Optimization Part 1: Policy

Tanwir Chaudhry
NAVFAC ESC

Cecily Sabedra
NAVFAC Southwest

Grady May
NAVFAC Northwest

Mike Singletary
NAVFAC Southeast

Joe Rail
NAVFAC Washington

Mark Hutchinson
NAVFAC Mid-Atlantic

Presentation Overview

- ► Optimization Introduction and Background
- Optimization Policy
- NORM Optimization Module
- Summary

Introduction

Environmental Restoration (ER) News
October 2011

"**Optimization** of our restoration efforts at all levels **is vital to our ER program** especially given the possibility of reduced funding levels. We've had a program-wide focus on optimization for several years; however, **we need to intensify our efforts** in this area to ensure we are **selecting, constructing, operating, and monitoring remedies in manners that are protective, sustainable, and cost effective**."

- *Brian P. Harrison, MPA, P.E.*
Director, Environmental Restoration Division
Naval Facilities Engineering Command HQ (NAVFAC HQ)

Optimization Policy and Guidance: The History

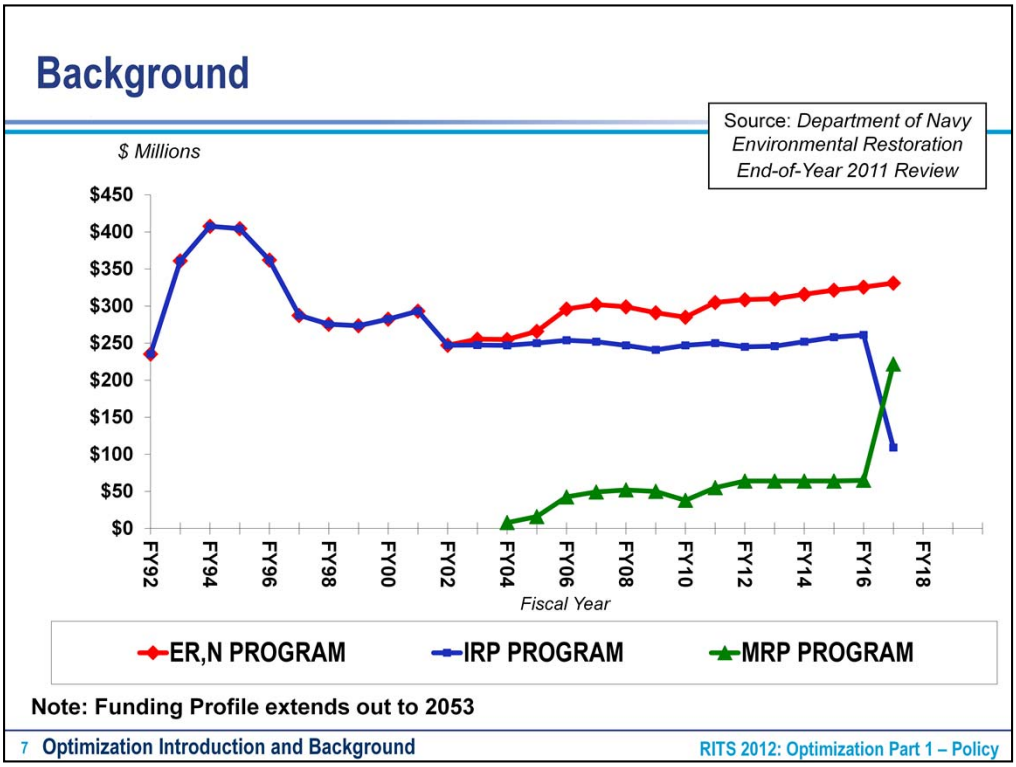
- 2001 DON Guidance for Optimizing Remedial Action Operation (Update pending)
- 2004 DON Policy for Optimizing Remedial and Removal Actions Under the Environmental Restoration Program
- 2010 DON Guidance for Optimizing Remedy Evaluation, Selection and Design
- 2010 DON Guidance for Planning and Optimizing Monitoring Strategies

Optimization Policy: Recent Policy and Guidance

- **2012 DON Policy for Optimizing Performance and Sustainability of Remedial and Removal Actions**
  RITS Optimization Part 1
- **2012 Navy Guidance for Preparing a Remedial Alternatives Analysis (RAA)**
  RITS Optimization Part 2
- **2012 Navy Environmental Restoration Program Monitoring and Management Approach**
  RITS Optimization Part 3
- **2012 DON Guidance on Green and Sustainable Remediation**
  RITS Optimization Part 4

Optimization: Past RITS

Spring 2010	**Green and Sustainable Remediation**
Spring 2010	**Using SiteWise™**
Fall 2009	**Long Term Monitoring Optimization Software**
Fall 2008	**Observational Approach to Optimize *In Situ* Remediation**
Fall 2007	**Long Term Site Management**
Spring 2006	**Remedial Performance Objectives**
Fall 2005	**Optimizing Data Collection**
Spring 2004	**Remedial Action Optimization (full day)**



RA-O/LTMgt is becoming a greater portion of the program.

The budget is dominated by long-term site cleanup commitments.

Optimization and GSR ensure appropriate remedies and timely, cost effective site closeout.

Optimization Policy Background section says, “As the Navy/Marine Corps have progressed through implementation of the ER Program, many sites have advanced through the remedy evaluation, selection, design and construction phases and are undergoing Remedial Action Operation (RA-O) and Long Term Management (LTMgt). This has shifted a growing proportion of the available Environmental Restoration Navy (ER,N) and Base Realignment and Closure (BRAC) funds to these long-term site cleanup commitments. The ER Program benefits from remedy optimization and green and sustainable remediation (GSR) efforts by ensuring the most appropriate remedies are screened, evaluated, selected, designed, and properly operated/maintained. Options are available to modify systems to ensure cleanup objectives are met in a timely, cost effective manner while minimizing negative environmental effects.”

