Headquarters U.S. Air Force

Integrity - Service - Excellence

REMEDIAL PROCESS OPTIMIZATION

U.S. AIR FORCE

Presented by

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Technology Transfer Div.

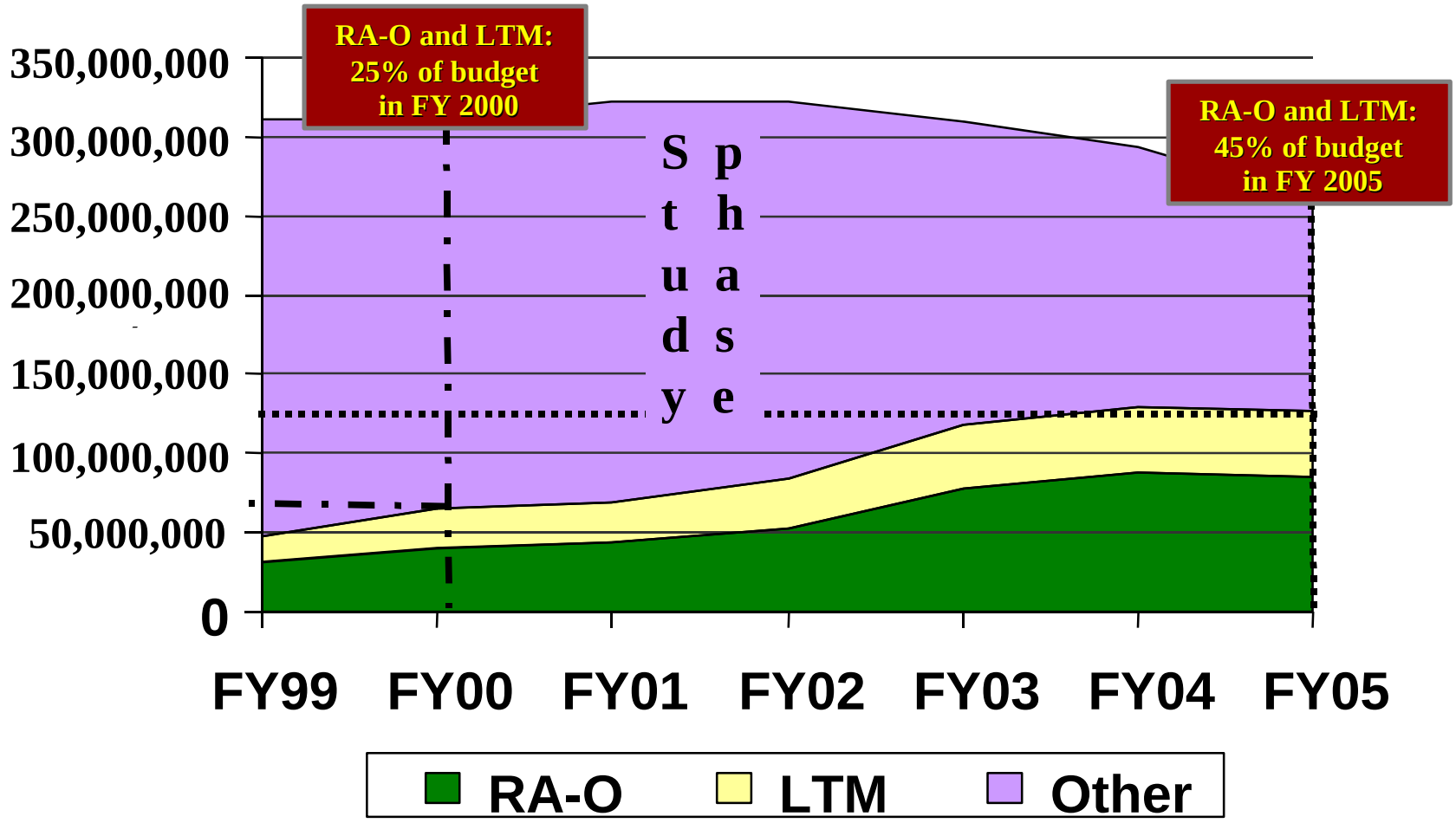
Environmental Restoration

U.S. AIR FORCE

Overview

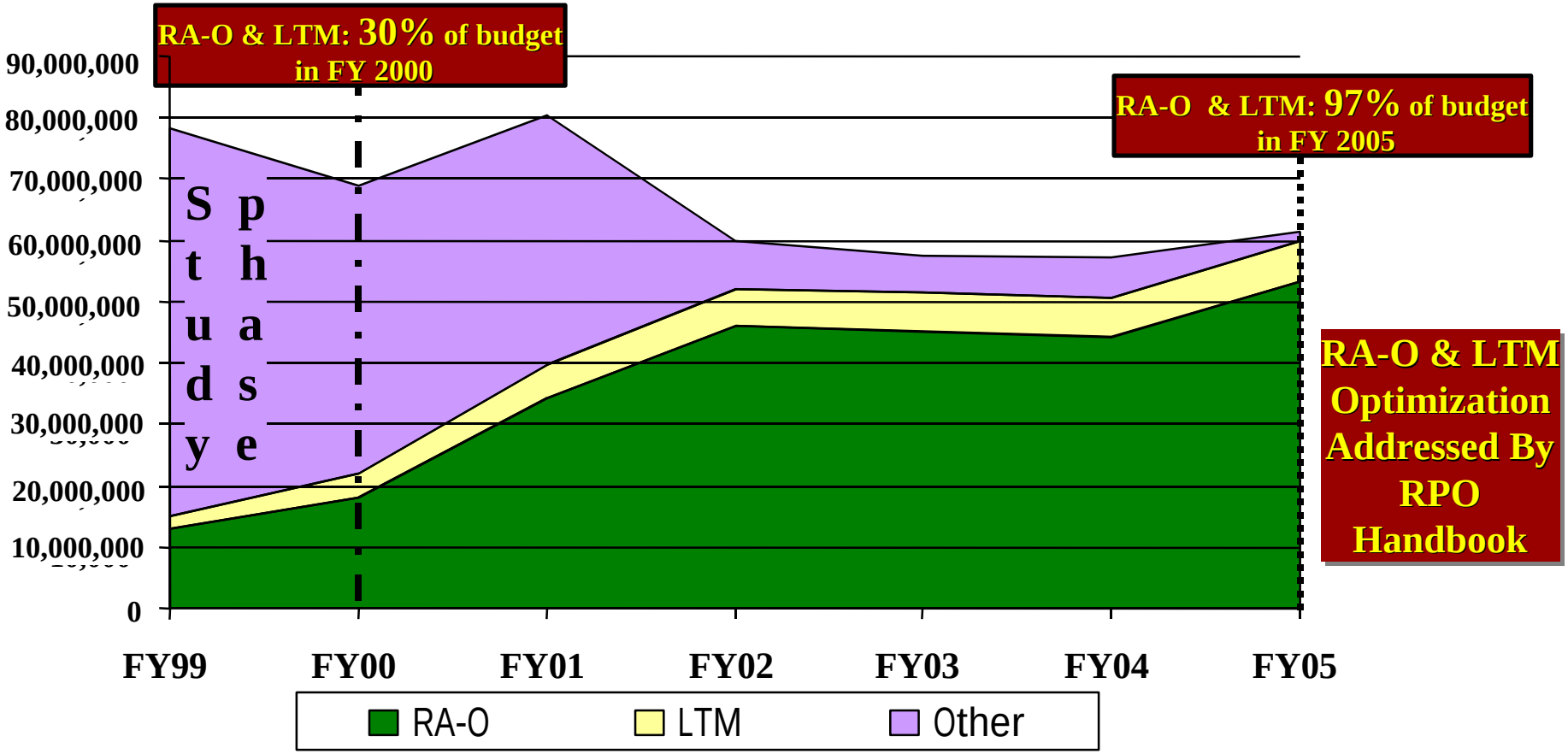
- AF Cleanup Status & Process
- What is RPO?
- Who Assisted in developing RPO?
- RPO products
- RPO beta tests and early results
- Future work

Cleanup over time Active AF Sites



FY 2001 President's Budget IRP Program AF ERA Restoration Budget w/o Mgmt & Support Costs

Cleanup over time BRAC AF Sites



FY 2001 President's Budget IRP Program AF BRAC Restoration Budget w/o Mgmt & Support Costs

Air Force Total Estimated 2005 RA-O & LTM Cost

~$ 200,000,000

RPO Workgroup Makeup

Nov 1997 - Oct 1999
Dave Becker, Marty Faile, LtCol Welch, Kathy Yager, Doug Zielmer

