



Open Environmental Restoration Resource (OER2) Webinar

Portfolio Optimization (P-OPT) Review of the Navy's IRP Sites - Phase I Overview and Findings

Presented by:

NAVFAC Environmental Restoration Program

August 23, 2017

Logistics



- **Submit all questions via chat box throughout the presentation**
- **Presentation is being recorded**
- **Complete the webinar survey (main feedback mechanism)**

Disclaimer:

This seminar is intended to be informational and does not indicate endorsement of a particular product(s) or technology by the Department of Defense or NAVFAC EXWC, nor should the presentation be construed as reflecting the official policy or position of any of those Agencies.

Mention of specific product names, vendors or source of information, trademarks, or manufacturers is for informational purposes only and does not constitute an endorsement or recommendation by the Department of Defense or NAVFAC EXWC. Although every attempt is made to provide reliable and accurate information, there is no warranty or representation as to the accuracy, adequacy, efficiency, or applicability of any product or technology discussed or mentioned during the seminar, including the suitability of any product or technology for a particular purpose.

Participation is voluntary and cannot be misconstrued as a new scope or growth of an existing scope under any contracts or task orders under NAVFAC

Speaker Introductions



Gunarti Coghlan (Presenter)

- Environmental Engineer (NAVFAC HQ)
- Registered Professional Engineer,
State of Virginia
- Specializes in
 - remedy optimization
 - advanced environmental restoration technology
 - environmental risk at technically complicated sites
 - Navy and OSD R&D efforts
- B.A. Chemical Engineering Universitas Sriwijaya, Palembang, Indonesia
- M.S. Environmental Science and Engineering, Colorado School of Mines



gunarti.coghlan@navy.mil

Speaker Introduction



Mike Singletary (Presenter)

- Senior Engineer at NAVFAC SE
- Specializes in:
 - groundwater hydrology
 - fate and transport of contaminants
 - bioremediation technologies
 - strategic planning and optimization of site investigation and remediation approaches.
- B.S. Civil Engineering (Georgia Tech)
- M.S. Environmental Engineering (Georgia Tech)



michael.a.singletary@navy.mil

OER2 Webinar Series

- **Why Attend?**
 - Obtain and hear about the latest DOD and DON's policies/guidance, tools, technologies and practices to improve the ERP's efficiency
 - Promote innovation and share lessons learned
 - **FEEDBACK** to the ERP Leadership
- **Who Should Attend?**
 - ERP Community Members: RPMs, RTMs, Contractors, and other remediation practitioners who support and execute the ERP
 - Voluntary participation
- **Schedule and Registration:**
 - Every other month, 4th Wed (can be rescheduled due to holidays)
 - Registration link for each topic (announced via ER T2 email)
- **Topics and Presenters:**
 - **ERP community members** to submit topics (non-marketing and DON ERP-relevant) to POCs (Gunarti Coghlan – gunarti.coghlan@navy.mil or Tara Meyers – tara.meyers@navy.mil)
 - Selected topic will be assigned Champion to work with presenter



Portfolio Optimization (P-OPT) Review of Navy's IRP Sites – Phase I Overview and Findings

Gunarti Coghlan
NAVFAC Headquarters

Mike Singletary
NAVFAC Southeast

Poll #1

- **What is the primary challenge at your cleanup site?**
 - **Complex site conditions**
 - **Unclear or lack of exit strategy**
 - **Perpetual RAO/LTM**
 - **All of the above**

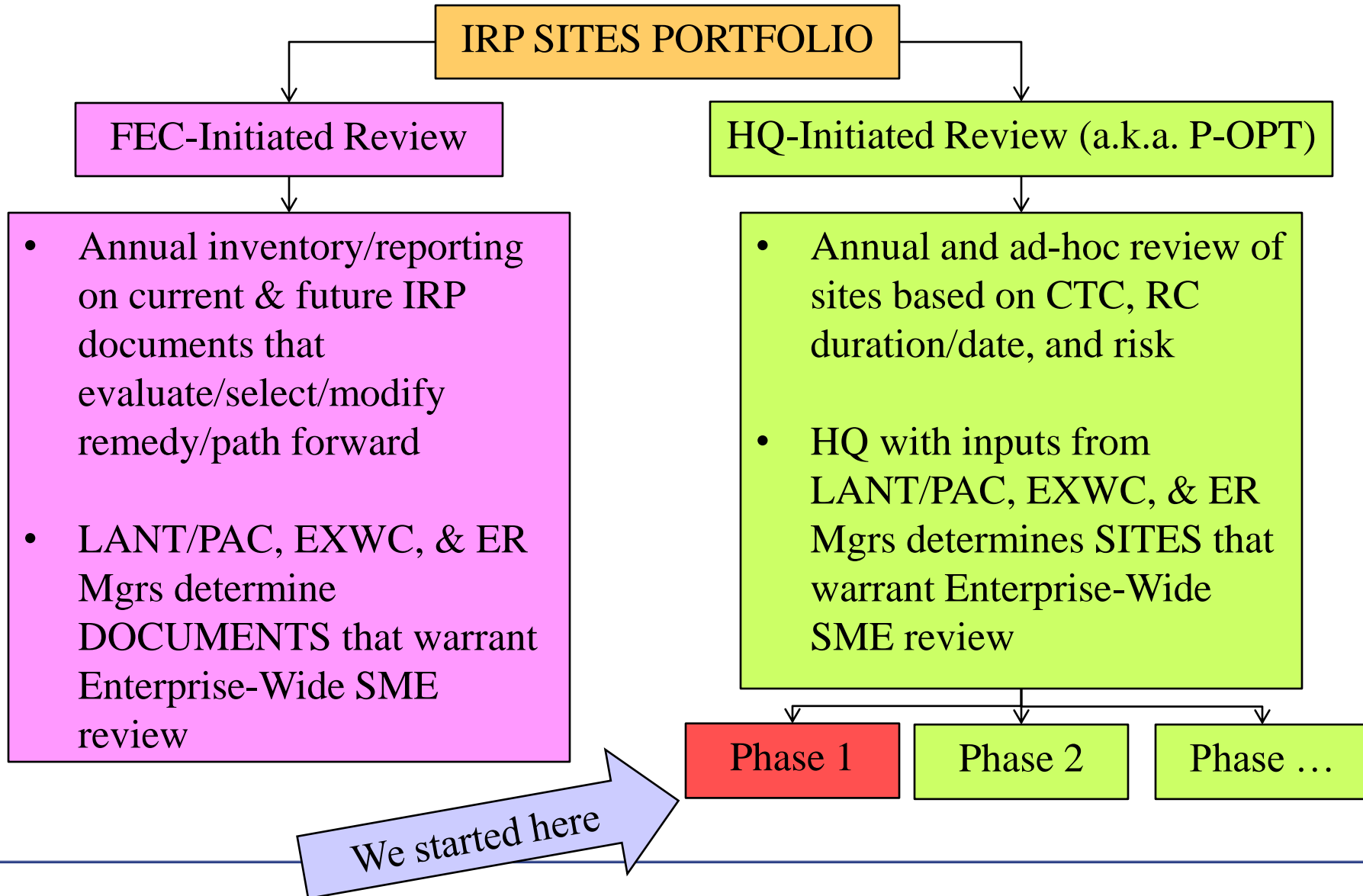
Why IRP Sites Review?

