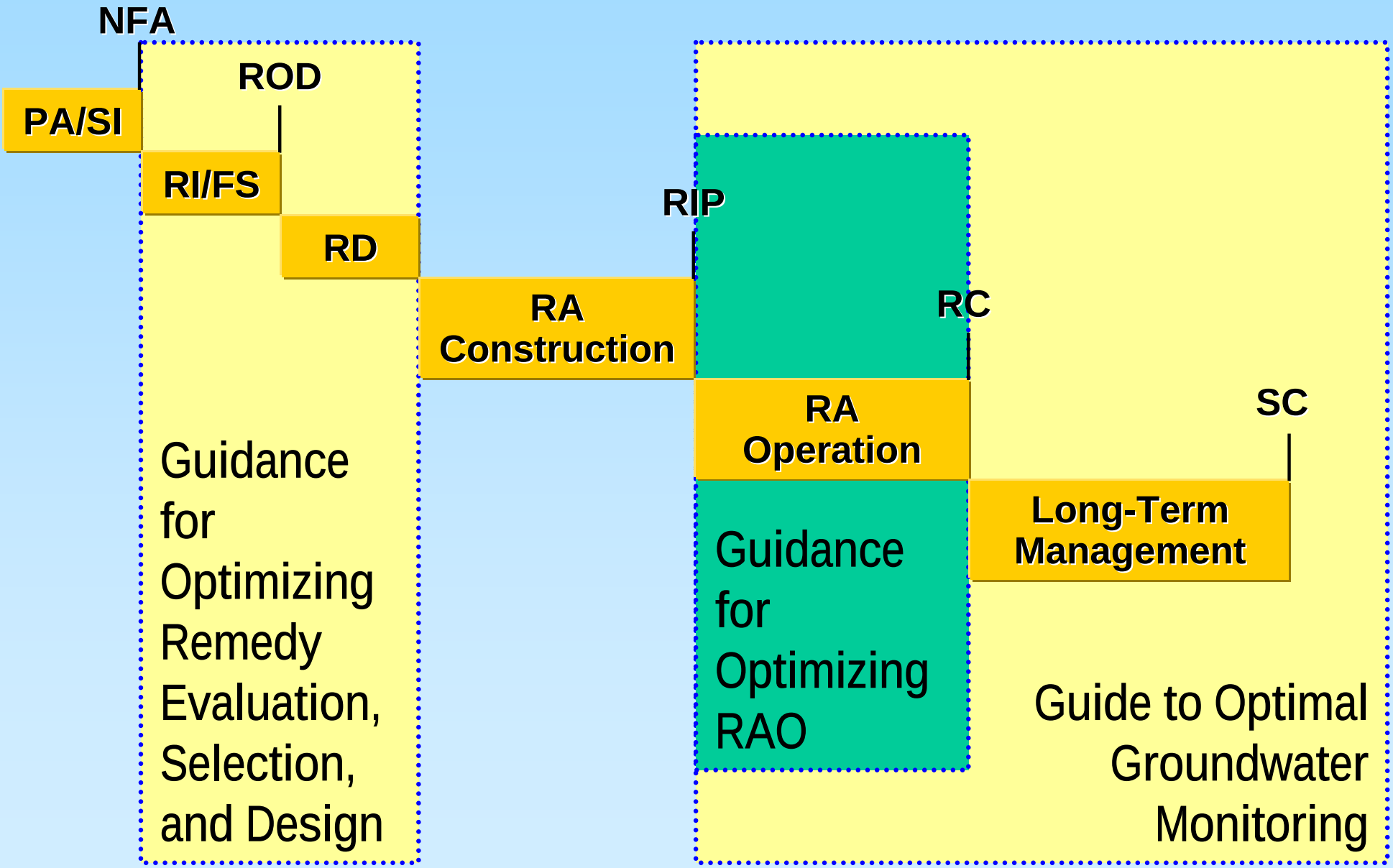
Navy Optimization Approach

- Navy/Marine Corps Optimization Policy, April 2004
  - Outlines efforts to be conducted to ensure all remedies are continually optimized through evaluation of all available data at each phase of the project.
  - Requires semi-annual tracking of optimization efforts.
- Navy/Marine Corps Remedial Action Operations/Long Term Management (RAO/LTMgt) Optimization Workgroup
- Guidance documents developed by the workgroup include:
  - Guidance for Optimizing Remedy Evaluation, Selection, and Design, 2004
  - Guidance for Optimizing Remedial Action Operations, 2001
  - Guide to Optimal Groundwater Monitoring, 2000