- **EPA: FFRRO, QAD, OSW, TIO**
- **Army: USACE, AEC**
- **Navy: NFESC**
- **Defense Logistics Agency**
- **USGS**
- **Air Force: ILEV, AFBCA, AFCEE**
- **AFCEE Contractors (Parsons, GSI, Mitretek)**

Cooperative Participation of Agencies Does not Necessarily Indicate Agency Approval

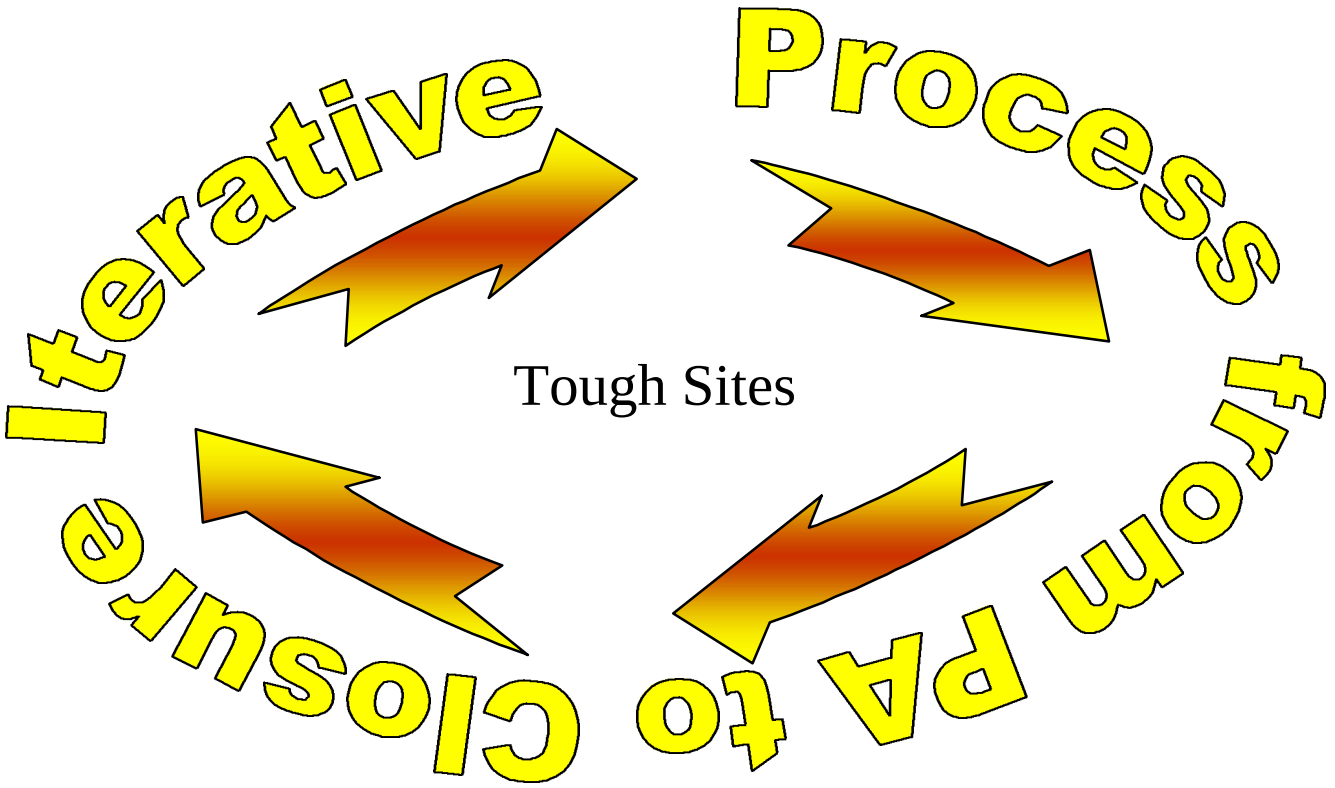
Other DoD RPO Equivalent

- USCOE - Dave Becker
  - Remedial System Evaluation (RSE)
- NFESC - Doug Zielmer
  - Pump & Treat Optimization Program
- EPA/TIO - Kathy Yager
  - Pump & Treat Optimization Model Study & Guide