Background (cont.)

- Requirement to optimize
  - Defense Environmental Restoration Program (DERP) Management Manual 4715.20 (9 Mar 2012)
  - Department of the Navy Environmental Restoration Program (NERP) Manual (Aug 2006)
- Recommendation to evaluate green and sustainable remediation
  - DON Guidance on Green and Sustainable Remediation UG-2093-ENV Rev 1. (Apr 2012)

Optimization Policy Background section says, “Enclosure 3 of the Defense Environmental Restoration Program (DERP) Management Manual, Reference (a) and Section 10.5.2 of the NERP Manual, Reference (b) requires the Navy to continually optimize remedies. In addition, the DON Guidance, Reference (c) recommends evaluation of GSR opportunities and implementation where and when it makes sense. This policy clarifies when, where and how to incorporate optimization and GSR considerations into the Navy/Marine Corps Environmental Restoration Program.”

Optimization Policy Reference a is Management Guidance for Defense Environmental Restoration Program (DERP) Enclosure 3 (9 Mar 2012)

Optimization Policy Reference b is Department of the Navy Environmental Restoration Program (NERP) Manual (Aug 2006) (2014 Update in Progress)

Optimization Policy Reference c is DON Guidance on Green and Sustainable Remediation (Apr 2012)

Presentation Overview

- Optimization Introduction and Background
- ► Optimization Policy
- NORM Optimization Module
- Summary

Optimization Policy: It's new and improved!

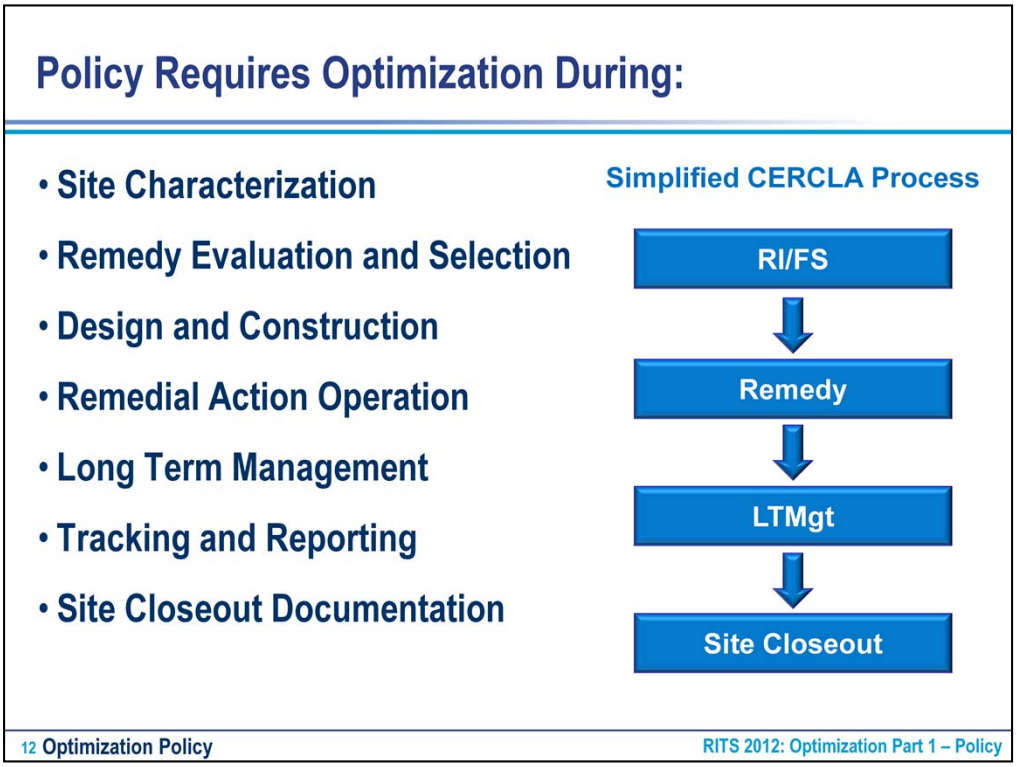
- **Updated language:**
  - **Incorporates sustainability analysis as part of the optimization process**
    - GSR and Optimization occur throughout the ER process (Figure 1)
    - Requirement to use SiteWise™ in the FS
  - **Adds Remedial Alternatives Analysis (RAA) requirement**
    - Phase 1 of Remedy Evaluation and Selection
  - **Introduces Management and Monitoring Approach**
    - Approach referenced as part of RA-O and LTMgt
  - **Includes section on proven remedial strategies**
    - Treatment train approach

Optimization Policy: Some Things Stay the Same!

- Provides direction on when to conduct optimization reviews
- Provides direction on who should conduct optimization reviews
- Relies heavily on references to the appropriate DON Guidance for optimizing each phase of the ER process

DON Policy for Optimizing Remedial and Removal Actions at all Department of Navy Environmental Restoration Program Sites

April 2012



Optimization Policy says, “Opportunities to improve performance and to evaluate sustainability practices shall be considered and implemented throughout all phases of remediation regardless of the regulatory framework under which cleanup may occur.”