Environmental Restoration Program Phases



Guidance Documents and ER Program Phases



Guidance for Optimizing Remedy Evaluation, Selection and Design

Key Concepts

- Review / update conceptual site model
- Identify remedial action objectives
- Identify target treatment zones - Treatment Train
- Develop remedial alternatives and lifecycle cost
- Develop performance objectives

Conceptual Site Model (CSM)

- An effective Conceptual Site Model provides:
  - Contaminant source and release information
  - Contaminant distribution, transport, and fate
  - Geologic and hydrogeologic data
  - Risk assessment information
- Basis for establishing Remedial Action Objectives
- Allows definition of the target treatment zone(s)
  - Impacts life cycle cost of remediation and cleanup time
  - Identifies hot spots and source zones

Conceptual Site Model (CSM), cont.

- CSM should be continually updated as new information becomes available
  - Prior to and during remedy selection and design (i.e., during RI and field treatability studies)
  - During remedy implementation and long-term management (i.e., as performance data is collected)
- Remedial Action Objective should be revisited during remedy selection and design
  - Regulations and project requirements change
  - Use flexible goals instead of fixed quantitative (i.e., “remove LNAPL to the extent practicable”)

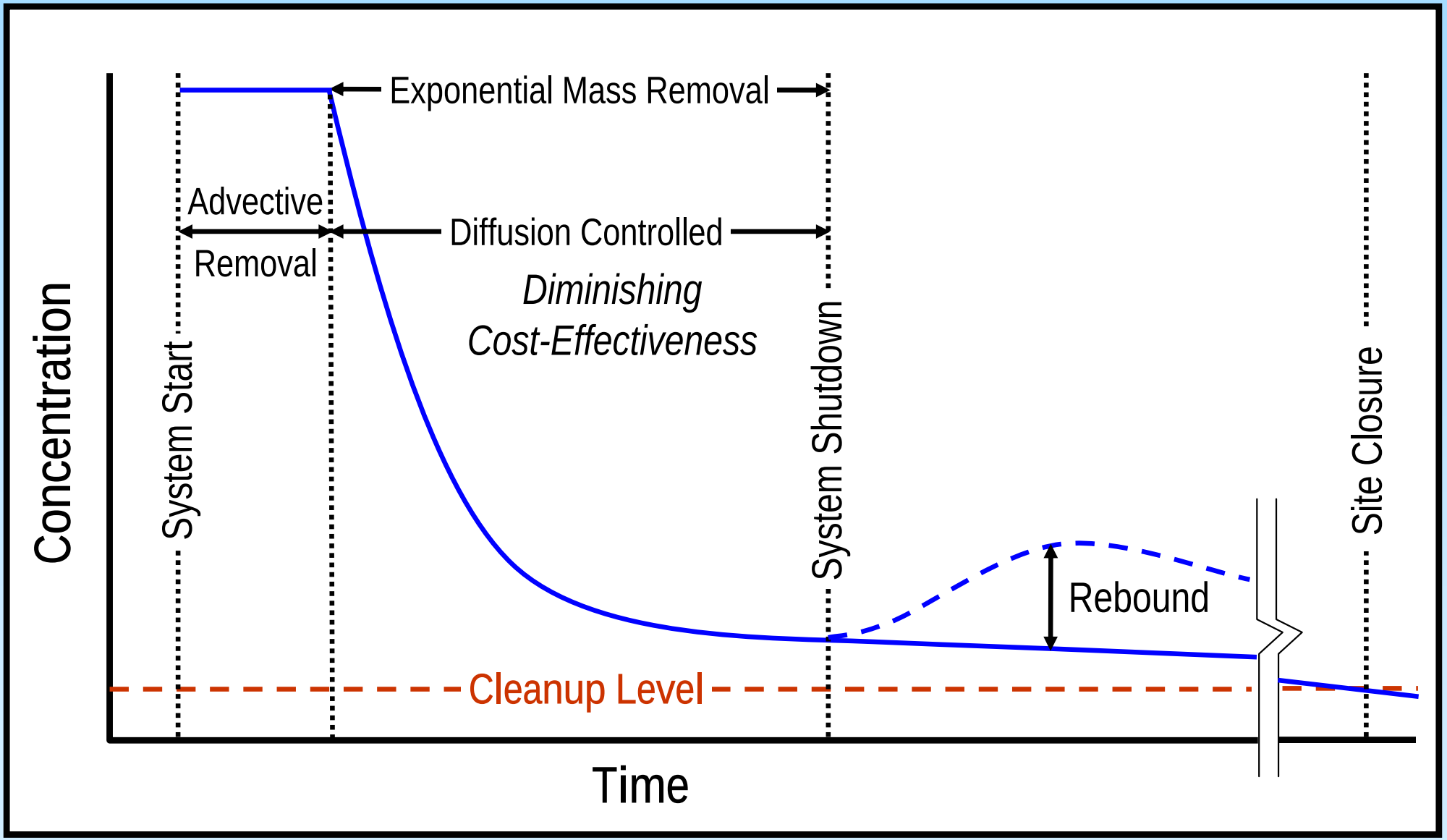
Multiple Remedial Technologies

- "Treatment Train" Approach
  - Concurrent or sequential use of multiple remedial technologies targeting various sections of a plume
  - Use of several different unit processes within a single treatment system (i.e., ex-situ remediation processes)
- Establish Performance Objectives for each Component of the Treatment Train
  - Defines expected effective operational range of technology
  - Identifies when to discontinue use of a specific technology once it's no longer operating within its pre-determined cost effective range

Multiple Remedial Technologies

- Cost-effective remediation will likely require transitioning between multiple treatment technologies
  - Media (e.g., bioslurping to bailing to groundwater treatment)
  - Aboveground treatment (e.g., catalytic oxidation to activated carbon to direct discharge)
- ROD flexibility
  - Remedy description should allow for flexibility in technology transition and unit process selection
  - Document performance objectives and overall exit strategy
  - Include a flow chart with decision criteria for stopping further system operation or transitioning technologies