Cleanup Process

PA þ SI þ RI þ FS þ RD þ RA þ LTM þ Closure

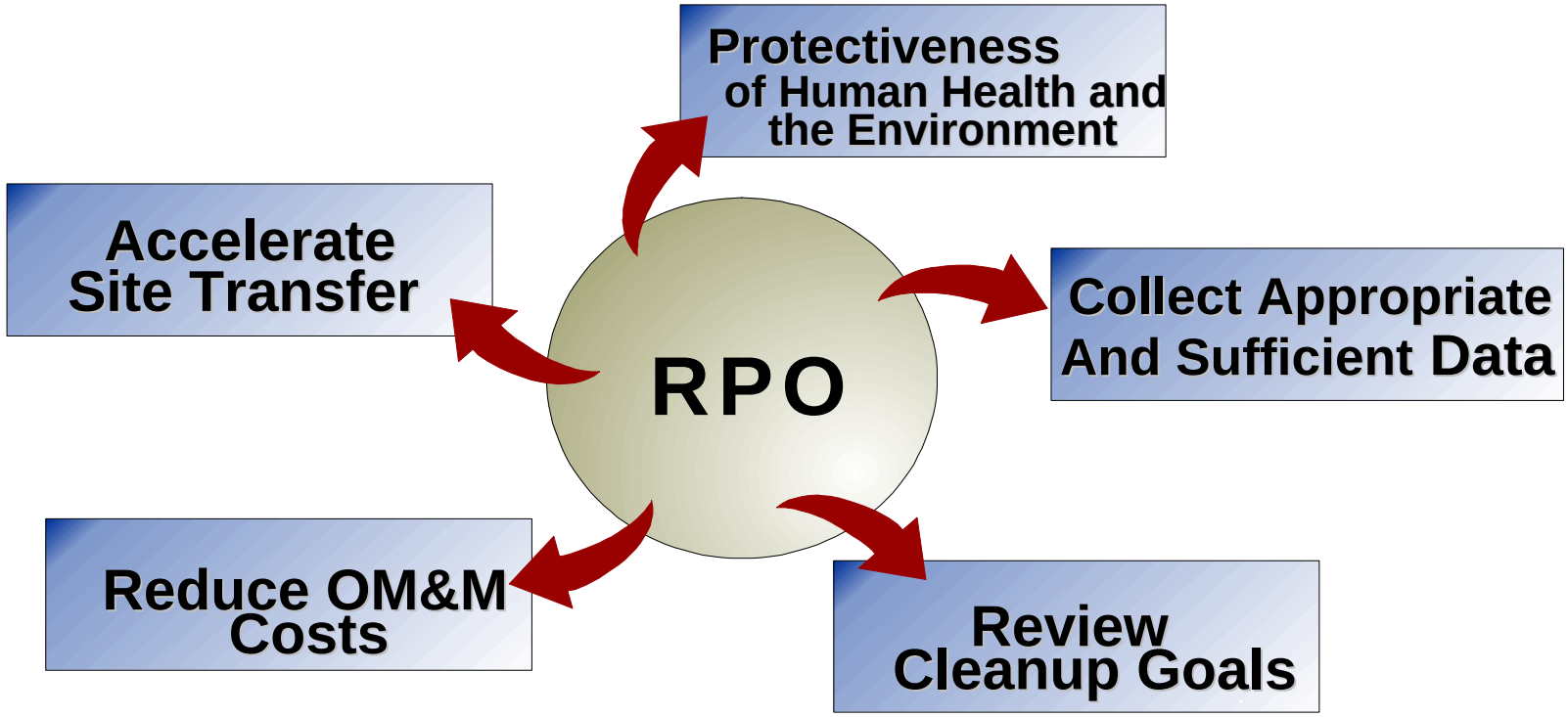
Linear Approach Adequate for Easy Sites (most easy sites are closed)



IRP Cleanup Process

RPO Applies to CERCLA as DQOs Apply to Data Collection

RPO Objectives



RISK PROTECTIVE - COST EFFECTIVE - SITE CLOSEOUT

CONTROL RISK - REDUCE COST - GET THERE SOON

Remedial Process Optimization (RPO)