- **Must demonstrate compliance with Program Metric – Response Complete (RC)**
- **Must implement best practices in program management**
- **ER,N Program ~ 4,000 sites and \$300M/annually**
- **Lean fiscal environment and mostly difficult sites/issues remain**
- **Technically and fiscally transparent and responsible**
- **Focuses on Installation Restoration Program (IRP) sites but principles apply to MRP and Radiological Program**

Poll #2

- **Technical review in the ER,N Program?**
 - Very important
 - Depends on cost, schedule, complexity
 - Should be an additional cost to the Navy

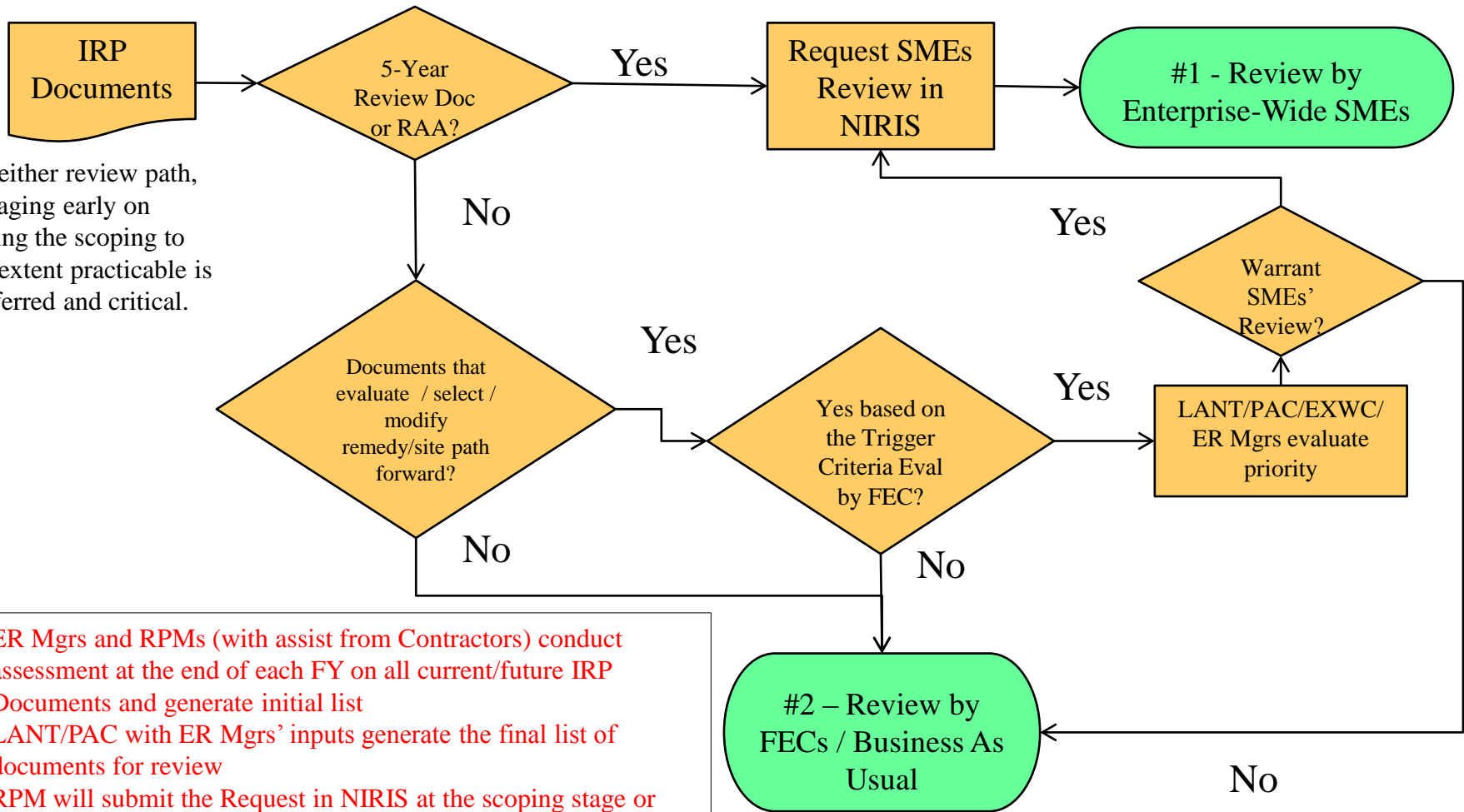
Installation Restoration Program (IRP) – Site Review Processes



Enterprise-Wide SMEs

- **Serve as third-party technical reviewers on both FEC Review and HQ Review Paths**
- **Drawn from across NAVFAC (FEC, LANT, PAC, EXWC, and HQ) environmental restoration community**
- **May include external NAVFAC SMEs as needed**
- **As needed/necessary involvement throughout the phases of the project/site**

FEC-Initiated Review Process



On either review path, engaging early on during the scoping to the extent practicable is preferred and critical.

- ER Mgrs and RPMs (with assist from Contractors) conduct assessment at the end of each FY on all current/future IRP Documents and generate initial list
- LANT/PAC with ER Mgrs' inputs generate the final list of documents for review
- RPM will submit the Request in NIRIS at the scoping stage or when the draft document is ready BEFORE going to the regulators based on final list from the collaborative screening

Trigger Criteria



Meeting Tier 1 Criteria by default warrants Enterprise-Wide SMEs review.

Tier 1 Criteria	Sub-Criteria
Precedence Setting	Site Reopener
	Off-Base Treatment
	New/Emerging Technology
	New/Expansion of P&T
	Implementation of Standard Uncommonly Used for Cleanup Goal
	Implementation of Low/Potentially Unachievable Cleanup Goal
	Red Flags in RAO Language
Emerging Issues	Emerging Contaminants
	PFAS
	Vapor Intrusion
	Chemicals with no Clear Risk Information
Public/Regulatory/Political Interest	

Tier 2 Criteria:

- Used alone at team’s discretion to justify review by Enterprise-wide SMEs
- Used to add weight to Tier 1 Criteria

Tier 2 Criteria	Sub-Criteria
Large Quantities of soil and sediment excavation	
RC duration is more than 20 yrs (does not include mature landfill sites in the LTM stage)	
Total CTC > or equal to \$5M	Large commitment in capital cost
	Large (>\$50K) commitment in RAO/O&M costs over long timeframe (>15 years)
	Low concentration contaminants with low commitment of RAO/LTM cost (e.g., <\$10K) over long period of time (>15 years)

Poll#3

- **Have you heard about ER,N Portfolio IRP Sites Review or P-OPT?**
 - Yes
 - No

HQ-Initiated Review (a.k.a. P-OPT)