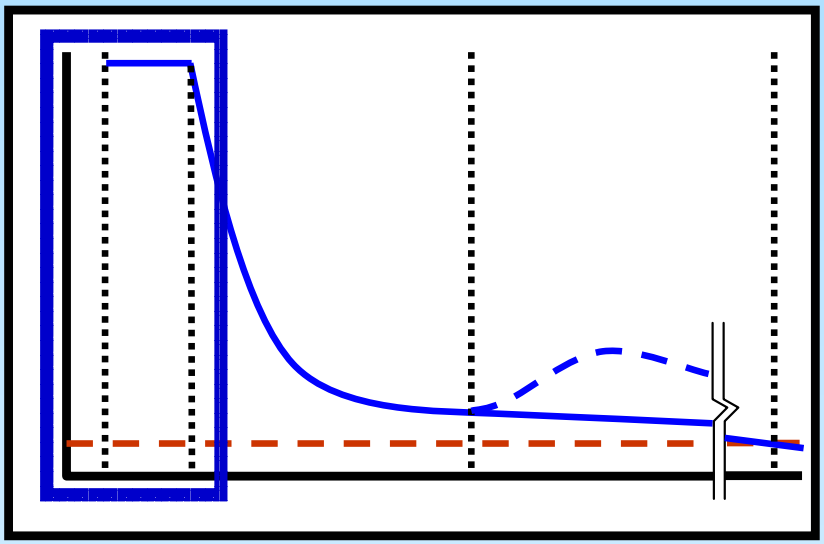
Typical Remediation Performance Curve



Remedial Design Considerations

Design for the entire life of the cleanup, not just the initial conditions

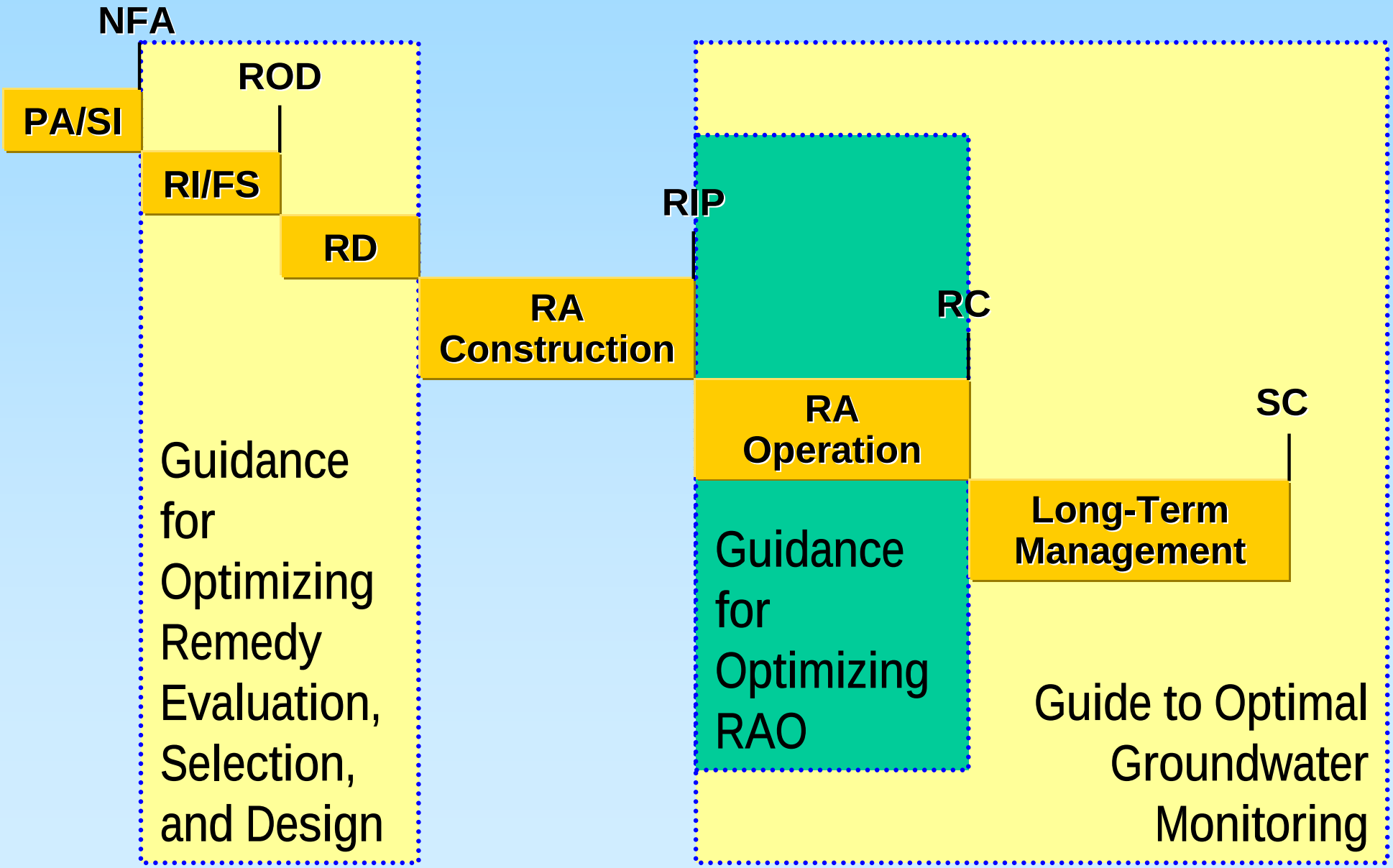
- Lease/Purchase Equipment
- Design Mobile Systems
- Use of Passive Delivery Systems
- Use Standard Designs and Parts
- Use Inexpensive Materials
- Plan for Intermittent Operation
- Evaluate Process Control Options
- Extend Maximum Operation Efficiency



Considerations for FS, ROD, and RD - From Guidance

- Feasibility Study
  - Conceptual site model; remedial action objectives; detailed analysis of alternatives; life cycle
- ROD
  - Flexible, smart , or performance based ROD
  - Allow adjustments and modifications; flexibility in technology transition
- Remedial Design
  - Life cycle design; treatment train
  - General Strategies: equipment lease, mobile systems, intermittent operation, process control options, O&M plans