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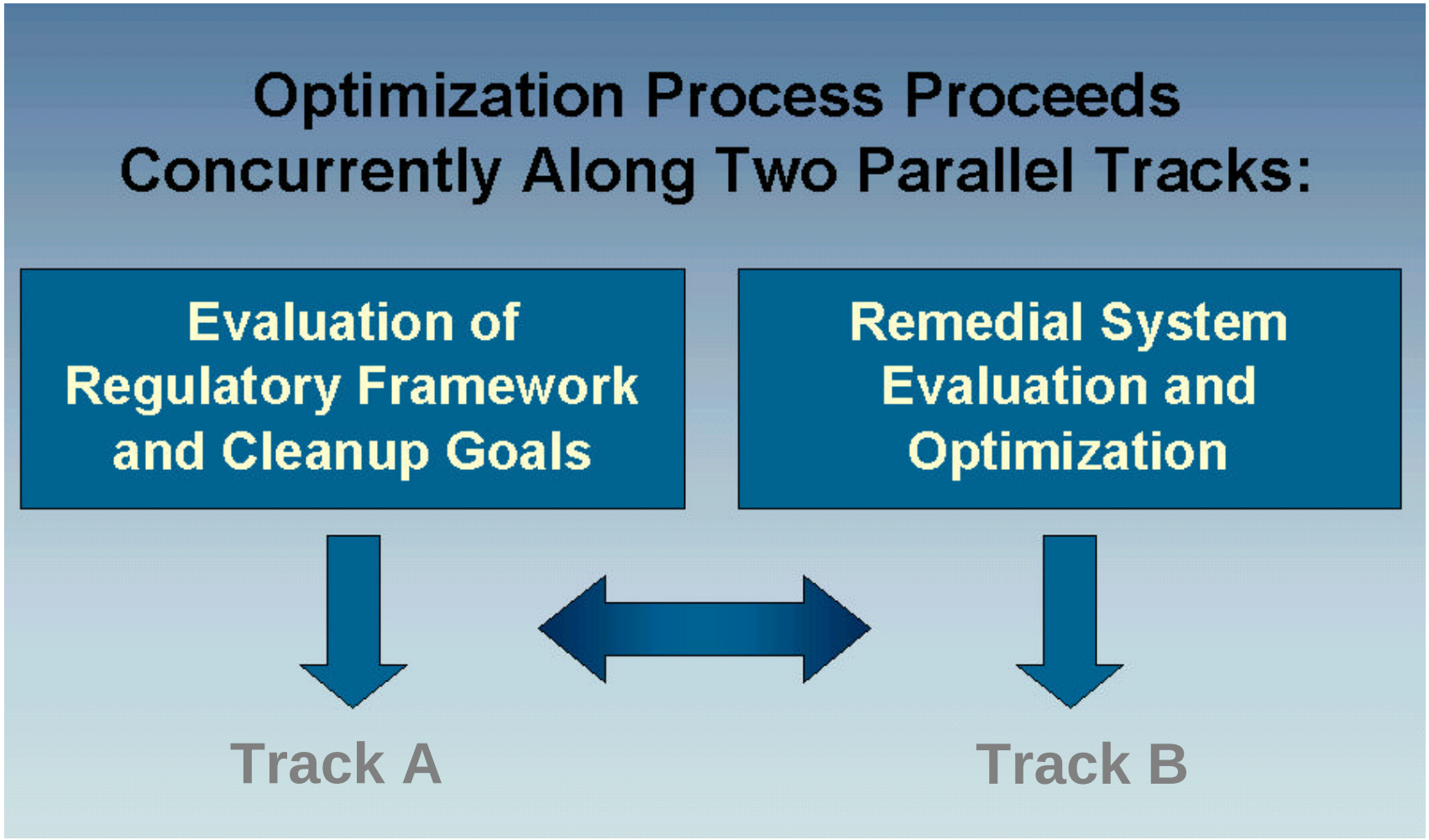
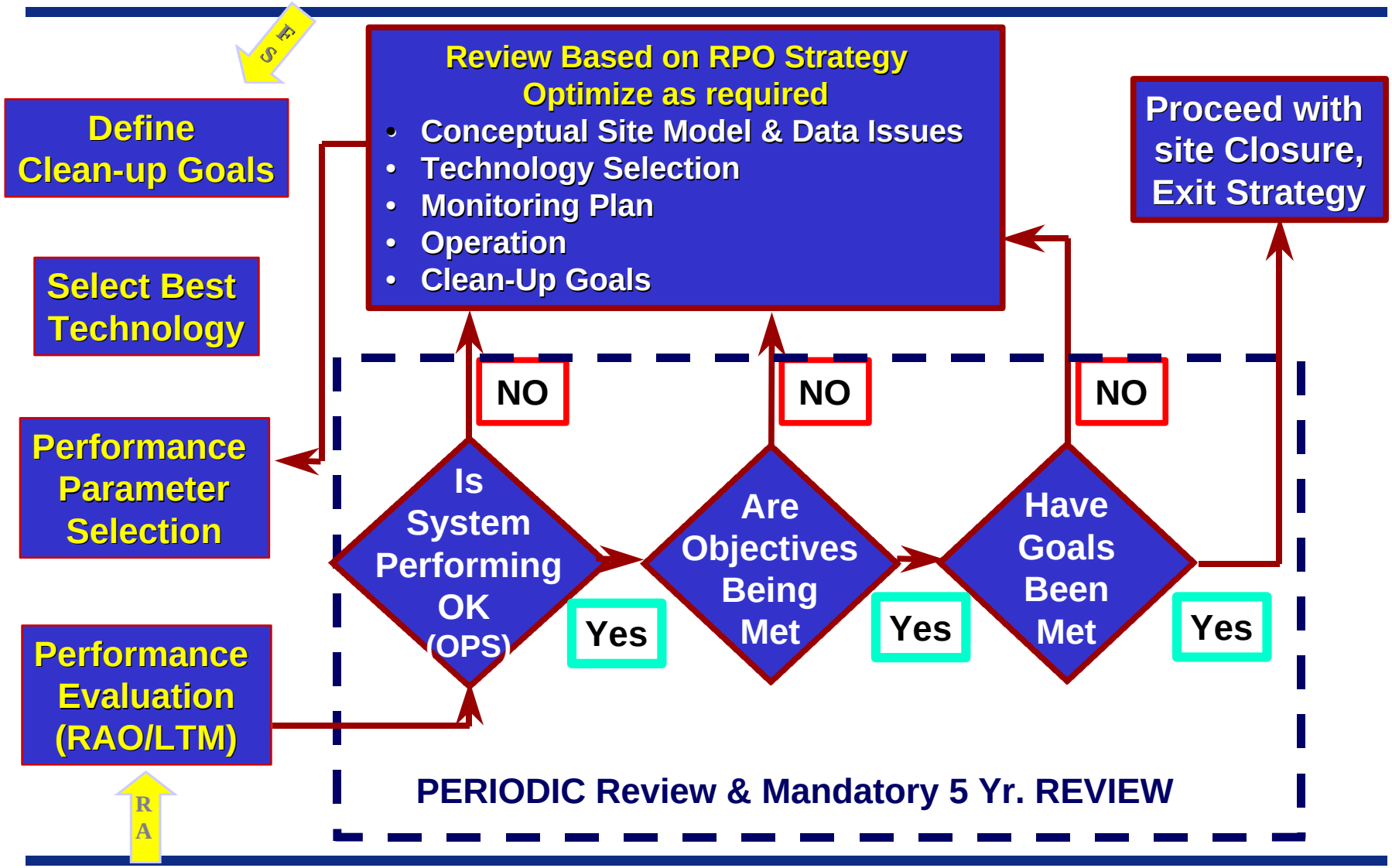
DEFINITION