Conduct Optimization Through:

- Routine optimization by the project team
- Periodic third-party optimization review
  - Tiger team for complex sites
  - Contracted team of experts not involved with the site
  - Project team with senior Navy technical staff

Optimization Policy says, "Routine optimization efforts such as recommendations from the O&M contractor or remedial project manager should be a regular practice for all projects. Periodically these efforts need to be reviewed by independent senior technical staff. These optimization reviews should include an evaluation of GSR considerations. To ensure an independent review, the review team should include technical experts who are not involved with the design or routine O&M of the remedy. The following options are appropriate for third-party optimization reviews:

Tiger Teams – Two options, mostly for complex sites

NAVFAC ESC Tiger Team - A third party independent optimization review coordinated through NAVFAC ESC drawing upon expertise from industry, academia, other government agencies, and DON. Depending on site specific requirements, this could be mostly a contracted effort.

Internal Tiger Team - A third party optimization review primarily by an internal DON team with senior technical staff from DON organizations; e.g., NAVFAC Atlantic, NAVFAC Pacific, Other FECs, NAVFAC ESC, and BRAC PMO. Relatively minor contract support may be acquired to support this effort.

Contracted Team – using contractors not involved with the site remedy being evaluated

Project Team - with participation from senior technical staff from the FEC and/or other Navy resources from Echelon III.

For sites with minor remediation and little opportunity for optimization, de minimis sites (e.g., less than 100 cubic yards soil excavation) formal optimization reviews may not be necessary. For de minimis sites, the RPM should consult senior technical staff from the FEC and/or other Navy resources from Echelon III, to determine if an optimization review is necessary."

Policy Requirements: Site Characterization

- Systematic Planning
- Data Quality Objectives
- Improved Strategies for Site Characterization

Applicable Guidance

- NAVFAC Tiered Approach for Developing Sampling and Analysis Plans (Jun 2011)
- Navy Guidance for Planning and Optimizing Monitoring Strategies (Nov 2010)
- Navy Guidance for Green and Sustainable Remediation (Apr 2012)

Policy Requirements: Remedy Evaluation and Selection

The Remedy Selection process provides the greatest opportunity to improve performance and reduce the footprint of the Navy ER Program!

Applicable Guidance

- **Navy Guidance for Optimizing Remedy Evaluation, Selection and Design (Mar 2010)**
- **Navy Guidance for Green and Sustainable Remediation (Apr 2012)**
- **NAVFAC Guidance for Preparing a Remedial Alternatives Analysis Document (Aug 2010)**

Optimization Policy Remedy Evaluation and Selection section says, “It is anticipated that the greatest opportunities to improve performance and reduce the footprint of the Navy ER Program are associated with the remedy selection process. Therefore, special emphasis is placed on addressing optimization and sustainability during remedy selection. The approaches outlined in the Navy Guidance for Optimizing Remedy Evaluation, Selection and Design, Reference (g), and Reference (e) shall be followed. Following these guidance documents will ensure that the most appropriate response actions are screened, evaluated, and selected for each Navy/Marine Corps IR and MR Site.”

Optimization Policy Reference g is Navy Guidance for Optimizing Remedy Evaluation, Selection and Design (March 2010)

Policy Requirements: Remedy Evaluation and Selection (cont.)

- **Updated policy and existing guidance defines treatment train approach to remedy optimization**
  - **Source area/hot spots: Active technologies**
    - Excavation
    - *In situ* treatment
  - **Plume area: Passive *in situ* technologies**
    - Natural attenuation
    - Enhanced bioremediation
  - **Installation property boundaries: *In situ* passive barriers**
    - Zero-valent iron permeable reactive barrier
    - Biobarrier

Optimization Policy Remedy Evaluation and Selection section says, "As the ER program has matured, there are several remedial strategies which have proven to be effective in meeting remedial action objectives. Multiple remediation technologies are typically implemented sequentially as a "treatment train" for each target treatment zone (TTZ) to achieve cost-effective remediation at a site. *In situ* treatment (e.g. *in situ* chemical oxidation, enhanced bioremediation) and/or removal actions (e.g. excavation) are typically focused on highly-contaminated source zones.

Following treatment of the source area, passive in situ technologies, such as natural attenuation or enhanced bioremediation, are typically implemented to further reduce contaminant mass and achieve ultimate remediation goals. For sites where contaminated groundwater has reached an active installation property boundary or is threatening to migrate off-site, *in situ* passive barriers or containment technologies (e.g. zero-valent iron permeable reactive barrier, biobarrier) are often used to intercept and treat contaminated groundwater and prevent or minimize off-site plume migration.

For BRAC sites undergoing soil and groundwater cleanup, property transfer and reuse factors should also be considered during remedy selection and design. Land use controls (LUCs) are typically implemented as part of treatment trains to prevent exposure to site contamination and to prevent unacceptable land use during remedy implementation and RAO/LTMgt. These types of remediation strategies and optimization efforts should be considered, when practicable, in remedy selection to achieve the greatest return on investment."

Remedy Evaluation and Selection Example

NAS Corpus Christi, UST 9

Treatment train approach

- Target pockets of light non-aqueous phase liquid (LNAPL) through limited free product recovery
- *In situ* air sparging to treat elevated dissolved benzene hot spots
- Monitored natural attenuation as a polishing technique for the remaining groundwater impacts

Cost Savings!

- Reduced treatment footprint
- Active treatment focused on zones of highest concentration
- Natural attenuation addressed lower-concentration regions of the plume

This engineered treatment train resulted in cost savings due to reductions in the treatment footprint and focusing active treatment on the zones of highest concentrations while allowing natural attenuation to address the lower-concentration regions of the plume.

Remedy Evaluation and Selection Example (cont.)