Guidance Documents and ER Program Phases



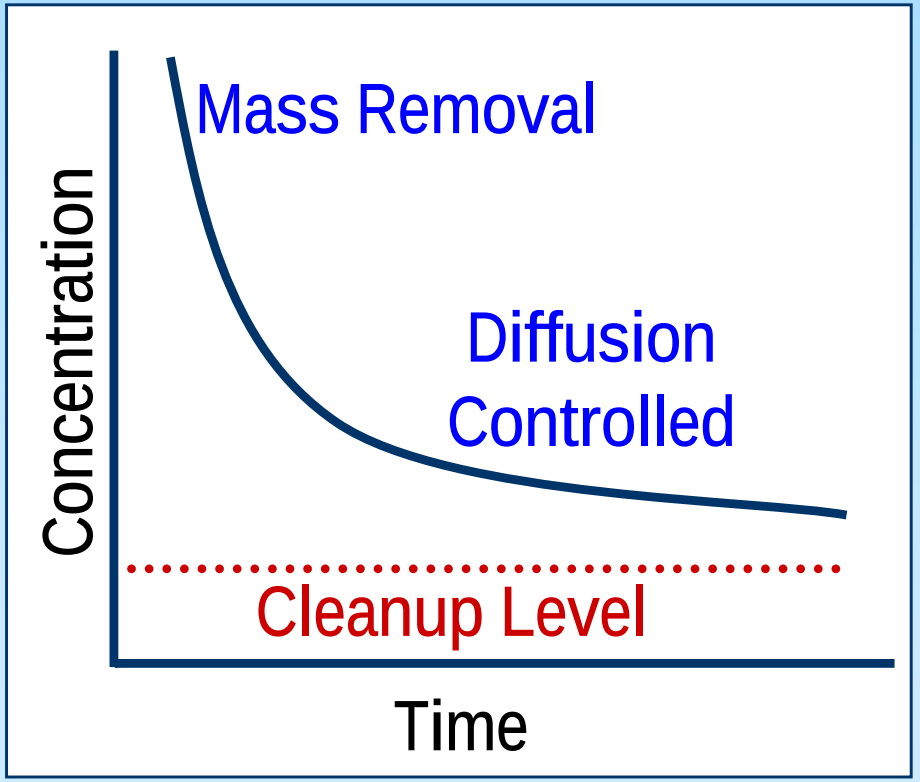
Remedial Action Operation (RAO) Phase

- Perform operation, maintenance, and monitoring
- Conduct routine sampling and analysis
- Prepare monitoring reports
- Evaluate performance against cleanup standards / goals
- Conduct evaluation / optimization