- **Overview of Phase 1**

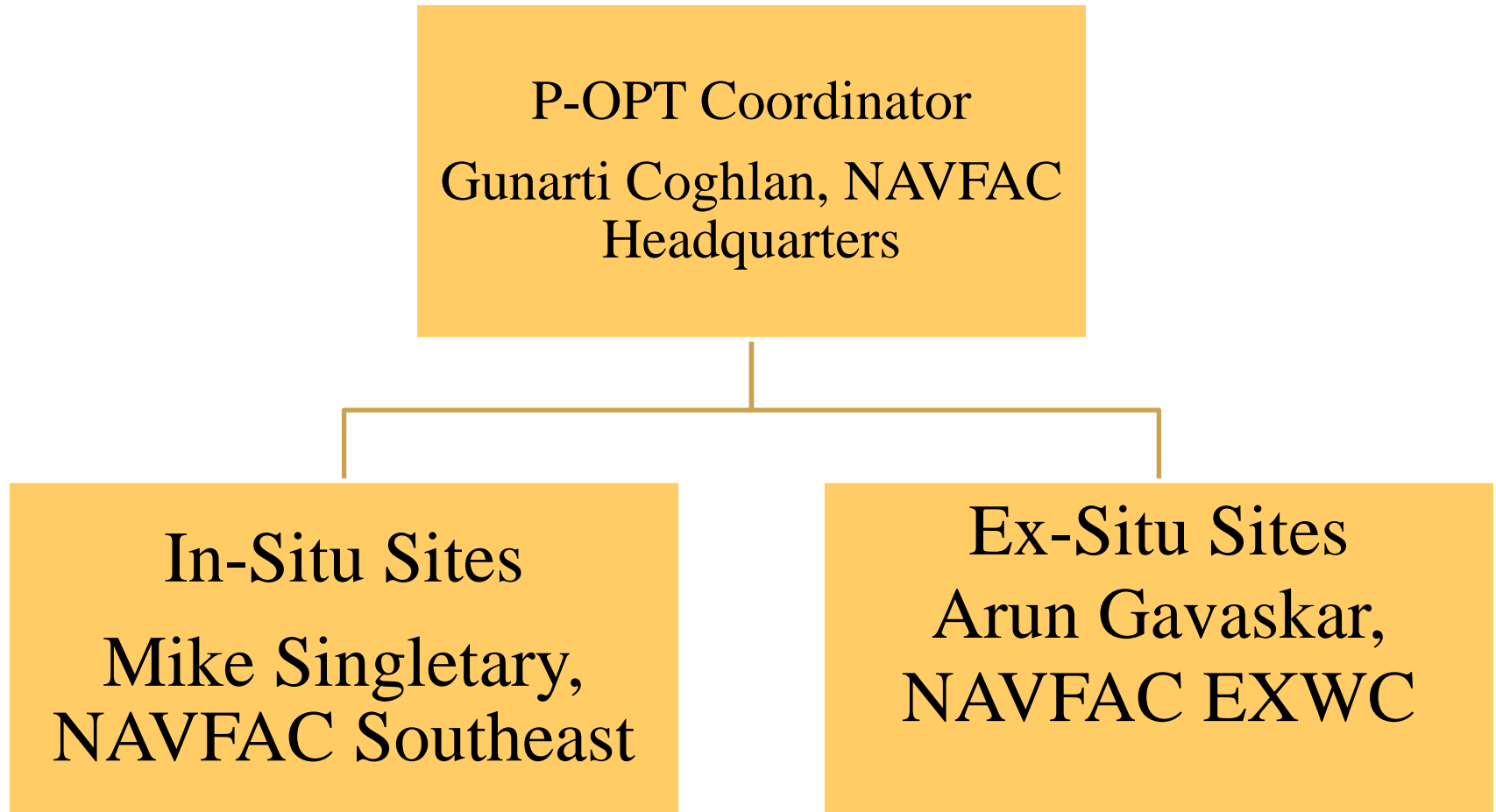
- **Methodology**

- **Common themes**

1. Unclear and inconsistent Response Complete Strategy
 - **Impetus of FEC-Initiated Review Process**
2. Nature of receptors near Navy's groundwater plumes
 - Importance of groundwater-to-surface water pathway
3. Potential for accelerating RC at certain types of sites
 - LNAPL site management
 - Risk management strategies and closure options
4. Back diffusion of contaminants from low permeability media
 - Role in plume persistence and remediation performance
 - Long-term management of back diffusion
5. Aging infrastructure for many of the Navy's P&T systems

- **Overview of Phase 2**

Phase I P-OPT Overview



P-Opt Sites Phase I

In-Situ, Ex-Situ and Ad Hoc Sites



In-Situ Sites

- JBPHH Site H0005/LF05
- JBPHH Site H09 (SS06)
- JBPHH Site H15 (SS015)
- JBPHH Site H16 (SS11 South)
- MCAS Cherry Point OU1/Site 52
- MCB Camp Lejeune Site 49
- NAB Little Creek Site 13
- ABL Site 5
- NS Newport Site 8
- NS Newport Site 12
- NB Kitsap Bangor OU8
- MCLB Albany Site 12
- NAS Jacksonville OU3
- NWIRP McGregor Area M
- NAS Fallon Site 14
- NSF - Indian Head Site 57
- NUWC Keyport OU1

Ex-Situ Sites

- NB Kitsap Bangor Site A
- NB Kitsap Bangor Site F
- Calverton Site 6A
- Barstow Site 37 (OU1-Yermo)
- Bedford Site 3
- NS Norfolk Site 1
- NS Norfolk Site 20
- ABL Site 1
- ABL Site 10
- NIROP Fridley

Ad Hoc Sites

- NAS North Island Site 9G
- NAS North Island Site 11G
- NAS North Island Site 20G
- Whidbey Island Site 6
- Jackson Park OU1
- Yorktown DFSP
- Cherry Point – UST Sites
- Guam Apra Harbor – Site 41
- China Lake

Individual Site Reviews

- Methodology

- In-house Navy subject matter experts (SMEs) intensively reviewed each site and developed preliminary findings and recommendations
- External SMEs, each with more than 20 or 30 years experience in the industry, were used to further vet the findings
- Portfolio-wide themes were developed by analyzing common findings from all sites
- Findings and recommendations were/are being discussed with RPMs and FECs – and adjusted based on additional insights from end users
- Navy SMEs are continuing to work with RPMs and FEC Managers to implement the Phase I recommendations
 - Where required, Navy SMEs are helping RPMs discuss the recommendations with stakeholders at the site.

Portfolio Optimization (P-OPT)

- *Summary of Site Reviews*

▪ In Situ Sites

- Restoration timeframes estimated at >30 years for most sites (actual timeframe likely greater)
- Source reduction technology (e.g. bioremediation, ISCO) typically implemented with natural attenuation and other passive technologies to treat/control downgradient plume
- Few opportunities to accelerate remediation timeframes
- Long-term monitoring and management requirements drive costs
- Long-term passive management appropriate long-term goal for most complex sites in Phase I (NRC 2012)
- Guidance needed for RPMs to determine when to transition sites from active treatment to passive management

Portfolio Optimization (P-OPT) - *Summary of Site Reviews*

▪ Ex Situ Sites

- Five P&T systems initially operated for mass removal and 6 for plume containment (hydraulic control)
- At 10 of the 11 sites, P&T systems have adequately contained the plume and improved downgradient water quality
- Limited opportunities to transition active P&T systems to passive management systems (e.g. PRBs)
 - P&T required for continued hydraulic containment of plumes
 - One site with perchlorate contamination in process of transitioning to passive bio-barriers
- Aging infrastructure becoming apparent in more frequent well fouling, pump failure, etc.
- One P&T system will require upgrade of aboveground treatment to address emerging contaminant (e.g. 1,4-dioxane)
- Emerging contaminants could add to capital investment of P&T systems in future

Poll #4

- **What is the primary actual risk driver at your groundwater sites?**
 - **Surface water**
 - **Vapor intrusion**
 - **Drinking water**

Portfolio Optimization (P-OPT)