- **Remedial Process Optimization**
  - **Systematic Planning**
    - **Iterative evaluation to provide technical feedback and update the decision process**
  - **Systematic Planning Promotes**
    - **Effectiveness:**
      - **Goals developed, updated, and met**
    - **Efficiency:**
      - **Classical Optimization of RA-O & LTM**

RPO Tracks


Optimization Process Proceeds Concurrently Along Two Parallel Tracks:
Evaluation of Regulatory Framework and Cleanup Goals
Remedial System Evaluation and Optimization
Track A
Track B

RPO Chart


S E
Define Clean-up Goals
Select Best Technology
Performance Parameter Selection
Performance Evaluation (RAO/LTM)
R A
Review Based on RPO Strategy
Optimize as required
• Conceptual Site Model & Data Issues
• Technology Selection
• Monitoring Plan
• Operation
• Clean-Up Goals
Proceed with site Closure, Exit Strategy
NO
NO
NO
Is System Performing OK (OPS)
Are Objectives Being Met
Have Goals Been Met
Yes
Yes
Yes
PERIODIC Review & Mandatory 5 Yr. REVIEW

RPO Strategy Components

1. **Evaluate the accuracy of CSM, the appropriateness of clean-up goals, and established DQOs**
2. **Assess the potential for the remedial design and/or remedial action to meet clean-up goals**
3. **Establish decision rules, and decision trees to update clean-up goals, technology selection, performance evaluation, etc.**