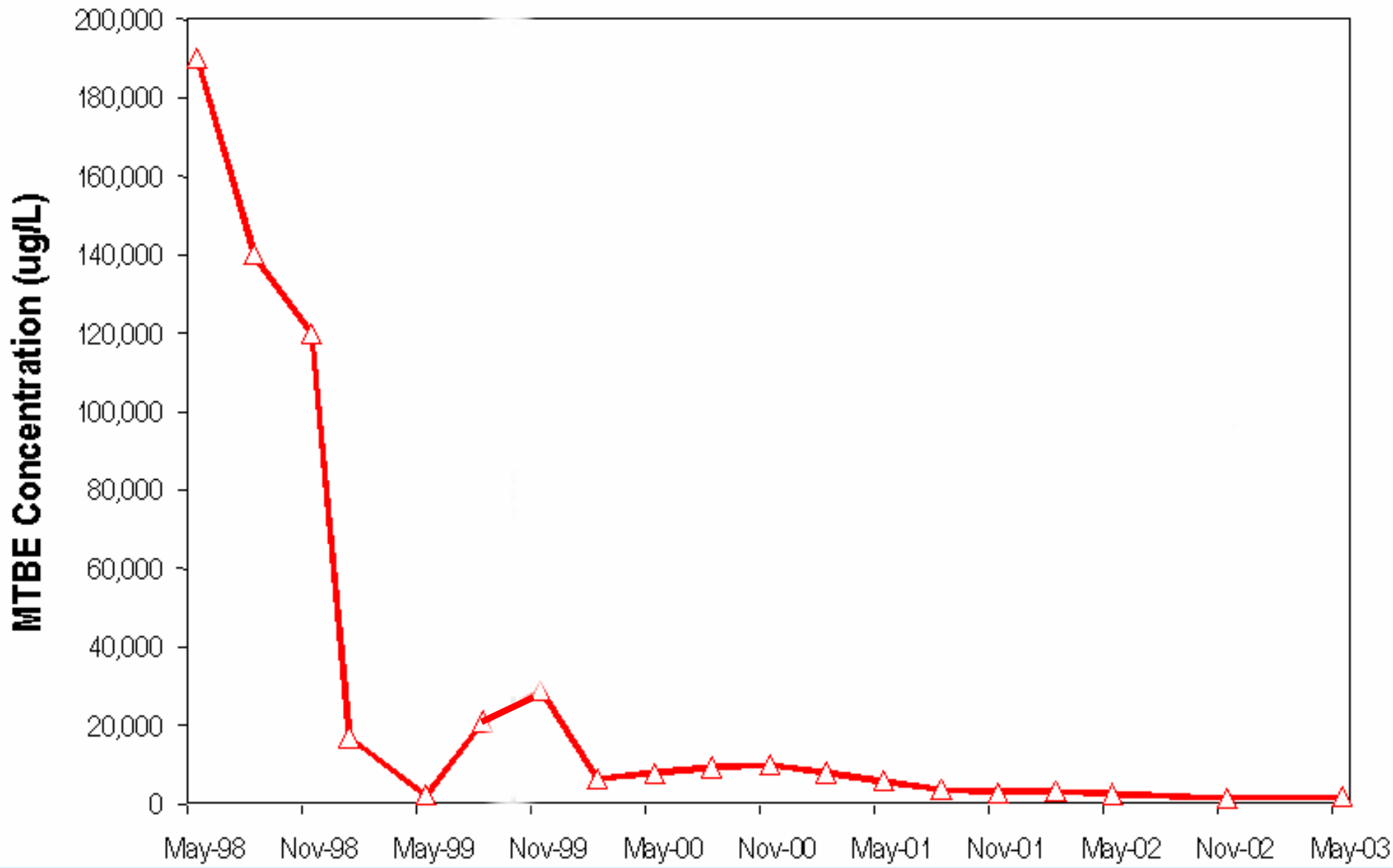
RAO Optimization Process from Guidance

Process Elements

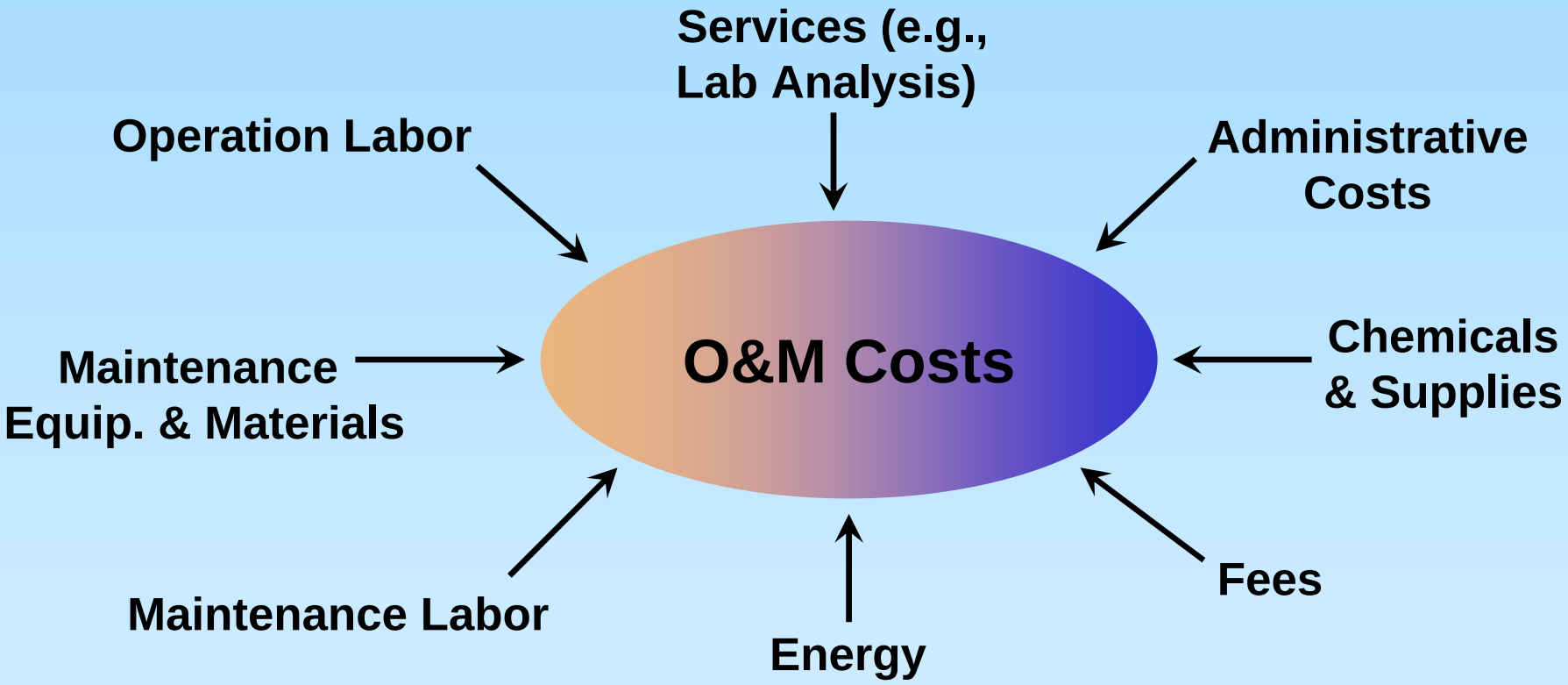
1. Review & Evaluate RA Objectives & Conceptual Site Model (CSM)
2. Evaluate Remediation Effectiveness
3. Evaluate Cost Efficiency
4. Identify Remediation Alternatives
5. Develop & Prioritize Optimization Strategies
6. Prepare Optimization Report
7. Implement Optimization Strategy