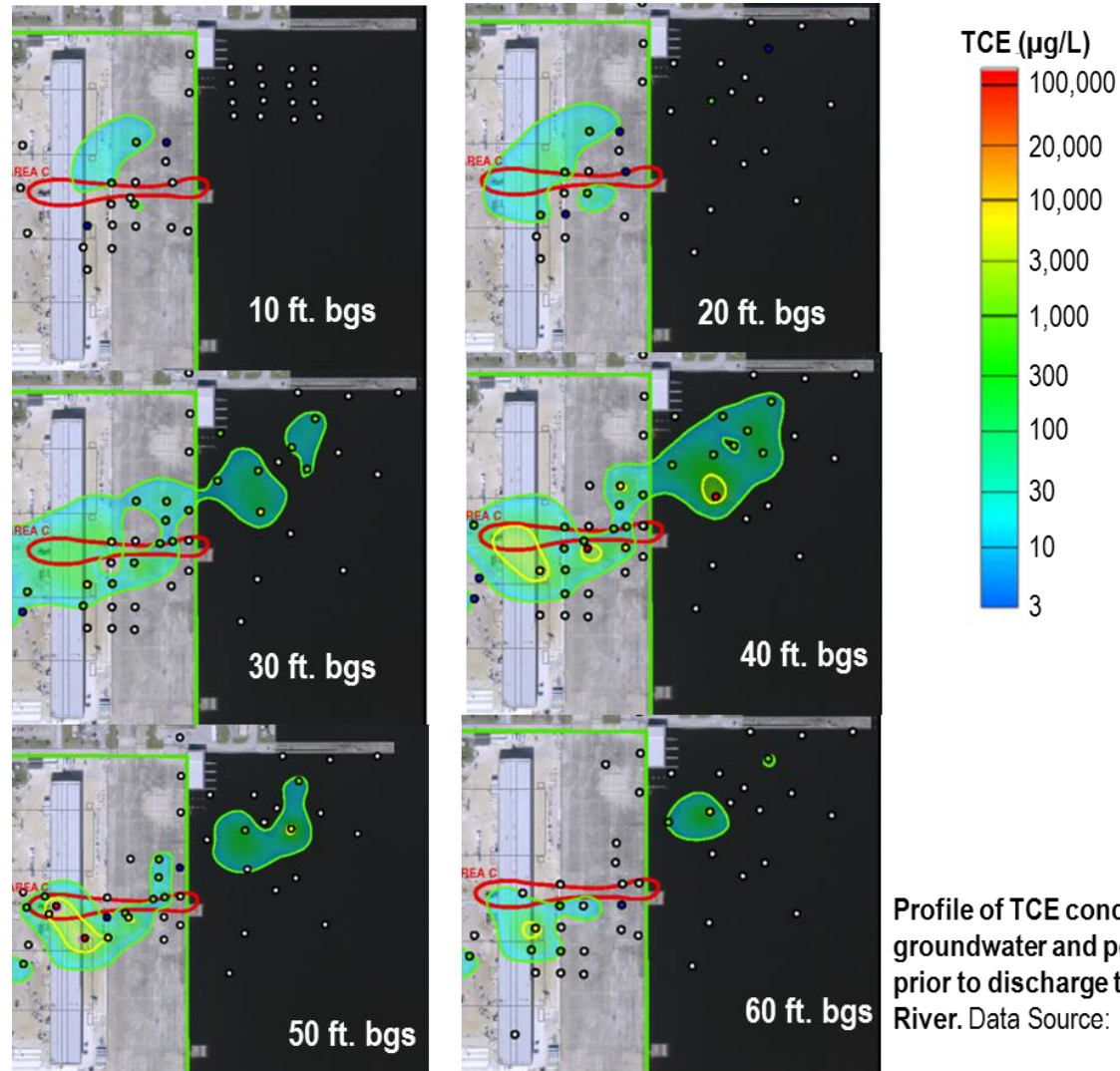
- *Nature of Risks at Navy Groundwater Sites*

- **Based on review of 32 Phase I sites (12 P&T and 20 in situ remediation sites), surface water nearest receptor for most of the Navy's groundwater plumes – not drinking water wells**
- **Specific P-OPT Findings**
 - **Majority of plumes discharge to surface water (25 of the 32 sites; 78%)**
 - ≤ 600 ft downgradient of 13 sites
 - 600-2000 ft of 6 sites
 - > 2000 ft of 6 sites
 - **Primarily fresh surface water classified as non-potable and mainly used for recreational purposes (e.g., fishing)**
 - **Groundwater discharge zones and natural attenuation processes not always included in conceptual site models**
 - **Rarely were groundwater discharge zones and/or natural attenuation process quantified**

Nature of Risks at Navy Groundwater Sites - Site Example – OU3 NAS Jacksonville



- Groundwater plume migrated through preferential pathway formed by absence of clay layer
- Plume does not discharge to St. Johns River and impact shallow sediment or surface water
- Plume attenuation through sorption onto organic carbon-rich sediments and biodegradation
- Periodic pore water and sediment sampling required to ensure long-term protectiveness of St. Johns River



Profile of TCE concentrations in groundwater and pore water prior to discharge to St. Johns River. Data Source: NAVFAC SE

Nature of Risks at Navy Groundwater Sites

- *Take Homes Messages*



- **Groundwater discharge to surface water nearest receptor at most sites**
- **Attenuation processes observed over relatively small distances at the groundwater/surface water interface (GW/SWI)**
- **Typical settings encountered at Navy sites**
 - **Coastal and wetland settings**
 - **Unique environments and conditions that affect attenuation**
- **Variety of tools available to identify and evaluate flux and attenuation at GW/SWI**
- **Attenuation observed at the GW/SWI interface can be incorporated into overall site management strategy**
- **Once “no unacceptable risk” demonstrated to regulators, passive management strategies can often be implemented for any remaining groundwater plume**

Poll #5



- What metric do you use as a stopping point for LNAPL recovery?
 - State prescribed product thickness (e.g. 0.01 ft)
 - Asymptotic recovery
 - LNAPL transmissivity
 - Other risk-based approach

Portfolio Optimization (P-OPT)