RPO Strategy Components

4. **Optimize Remedial Action Operations (RA-O) and performance monitoring or Long Term monitoring (LTM)**
5. **Verify that field and analytical procedures meet DQOs**
6. **Streamline and standardize data management**
7. **Create cleanup-team incentives that promote accelerated closure without compromising risk protectiveness**

RPO Guidance

- **Guidance**
  - **Remedial Process Optimization Handbook**
    - **Technology Review Checklists (USACE)**
    - **RPO Field Procedures and Quality Assurance Handbook**
    - **Performance Evaluation Tools**

http://www.afcee.brooks.af.mil/er/erproducts.htm

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RPO Tools

- **Tools - Development and Evaluation**
  - **Diffusion Samplers (USGS, AFCEE, NFESC, USEPA, ITRC)**
  - **Remote Sensors (AFCEE, EPA-TIO & OSW)**
  - **Monitoring and Remediation Optimization System (MAROS)**
  - **Vertical Profiling (PneuLog)**

http://www.itrcweb.org/common/default.asp

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RPO Handbook Contents

- Introduction
  - Purpose
  - Benefits
  - RPO Overview
- Phase I Evaluations
- Phase II Detailed Evaluations
- Phase III Implementation of Recommendations
- Appendices

RPO Handbook Contents

- **Appendices**
  - **References**
  - **Example of RPO Statement of Work**
  - **USACE Remedial Systems Evaluation (RSE) Checklists**
  - **AFCEE LTM Guide**
  - **AFCEE RPO Field Procedures and QA Handbook**
  - **Performance Tracking Tool**

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Remedial Process Optimization Scoping Visits (RSVs)

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Purpose of RSVs

- **Basewide review to identify RPO opportunities**
  - **Process: review documents, visit sites, and interview personnel**
- **Focus on sites with on-going Remedial Action operation, maintenance, or monitoring**
- **Identifies opportunities to implement the RPO strategy**
- **RSV Product**
  - **RPO Scoping Report**
- **RSV "jump-starts" the base RPO Phase I program**

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RSV Recommendations

Zone	Site ID	Name	STC/ CTC	CSM	Cleanup Goals	Decision Rules	Alt. Tech	Mon Opt.	System Opt.
1	D-2	Landfill							
1	D-4	Landfill				●			●
1	D-5	Landfill				●			●
1	GW 1	Ground Water Zone 1	●		○	●			
2	E-1	Chem Evaporation Pit	●			●	▲		
2	E-3	Evaporation Pit				●			
2	GW 2	Ground Water Zone 2	●		○	●			
3	S-8	UST/Spill Site	●	●		●			
3	MP	Metal Plating Shops	●			●			
3	S-4	Fuel Spill Area	●			●		▲	
4	GW 4	Ground Water Zone 4	●	●		●	▲		
5	S-1	Oil/DRMO Storage	●	●	●	●			
5	A1500	Jet Fuel Spill			●				
5	GW 5	Ground Water Zone 5	●	●		●	▲	▲	●

● Opportunity now ○ Opportunity (low payoff) ▲ Out year opportunity

RPO Phase II
Beta Tests Results

Eielson AFB LTM Study - 1998

Short-Term Opportunities to Optimize	Implementation Cost	Annual Cost Avoidance	Life Cycle Cost Savings 30 Yr.	Time Savings	Difficulty of Implementation
Plume Stable Reduce Sampling Frequency: 1. VOCs to Annual & 3 Years 2. Metals to Annual & 5 Years	$ 30K	$196K	$ 5.8 M	None	Moderate (Was approved by regulators and implemented in 1998)

Estimated Cost of Eielson LTM Study = $ 60K

George AFB RPO Study - Oct 99

Short-Term Opportunities to Optimize	Implementation Cost	Annual Cost Avoidance After Implementation	Life Cycle Cost Savings	Difficulty of Implementation
Remove 11 of 18 wells	$ 150K	$90K	$8.3M	Moderate Partially Implemented
Terminate air-stripping	$ 90K	$60K	$6.0M	Moderate
Optimize RA-O	$ 120K	$70K	$2.1M	Low
Total	$ 260K	$220K	$16.4M	