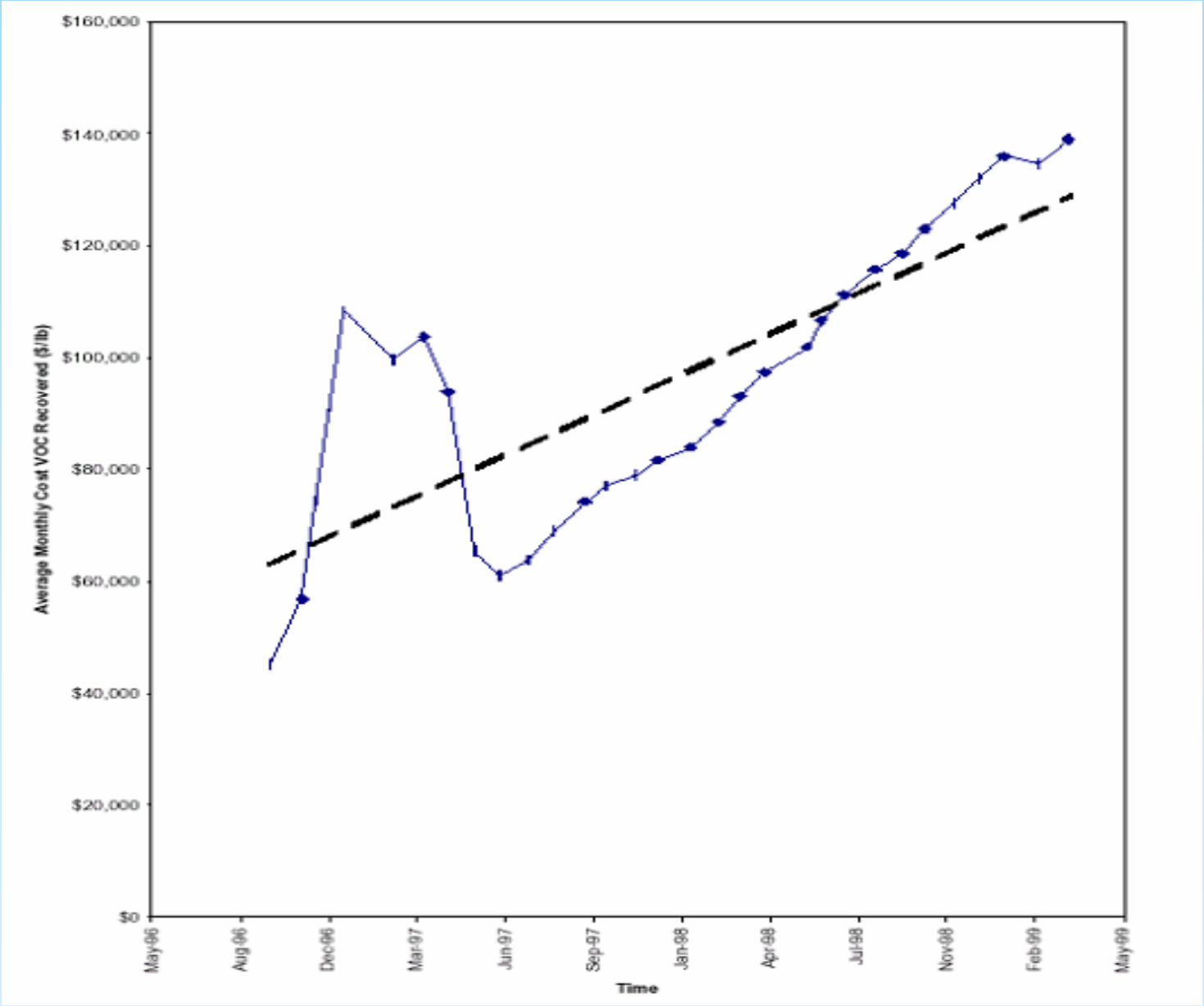
Asymptotic Conditions for MTBE – AS/SVE Shutdown