- *Potential for Accelerating RC*

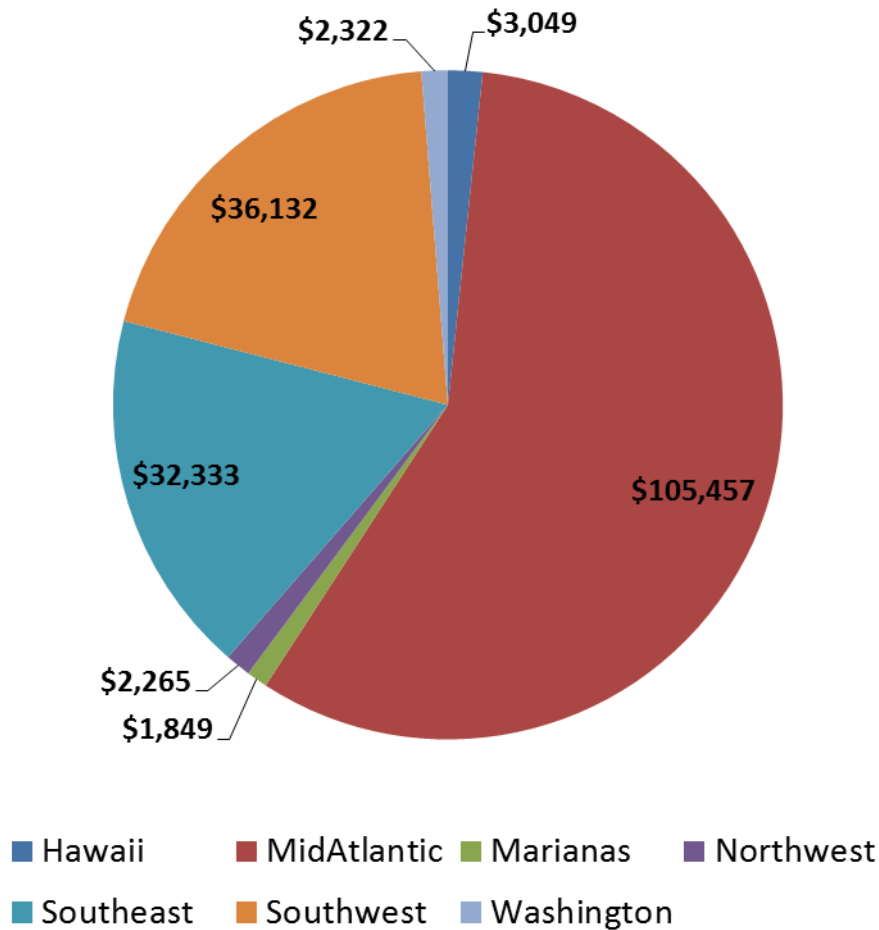


- Achieving SC/RC at most complex sites (e.g. chlorinated solvent DNAPL, fractured rock, multiple contaminants and pathways, etc.) remains significant challenge
- Some sites present opportunities for accelerating RC
 - Petroleum sites are typically low-risk sites in the Navy's portfolio that could be accelerated to RC (need to be reviewed further in Phase 2)
 - A number of states now have guidance for risk-based criteria for closure of petroleum sites and are not relying only on achieving an extremely low thickness (e.g., 0.01 ft) of LNAPL in wells.
 - Rely on LNAPL transmissivity data to evaluate LNAPL recoverability
 - Many Navy legacy sites have old spills that meet these low-risk criteria and continued LNAPL recovery may not be necessary
 - Recent updated Natural Source Zone Depletion (NSZD) conceptual model (avoid potentially high costs tied to continued LNAPL recovery)

Potential for Accelerating RC - Status of the Navy's UST Program



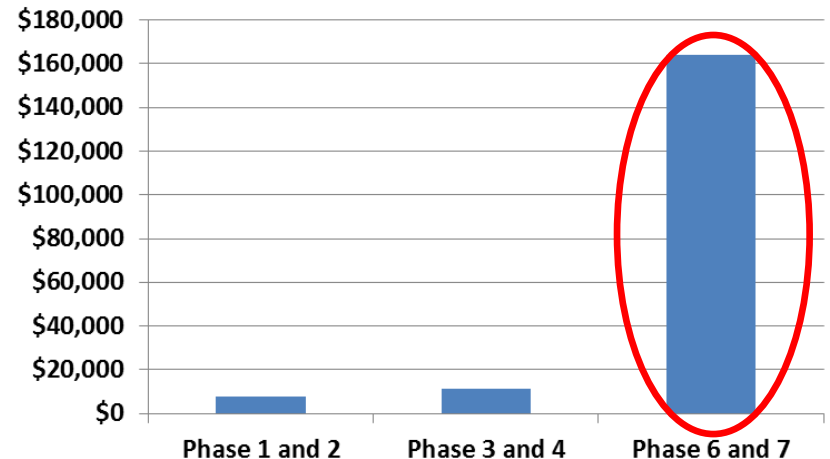
Navy Petroleum Program CTC (\$K)



CTC = \$183.4M Data Source: NAVFAC

- Navy Petroleum CTC \$183M
- Approximately 90% CTC in Phases 6/7
- Long-term costs for petroleum program likely underestimated
- Improved LNAPL conceptual site models needed to evaluate risk exposure and remedial options
- Optimization efforts needed to accelerate RC through risk-based closure options

Navy Petroleum CTC Breakout by Phase (\$K)



Data Source: NAVFAC

Potential for Accelerating RC - *Site Closure Options*



- **Site Closeout (SC) – “Clean Closure” or Cleanup to Unlimited Use/Unrestricted Exposure (UU/UE) and no expectation of expending additional ER,N or BRAC funds at the site**
 - Difficult for most complex sites
 - Possible for small sites and minimal impacts to groundwater
- **Response Complete (RC) – Milestone achieved when all cleanup goals specified in decision document have been met. LUCs and/or LTM can continue after RC.**
 - Reasonable target endpoint for many LNAPL sites
 - Many state UST regulatory programs allow for risk-based closure of sites that would meet DOD requirements for RC
 - Land use controls (LUCs) may be required
- **Conditional Closures or “No Further Action (NFA)”**
- **Reuse of LNAPL contaminated land is quite common**

Potential for Accelerating RC - *Take Home Messages*



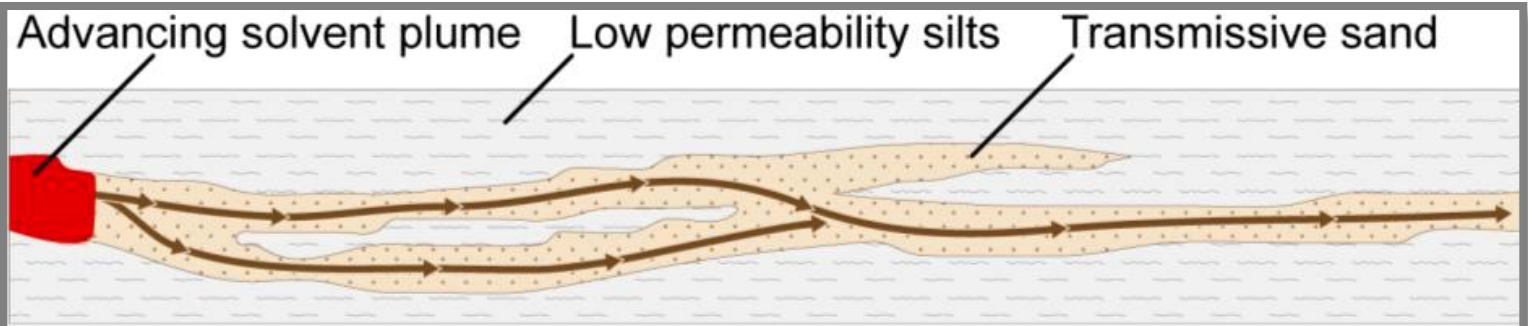
- **Potential for accelerating RC at LNAPL sites**
 - **Several states have risk management options for managing LNAPL in place for low risk sites**
 - “..Free product removal is not technologically feasible or cost-effective, and; Free product is not migrating and does not pose a risk to human health, public safety or the environment” (Draft FDEP 62-780 August 2017)
- **Updated tools are now available to better manage LNAPL sites**
 - **LNAPL transmissivity for evaluating product recoverability**
 - **New tools to measure NSZD rates at field sites**
 - **New Developments in LNAPL Site Management -**
https://www.navfac.navy.mil/content/dam/navfac/Specialty%20Centers/Engineering%20and%20Expeditary%20Warfare%20Center/Environmental/Restoration/er_pdfs//navfacexwc-ev-fs-1709-newdev-lnapl-201704.pdf
- **Many state UST regulatory programs allow for risk-based closure of sites that would meet DOD requirements for RC**
 - **Free product recovered to extent technically feasible**
 - **Plume stability**
 - **No uncontrolled VI issues**
 - **Land use controls (LUCs) may be required**