NAS Corpus Christi, UST 9

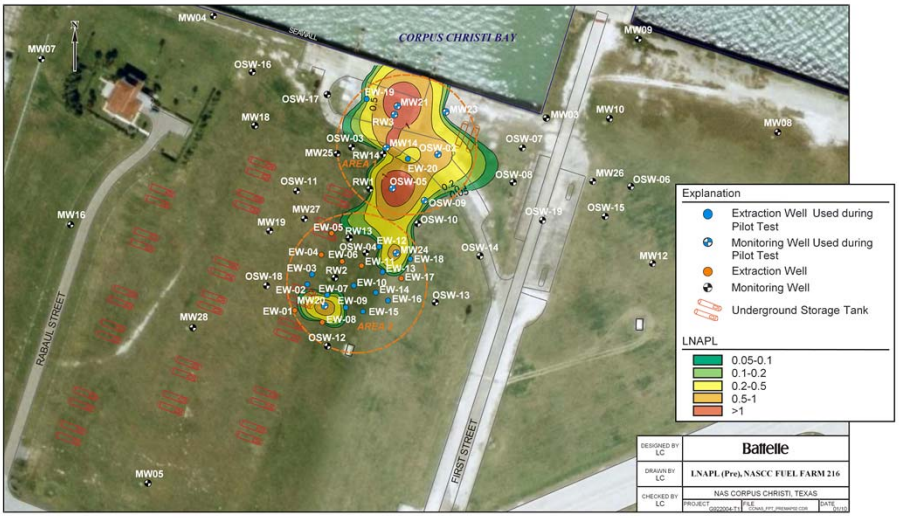
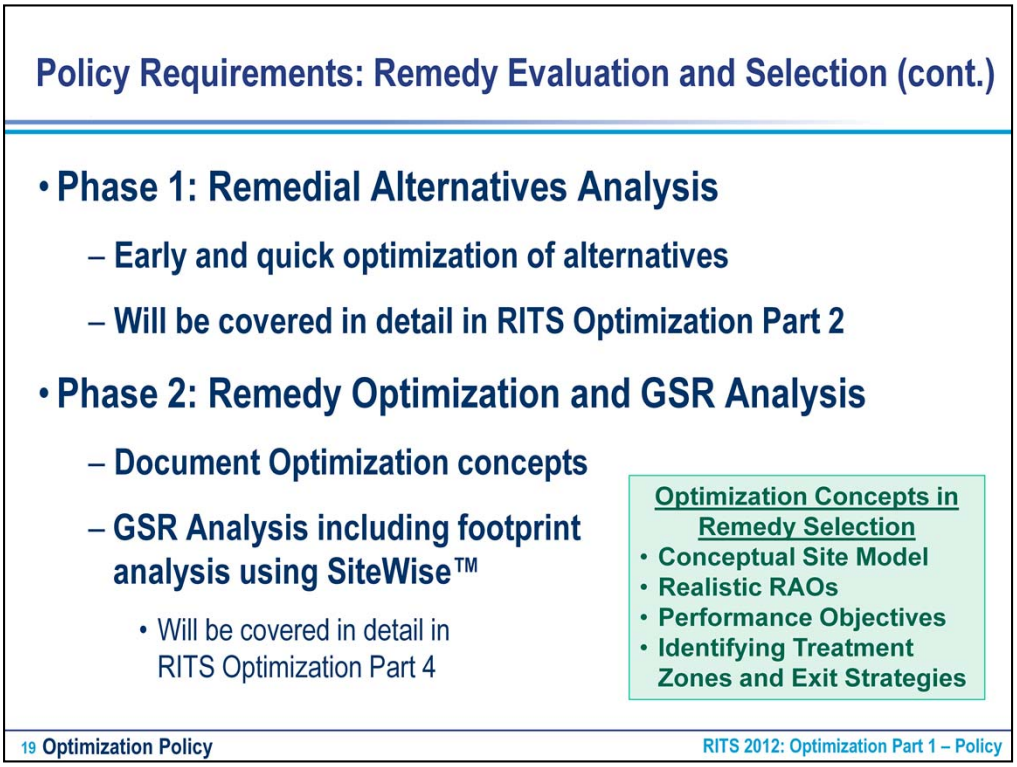


Figure 2-7. LNAPL Contour Map Based on Measurements Collected in October 2009 (Before Pilot Test), NASCC Fuel Farm 216

Courtesy U.S. Navy

LNAPL was removed through free product recovery. Following product recovery, remaining BTEX in groundwater will be removed through air sparging / biosparging followed by MNA of the low level plume.



Optimization Policy Remedy Evaluation and Selection section says, "A two phase approach shall be used for remedy evaluation/selection documents (i.e., FS, Engineering Evaluation/Cost Analysis [EE/CA], Corrective Measures Study [CMS] or Corrective Action Plan [CAP]). Phase 1 is an initial optimization step called the Remedial Alternatives Analysis (RAA), and Phase 2 includes remedy optimization and a GSR analysis of each of the alternatives evaluated in the remedy selection document.

2a. Remedy Evaluation and Selection Phase 1- Remedial Alternatives Analysis: For the initial optimization step, a brief RAA document shall be prepared for internal review prior to developing the draft remedy evaluation/selection document. The RAA shall be prepared and reviewed in accordance with Reference (h) for DON sites. The goal of the RAA review is early and quick optimization of the remediation alternatives that will ultimately be considered in the remedy evaluation document. This step ensures that all appropriate alternatives have been identified and that the alternative screening process has not eliminated appropriate alternatives prematurely. These alternatives are typically carried forward into the remedy evaluation document for further analysis.

2b. Remedy Evaluation and Selection Phase 2 - Remedy Optimization and GSR Analysis: Each alternative carried forward into the draft remedy evaluation document shall be optimized in accordance with Reference (g).

Reference (g) provides details on the optimization concepts that should be incorporated in the remedy evaluation process and documented in the remedy evaluation and decision documents. These include development of a conceptual site model, realistic remedial action objectives, performance objectives, and identifying treatment zones and exit strategies.