O&M Costs for RAO Optimization



Cost Efficiency Data - Escalating Costs



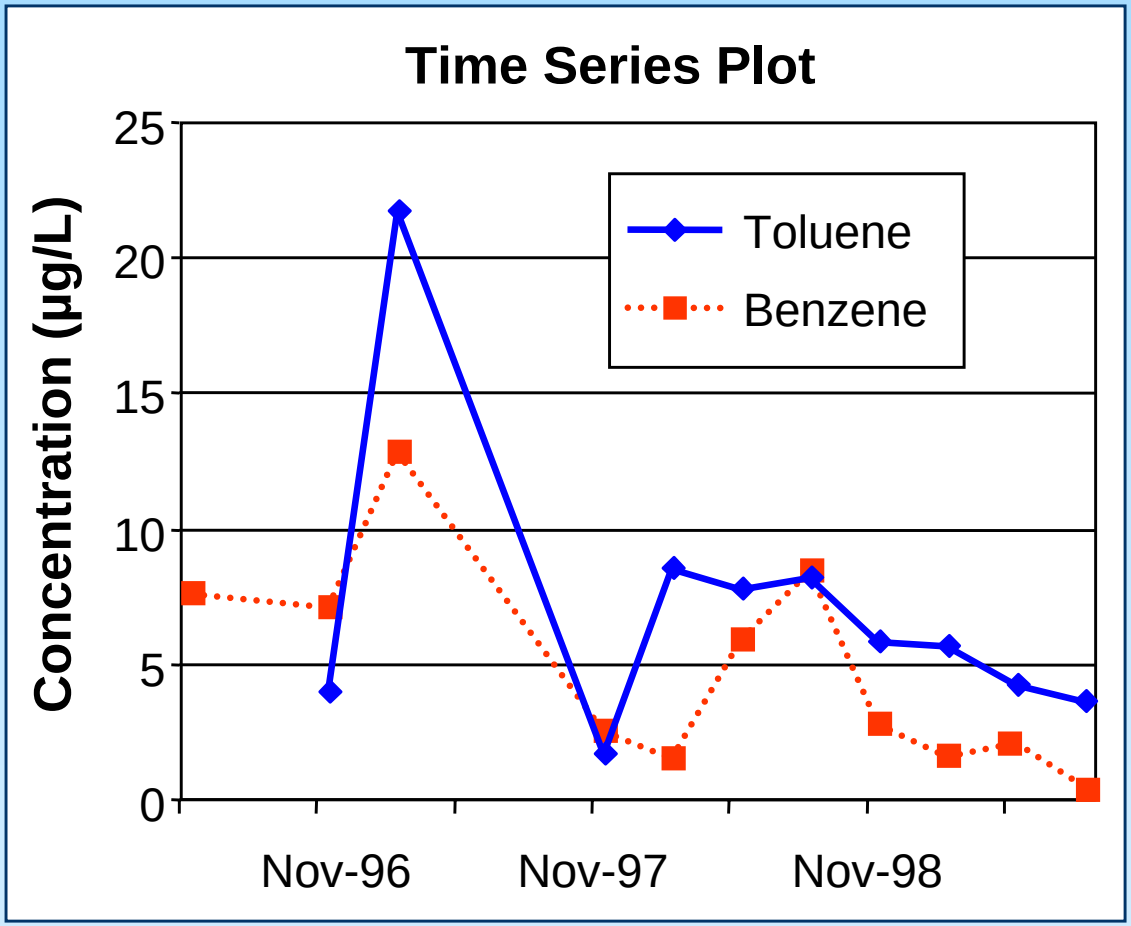
Pump & Treat Systems – Lessons Learned

- 4 Navy P&T Systems evaluated by the RAO/LTMgt Optimization WG
  - Results indicated minimal progress towards reaching remediation goals
- 2002 Survey of Navy P&T Systems (29 responses)
  - 62% have remediation to MCLs or similar standards as part of objective
- Optimization efforts generally not focusing on:
  - Contaminant tailing / asymptotic conditions
  - P&T's inability to attain MCLs
- 2004 Navy/Marine Corps Optimization Policy requires NAVFAC Headquarters approval of new P&T Systems
- Optimizing performance of existing P&T systems or identifying more appropriate remedial technologies should be a priority

LTM Optimization Process from Guidance

Process Elements

1. Program goals
2. Monitoring point locations
3. Monitoring frequency
4. Monitoring parameters
5. Sample collection methods
6. Data evaluation and presentation
7. Regulatory acceptance



Future Optimization Tracking

- Navy policy requires RPMs to track optimization progress semi-annually through FS, RD, RAO, and LTMgt phases
- New module in the Navy's IR Data Management System will allow for a systematic way to track optimization efforts
- Information collected will include:
  - Site, phase, and optimization study description
  - Date and cost of the evaluation
  - Optimization recommendations, estimated cost of implementation, and potential cost avoidance
  - Implemented actions, actual implementation cost, and actual cost avoidance

Key Points

- Navy/Marine Corps policy and guidance documents emphasize continual optimization of response actions at Installation Restoration and Munitions Response sites
- Navy guidance documents are available for specific optimization procedures during

  FS - RD -------- RAO --------- LTMgt

- Navy is minimizing installation of new P&T systems
- Navy will track/report the effectiveness of optimization efforts for all sites

Additional Information

- NAVFAC Environmental Restoration and BRAC Website:

  http://enviro.nfesc.navy.mil/scripts/WebObjects.dll/erbweb

  Navy Support ⇨ Work Groups ⇨ RAO/LTMgt

- Points of Contact:

Karla Harre
NFESC
(805) 982-2636
karla.harre@navy.mil

Tanwir Chaudhry
NFESC/Intergraph
(805) 982-1609
tanwir.chaudhry@navy.mil