Poll #6

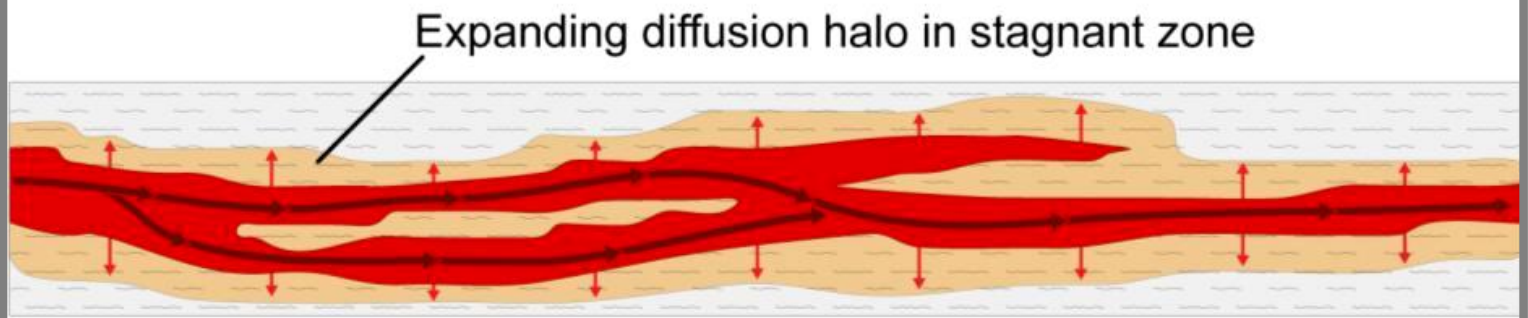
- **Do you include matrix diffusion into the CSM at your groundwater sites?**
 - Yes
 - No
 - Depends on site characteristics
 - Never heard of

Portfolio Optimization (P-OPT) - *Back Diffusion from Low Permeability Media*

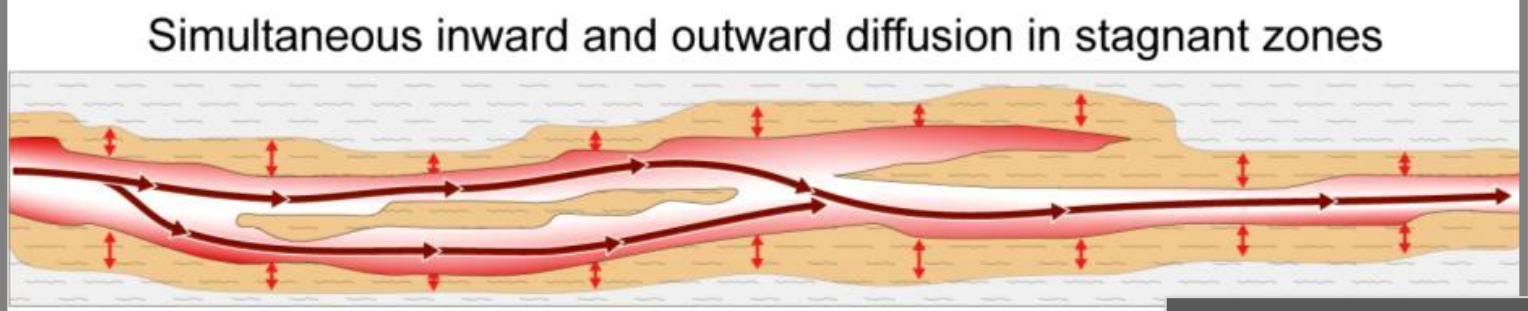
Initial Release



Loading Stage



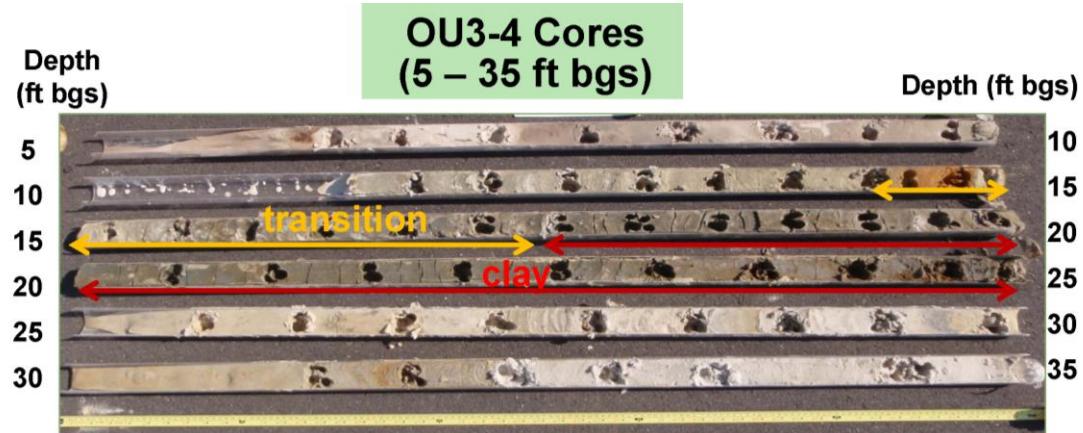
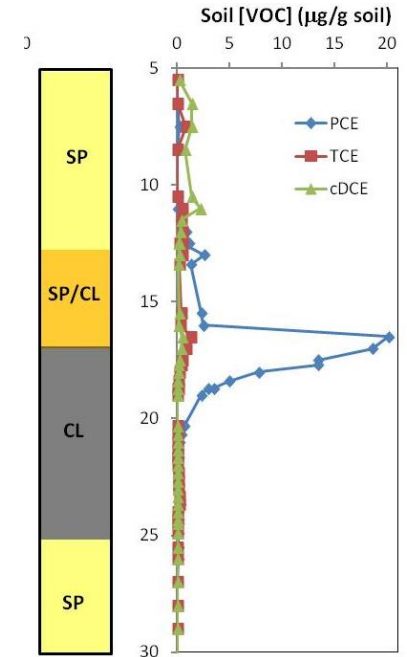
Back Diffusion Stage



Back Diffusion from Low Permeability Media - Source Zone Example – OU3 NAS Jacksonville



- High resolution site characterization (HRSC) tools used to delineate chlorinated solvents diffused into low permeability layers
- Contaminants stored in clay can act as long-term source following active treatment
- Options for managing long-term diffusive flux from low permeability units
 - Natural attenuation
 - Sustained treatment at clay interface
 - Aggressive treatment?