As part of this step, remedy footprint analysis using the SiteWise™ tool shall be conducted in accordance with Reference (e). Other tools, such as the AFCEE Sustainable Remediation Tool (SRT™) or similar GSR tools can also be used; but they can only be used in conjunction with or after an analysis using the SiteWise tool has first been performed. The GSR metrics used for this analysis may include green house gas (GHG) emissions, energy consumption, air pollutants, water impacts, ecological impacts, resources consumption, worker safety and community impacts.

The GSR metrics shall be incorporated into the review of the CERCLA Nine-Criteria as described in Reference (e)."

Policy Requirements: Design and Construction

Applicable Guidance

- Navy Guidance for Optimizing Remedy Evaluation, Selection and Design (Mar 2010)
- Navy Guidance for Green and Sustainable Remediation (Apr 2012)

- **Follow guidance during Remedial Design**
- **Guidance may be referenced during Construction phase if conditions change**

Optimization Policy Design and Construction section says, “The guidance outlined in References (e) and (g) shall be followed during Remedial Design. These guidance documents could also be referenced during the Remedial and/or Removal Action Construction phase; applicability during this phase will likely be due to changed conditions found during construction.

Following this guidance while designing and constructing the remedy will ensure that the most appropriate response actions are implemented for each Navy/Marine Corps IR and MR Site.”

Reference e is Navy Guidance for Green and Sustainable Remediation (Jan 2012)

Reference g is Navy Guidance for Optimizing Remedy Evaluation, Selection and Design (Mar 2010)

Policy Requirements: Remedial Action Operation

- Operating systems should be evaluated at least annually
  - Measure progress towards RAOs
  - Identify opportunities for optimization
- A more rigorous review is required if the annual evaluation shows:
  - Poor or erratic remedial performance
  - Excessive operating costs
  - Frequent equipment breakdown
  - High monitoring costs

Applicable Guidance

- Navy Guidance for Green and Sustainable Remediation (Apr 2012)
- NAVFAC Monitoring Report Template (May 2011)
- Navy Guidance for Optimizing Remedial Action Operation (April 2001)
- Navy Guidance for Planning and Optimizing Monitoring Strategies (November 2010)

Optimization Policy Operation section says, “For sites where the remedial action objectives are not achieved at the completion of the remedial action construction phase, operation of the remedial/removal system commences. The performance of these systems should be evaluated at least annually to measure progress toward the remedial action objectives and identify possible opportunities for optimization. The NAVFAC Monitoring Report Template, Reference (j), may be used to develop well-written annual monitoring reports; this template is particularly applicable for annual monitoring reports where significant amounts of data may be included. This type of documentation will facilitate future optimization efforts and Five-Year Reviews. A more rigorous optimization review shall be conducted if the annual evaluation reveals poor or erratic remedial performance, excessive operating costs, frequent equipment breakdowns, or high monitoring costs. The Navy Guidance for Optimizing Remedial Action Operation (RA-O), Reference (k), along with Reference (e), shall be followed for optimizing the RA-O phase of the process. SiteWise™ may be used to quantify GSR metrics of the existing system and evaluate the impact of potential optimization options. These metrics may also be useful to support decisions to transition from one phase of remedial operation to another. Reference (d), shall be followed to optimize any monitoring program(s) associated with the remedy.”

Policy Requirements: Remedial Action Operation (cont.)

Conduct spatial and temporal trend analysis to determine:

- When each technology has reached its limit of effective use
- When it is time to transition to a sequential phase
- Whether a remedy needs to be modified or replaced
- When RAOs have been met

SiteWise™ may be used to quantify GSR metrics and evaluate optimization options

When implementing optimization recommendations, check with counsel:

- If the ROD is not sufficiently flexible and/or
- Before implementing significant changes

Optimization Policy Operation section says, “Following these guidance documents during the RA-O phase will ensure that the remedy is operating efficiently and as designed, with minimal negative impacts to the environment. Spatial and temporal trend analysis of data will help assess system performance and its ability to effectively treat the target area contaminants. Data analysis shall be used to determine 1) when each technology has reached its limit of effective use, 2) when it is time to transition a remedy to a sequential phase, 3) whether a remedy needs to be modified or replaced with a more effective system, and 4) when remedial objectives have been met. If the ROD is not sufficiently flexible to allow implementation of the optimization recommendations, then it may be necessary to prepare an ESD or ROD amendment. Check with your counsel before implementing significant remedy changes.”

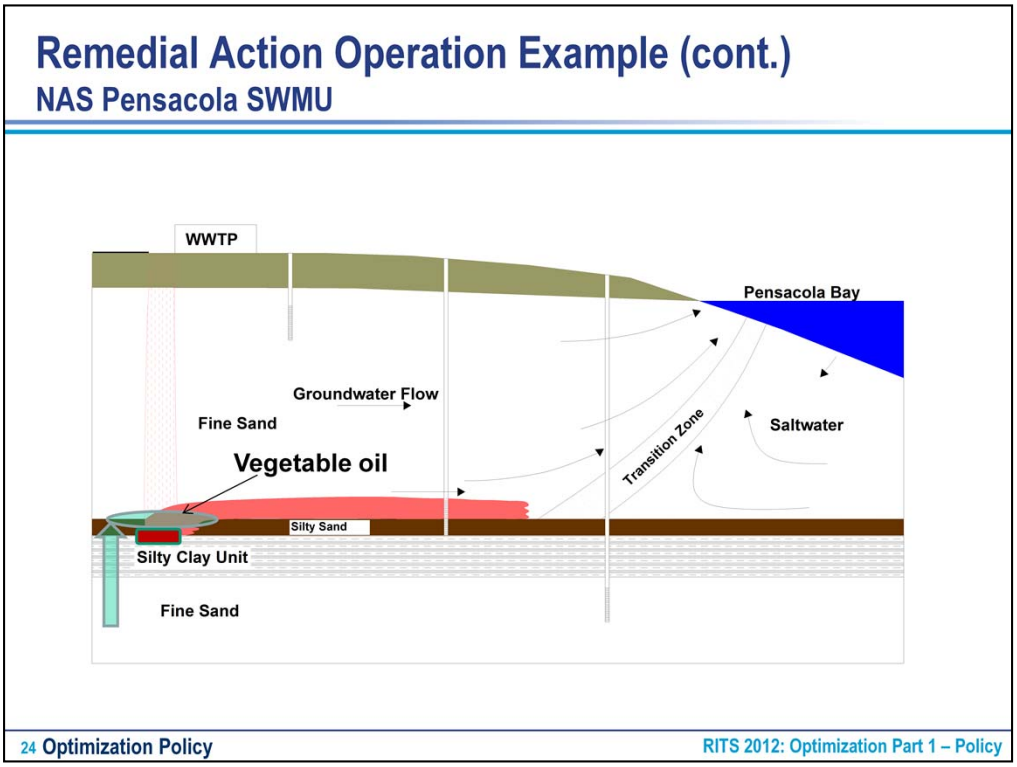
NIRIS can be a useful tool for extracting the data for analysis.

Remedial Action Operation Example

NAS Pensacola SWMU 1

- **Several rounds of optimization addressing a TCE plume replaced P&T system and resulted in significant life-cycle cost savings**
  1. ***In situ* chemical oxidation and enhanced bioremediation for source area treatment**
  2. **MNA to address dissolved phase TCE in the downgradient plume**
  3. **MNA at groundwater-surface water interface**
     - Significant dilution of low-level TCE prior to discharge to Pensacola Bay

NAS Pensacola, SWMU 1 - Several rounds of optimization resulted in a treatment train approach to address a chlorinated solvent (TCE) plume: 1)*In situ* chemical oxidation and enhanced bioremediation for treatment of the TCE source area, 2) monitored natural attenuation to address dissolved-phase TCE in the downgradient plume, and 3) further natural attenuation at the groundwater-surface water interface that results in significant dilution/mixing of the low-level TCE plume prior to discharge to Pensacola Bay. This optimized treatment train approach was designed to replace a former, ineffective pump-and-treat system and resulted in significant life-cycle cost savings.



Source area treatment of TCE through enhanced bioremediation (emulsified vegetable oil) followed by MNA in the plume through reductive dechlorinated of TCE -> VC and mixing and aerobic biodegradation of any remaining contamination before groundwater discharges to Pensacola Bay.

Policy Requirements: Long Term Management (LTMgt)

- **Following Response Complete, LTMgt may be needed to ensure the remedy remains protective if Unrestricted Use/Unrestricted Exposure is not met**

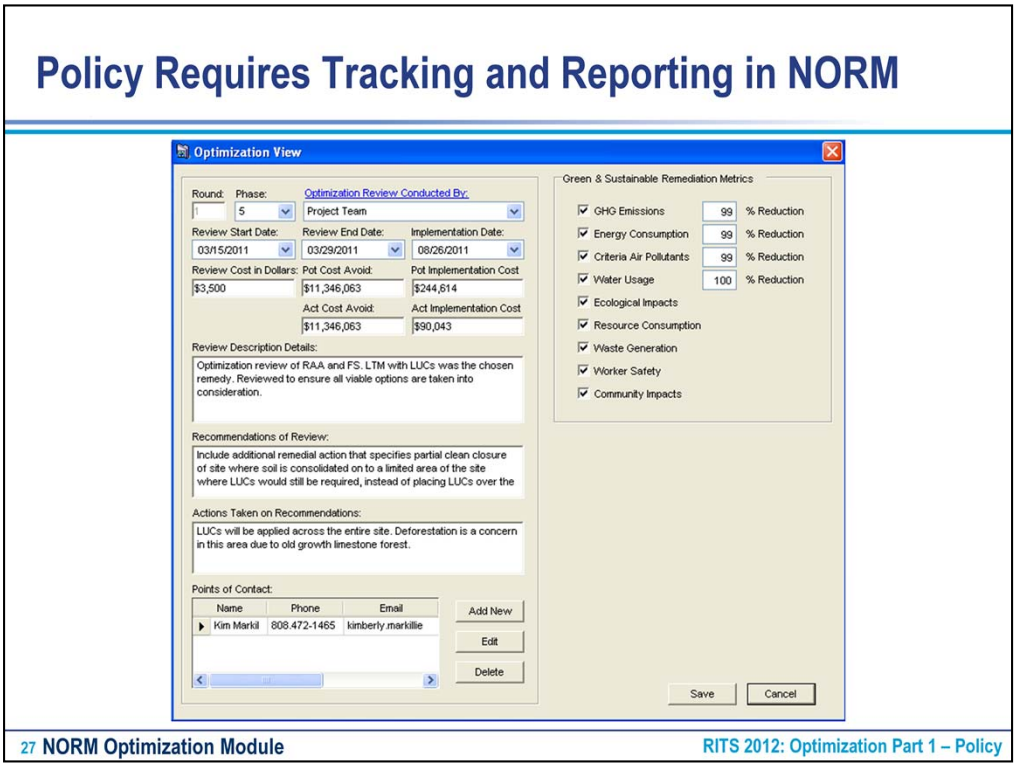
Applicable Guidance

- Navy Guidance for Green and Sustainable Remediation (Apr 2012)
- NAVFAC Monitoring Report Template (May 2011)
- Navy Guidance for Planning and Optimizing Monitoring Strategies (November 2010)

Optimization Policy Long Term Management section says, “When the remedial action objectives have been met and the Response Complete (RC) milestone has been reached, there may be a need for further LTMgt to ensure the remedy remains protective if the cleanup levels achieved do not allow for unrestricted use of the property. Reference (d) and Reference (e) shall be followed. As was mentioned in Paragraph 4, Operation, the NAVFAC Monitoring Report Template, Reference (j), may also be used for LTMgt to develop well-written monitoring reports. Following these guidance documents will ensure that the LTMgt requirements are achieved in a cost effective manner.”