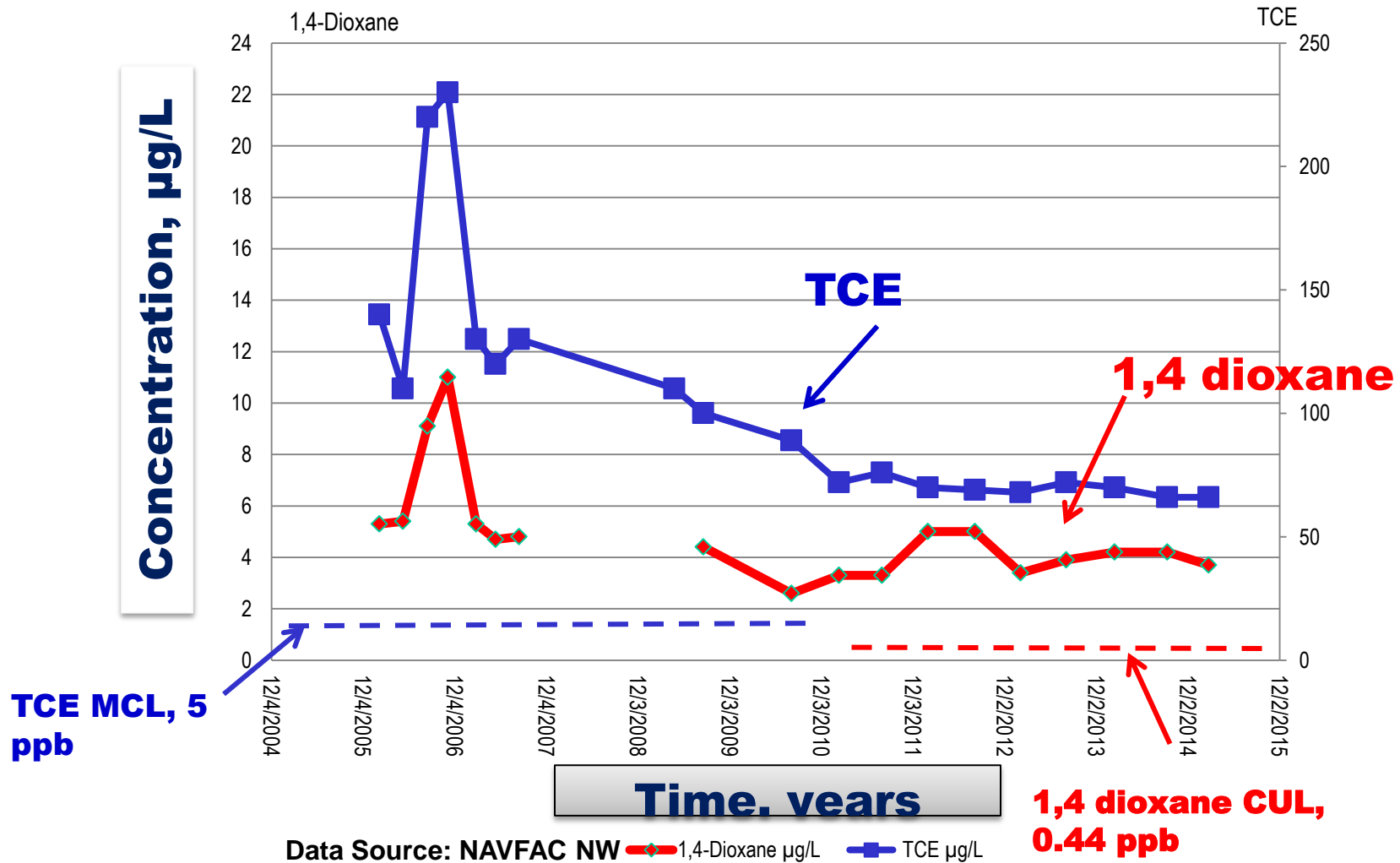


Data Source: NAVFAC SE

Back Diffusion from Low Permeability Media - Dissolved Plume Example – OU6 NAS Whidbey Island



P&T for TCE – 1997 and 2014



Back Diffusion from Low Permeability Media

- *Take Home Messages*



- Matrix diffusion is the main factor that prevents dilute plumes from receding quickly as the original source depletes
- Dilute plumes with low concentrations throughout the plume and source area present challenges for remediation
- Path forward for dilute plumes depends on the risk posed to downgradient receptors and from any vapor intrusion potential
- Determining plume stability is a key consideration
- Matrix diffusion is difficult to overcome through aggressive measures
- A renewed case for MNA can be supported by new tools
- Low-threat closure guidance from states may be an option in some cases

Poll #7

- **What is the primary objective of your P&T system?**
 - Mass treatment to reach MCLs
 - Hydraulic containment
 - I don't know
 - Don't have any P&T systems

Portfolio Optimization (P-OPT) - *Aging Pump and Treat Infrastructure*

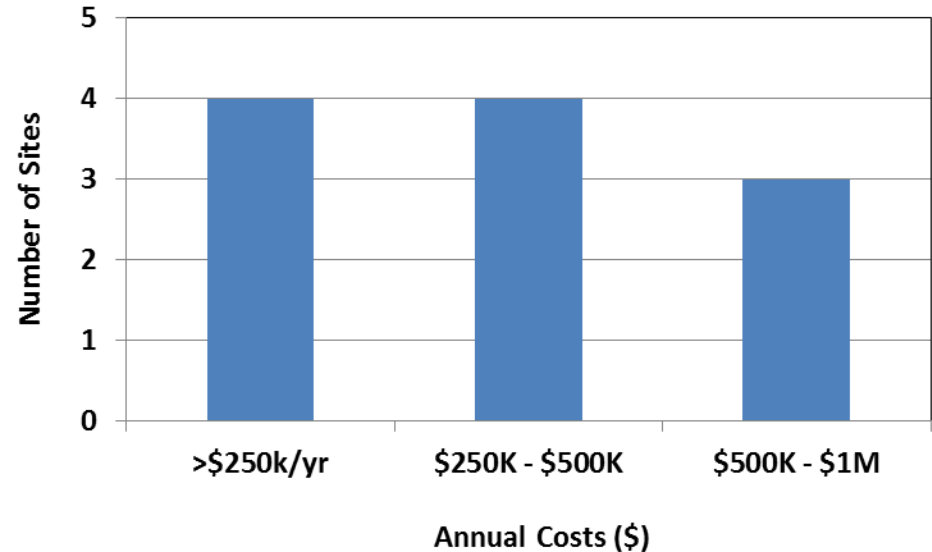


- Ten of 11 P&T systems more than 15 years old
- Five of 11 P&T systems more than 20 years old
- Oldest built in 1992 (NIROP Fridley, MN)
- Aging infrastructure may cause plume bypass of P&T systems, not inadequate number of wells
 - Declining extraction rates
 - Extraction well fouling
 - Pump failure
 - Aboveground system failures (piping, trenching systems, treatment operations)

Aging Pump and Treat Infrastructure - *Take Home Messages*



- Navy needs to systematically rehabilitate or replace aging infrastructure
 - Well replacement costs > preventative maintenance costs
- Transition P&T systems to passive management when possible
 - NWIRP McGregor (P&T to bio-barrier in progress)
- Well maintenance to remove biomass and precipitates, fine particle migration into filter pack
 - Additives
 - Backwash/Re-development
 - Rehabilitation
 - Screen replacement
- Production Well Construction and Maintenance Guide -
https://www.navfac.navy.mil/content/dam/navfac/Specialty%20Centers/Engineering%20and%20Expeditio%20nary%20Warfare%20Center/Environmental/Restoration/er_pdfs/p/navfacexwc-ev-fs-1708-prodwellmaintenance-201704.pdf



Breakdown of Annual O&M Costs for 11 P&T Systems (Data Source: NAVFAC)

P-OPT Phase 2 Site Selection Criteria

- 1. Sites with high CTC and RC > 2021**
 - A. Objective is to reduce CTC**
 - B. Phase 1 shows that P-OPT approach can have a huge impact**
 - C. Also, sites with biggest increase in CTC identified during VTCs**