Presentation Overview

- Optimization Introduction and Background
- Optimization Policy
- ► NORM Optimization Module
- Summary



Optimization Policy Tracking and Reporting section says, “An optimization module is located in the Navy's NORM database where RPMs shall update and track optimization efforts through all phases of the cleanup process on a semi-annual basis. The Navy will use this data to report on our efforts to continuously optimize and improve the sustainability of our remedies. Specific guidance for inputting data into NORM shall be provided in future NAVFAC HQ Budget Guidance documents. GSR metrics are also included in the NORM optimization module.”

ER,N Optimization Investment Results

- All NORM Optimization data as of 11/11

Optimization Study/ Review Costs	Costs to Implement Optimization Recommendations	Actual Cost Avoidance	Potential Cost Avoidance
$14,419,586 (508 sites)	$13,479,123	$161,813,608	$304,109,014

- Return on Investment (ROI): 5.8 (based on actual costs)

Study costs are actuals to date.

Implementation Costs include: Changed remedies, Explanation of Significant Differences, pilot studies, etc.

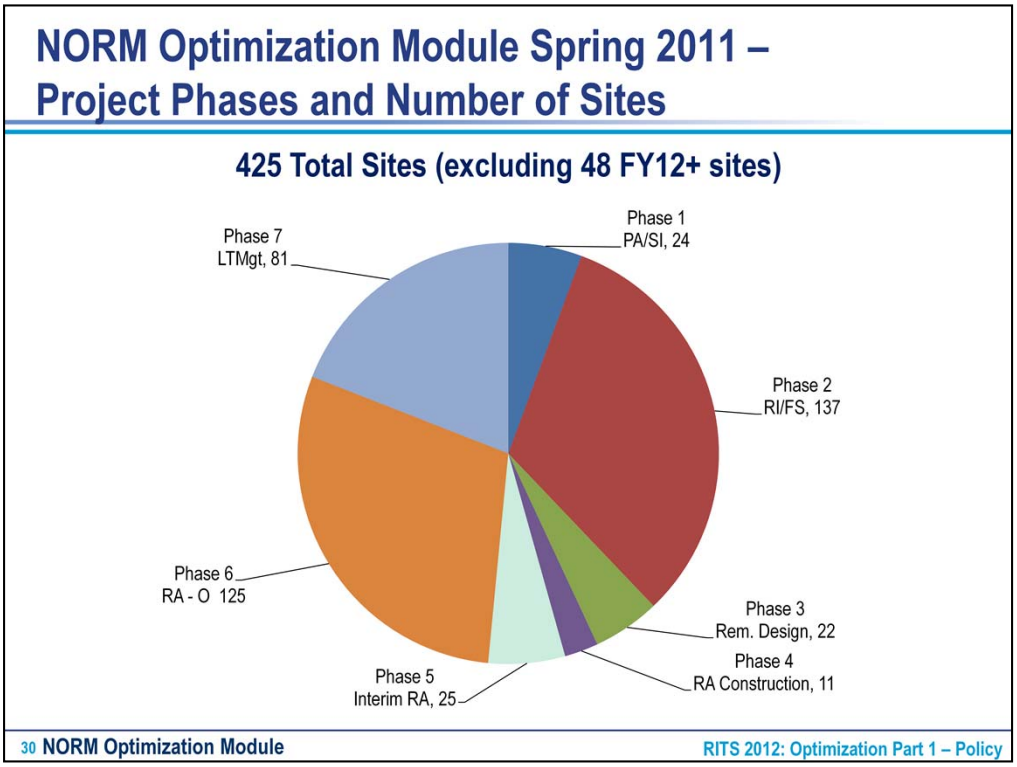
Cost avoidance is calculated after all study and implementation investments are completed (ROI)