- 2. Sites that could be accelerated to RC by 2021, with P-OPT support**
 - A. Petroleum sites**
 - B. Chlorinated solvent sites that meet certain criteria for low-threat closure**
 - C. Landfill sites with (proven) stable groundwater plumes**
 - D. Sites identified in audit readiness with RC < 20201 and high CTC (will the planned new investments truly achieve RC?)**

Example Criteria 2 Sites (Potential RC Acceleration)

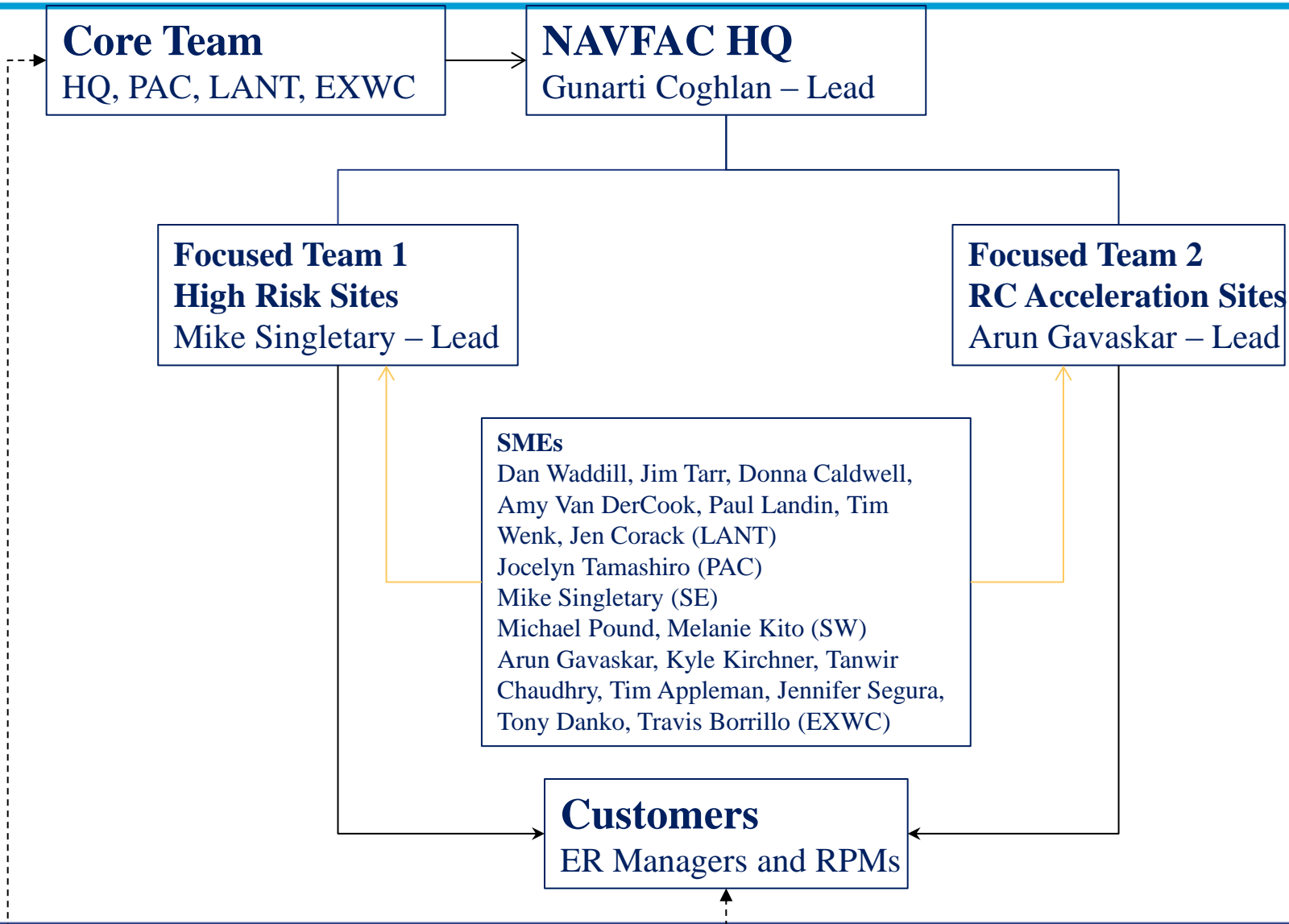
- **Sites with primarily petroleum contamination and free product levels < 1 ft in all wells**
 - Once these sites are identified, SMEs can see if benzene plumes are stable (likely), no emerging contaminant issues, etc.
 - Is it under CERCLA or State petroleum program?
 - Leverage state's low-threat closure criteria
- **Sites with groundwater containing low chlorinated solvent levels (TCE < 100 ppb; DCE < 100 ppb, but VC below 10 ppb)**
 - SMEs will further screen to see if CVOC levels are at an asymptote, plume is stable, other low-threat closure criteria, etc.
 - Plumes are wholly on Navy property
 - Doesn't matter what remedy is being implemented
 - Leverage state's low-threat closure criteria
- **Sites with RC < 2021 and high CTC**
 - Identified through audit readiness exercise

Example Criteria 2 Sites (Cont.)

- **Landfill sites**
 - Landfill is capped
 - Any resulting groundwater plume is stable based on at least 5 years of LTM data
 - Groundwater has been tested for emerging contaminants (1,4-dioxane, PFAS, etc.)

- **Sites with RC < 2021 and high CTC**
 - Identified through audit readiness exercise

P-OPT Phase 2 IRP Teams



P-OPT Phase II Sites



Complex Sites

JBPHH Site 31 (Aiea Laundry)
JBPHH Site 39 (Onizuka Village)
St Julian's Creek (Site 2)
Newport RI NETC Site 24
Yorktown Site 3
Yorktown Site 6
Yorktown Site 31
Parris Island Site 16
Parris Island Site 45
Portsmouth Site 3
Williamsburg Site 7
Beaufort UST 16
Newport Site 7
Newport Site 10

Whidbey Island Site 56
Corpus Christi SWMU 5
Whiting Field Site 40
NB San Diego Site 22
Yuma Site 19
Camp Pendleton Site 6
Seal Beach Site 70
Indian Head Site 4
Indian Head Site 66
Camp Lejeune (all other sites)

RC Acceleration Sites

Parris Island Site 1
Norfolk UST 1
Corpus Christi UST 9
Camp Pendleton Site 7
NB San Diego Site 1
29 Palms UST 10
Camp Pendleton UST 13
Quantico Site 102
Quantico Site 95
Cherry Point (USTs)
Oceana (USTs)
Camp Lejeune (USTs)
Barrow (Petroleum Sites)
Mayport (SWMUs)
Fallon (USTs)
NRTF Driver Site 1
NAS Fallon Site 20
Anacostia Site 15B
Camp Pendleton Site 1118
NAS Lemoore Site 14

Questions



Wrap Up



- **Please complete the feedback questionnaire at the end of this webinar. We are counting on your feedback to make this webinar series relevant!**
- **Next OER2 Webinar Info....**
Title: Advances in Microbial Characterization of MNA & Bioremediation
Presenter: Dr. Anthony Danko, NAVFAC EXWC
Date: November 15 2017
Time: 1100 PST
- **Thank you for participating!**