Cost avoidance is a combination of CTC reduction and avoidance of CTC increases

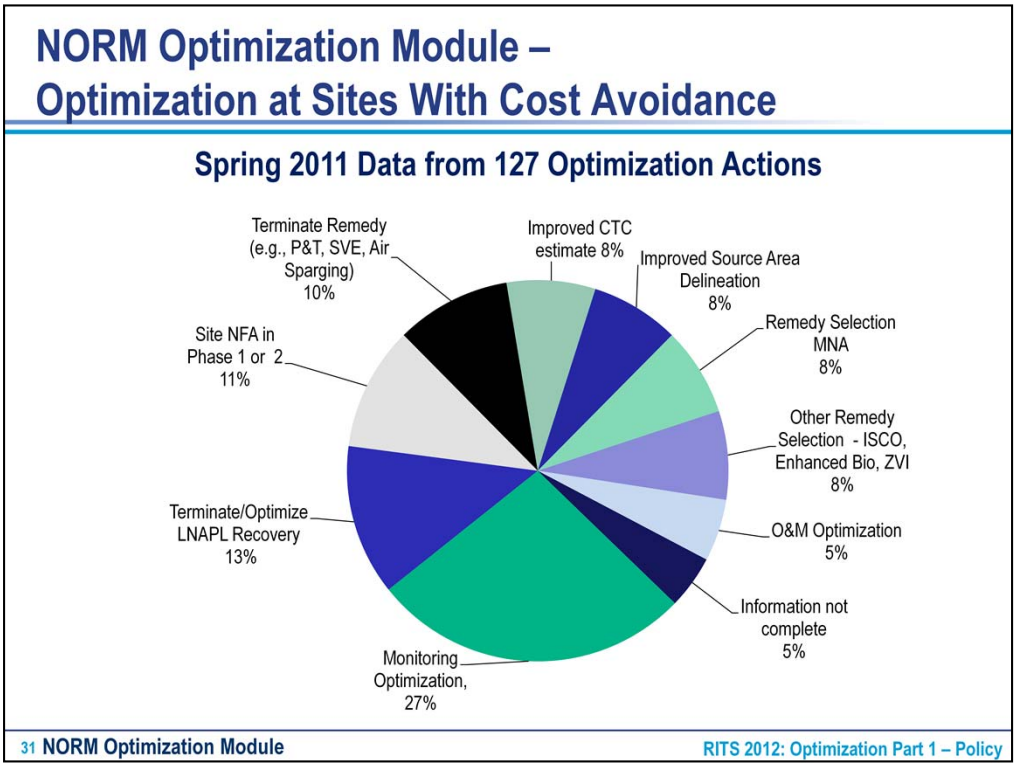
Analysis of NORM Optimization Data

NORM Optimization Module

- >600 entries representing >400 sites
- >500 unique narrative entries describing optimization actions
- >120 unique entries showing actual cost avoidance
- Categorizing data shows what types of optimization recommendations are most often implemented



Recently updated guidance documents target phases where optimization is most often occuring.

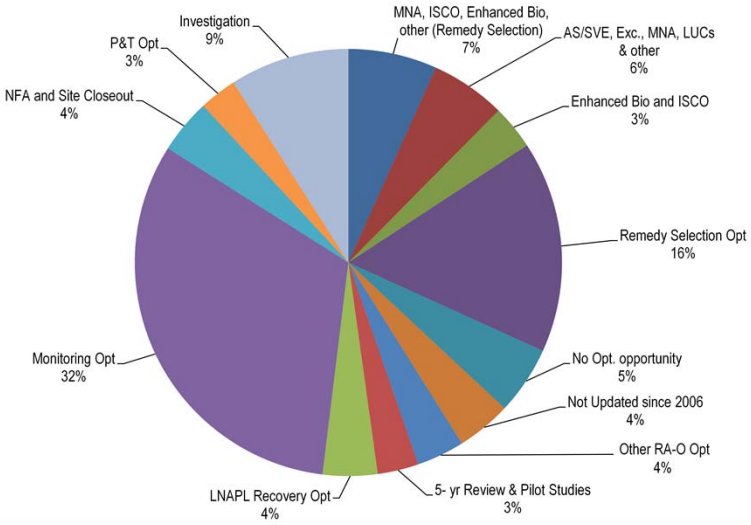


Spring 2011 Total Cost Avoidance =$134 million

Some of the largest cost avoidance items - MNA is 8% of the optimization actions with 20% of total cost avoidance; Monitoring optimization is 27% of the optimization actions with 19% of total cost avoidance; Terminate Remedy category is 10% of the actions with 18% of cost avoidance.

NORM Optimization Module – Optimization Actions (Actual Cost Avoidance not Provided)

Spring 2011 Data from 387 Optimization Actions



You Can Improve NORM Module Data Findings

Conduct optimization and update NORM according to the Optimization Policy

- **Provide actual cost avoidance**
- **Always practice monitoring optimization**
- **Provide enough detail to determine what was done**
- **Only report actual optimization efforts**
- **Use existing guidance documents**

RPMs: Here is how you can improve this data

- Actual cost avoidance is not provided for a large number of optimization actions.
- Monitoring optimization is practiced at a large number of sites. It should be applied to all sites. Almost always Monitoring Optimization has associated cost avoidance.
- Need to improve quality control for optimization module input . 138 optimization actions did not have enough detail.
- 5 year reviews and most pilot studies are not part of optimization, but a few sites reported these items in the optimization module.
- 5% of the sites reported no need for optimization. The stated reasons included: low cost, low soil excavation volume, time critical removal action, and low monitoring frequency (annual).
- Continued need for RPM and contractor training. Guidance documents have been updated recently. Revised RA-O guidance is under workgroup review
- Optimization module is not designed for providing technology specific information

Presentation Overview

- Optimization Introduction and Background
- Optimization Policy
- NORM Optimization Module
- ► Summary

Take-Home Points

- Optimization of ER projects remains a priority
- Updated policy language includes
  - Incorporation of sustainability analysis as part of the optimization process
  - Added Remedial Alternatives Analysis (RAA) requirement
  - Management and Monitoring Approach provided
  - Added section on proven remedial strategies
- Reporting optimization efforts in NORM is required and documents optimization success

Resources

- DON Policy for Optimizing Remedial and Removal Actions at all Department of Navy Environmental Restoration Program Sites (April 2012)
- DON Guidance for Optimizing Remedial Action Operation (April 2001 update pending)
- NAVFAC Guidance for Preparing a Remedial Alternatives Analysis Document (April 2012)
- NAVFAC Tiered Approach for Developing Sampling and Analysis Plans (June 2011)
- DON Guidance for Planning and Optimizing Monitoring Strategies (November 2010)

Resources (cont.)

- DON Guidance for Remedy Evaluation, Selection and Design (March 2010)
- NAVFAC Management and Monitoring Approach (May 2011)
- DON Guidance for Green and Sustainable Remediation (April 2012)