Cost of George RPO Phase II Study = $ 122K

6 mg/L ~ 22 g TCE/day ~ 1.5 Tbl spoons/day ~ $40,000/lb TCE

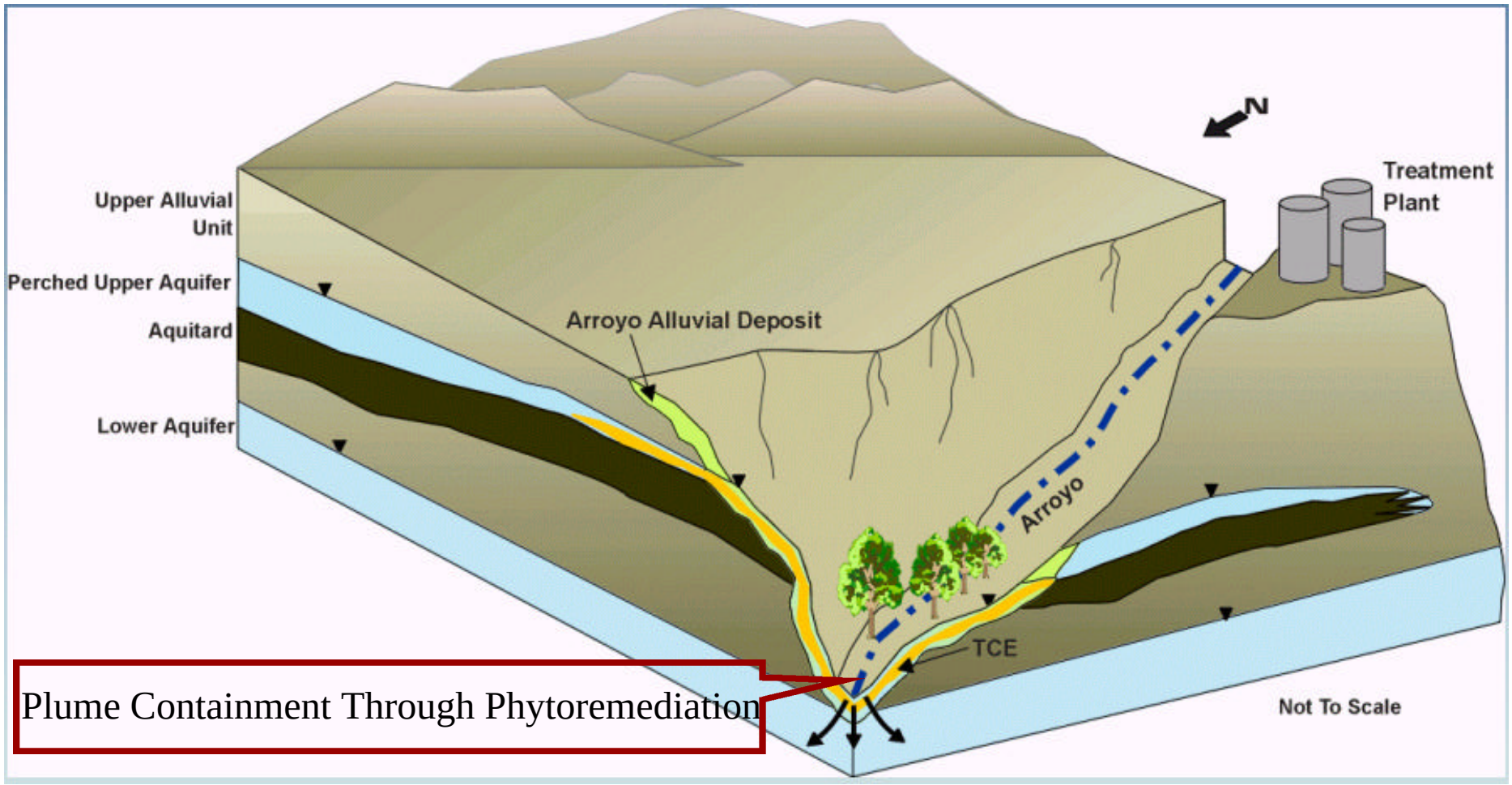
George AFB
RPO Final Report

Long-Term Optimization Opportunities	Implementation Cost	Annual Cost Avoidance after Implementation	Life Cycle Cost Savings	Difficulty of Implementation
Evaluate MNA & Phytoremediation / terminate pump and treat system	$190K	$180K	$16M	High (To Be Discussed at BCT Meeting)
Refine hydrologic model / terminate all or part pump and treat system	$250K	$150K	$14M	Moderate to High

Cost of George RPO Phase II Study = $ 122K

6 mg/L ~ 22 g TCE/day ~ 1.5 Tbl spoons/day ~ $40,000/lb TCE

George AFB



Plume Containment Through Phytoremediation

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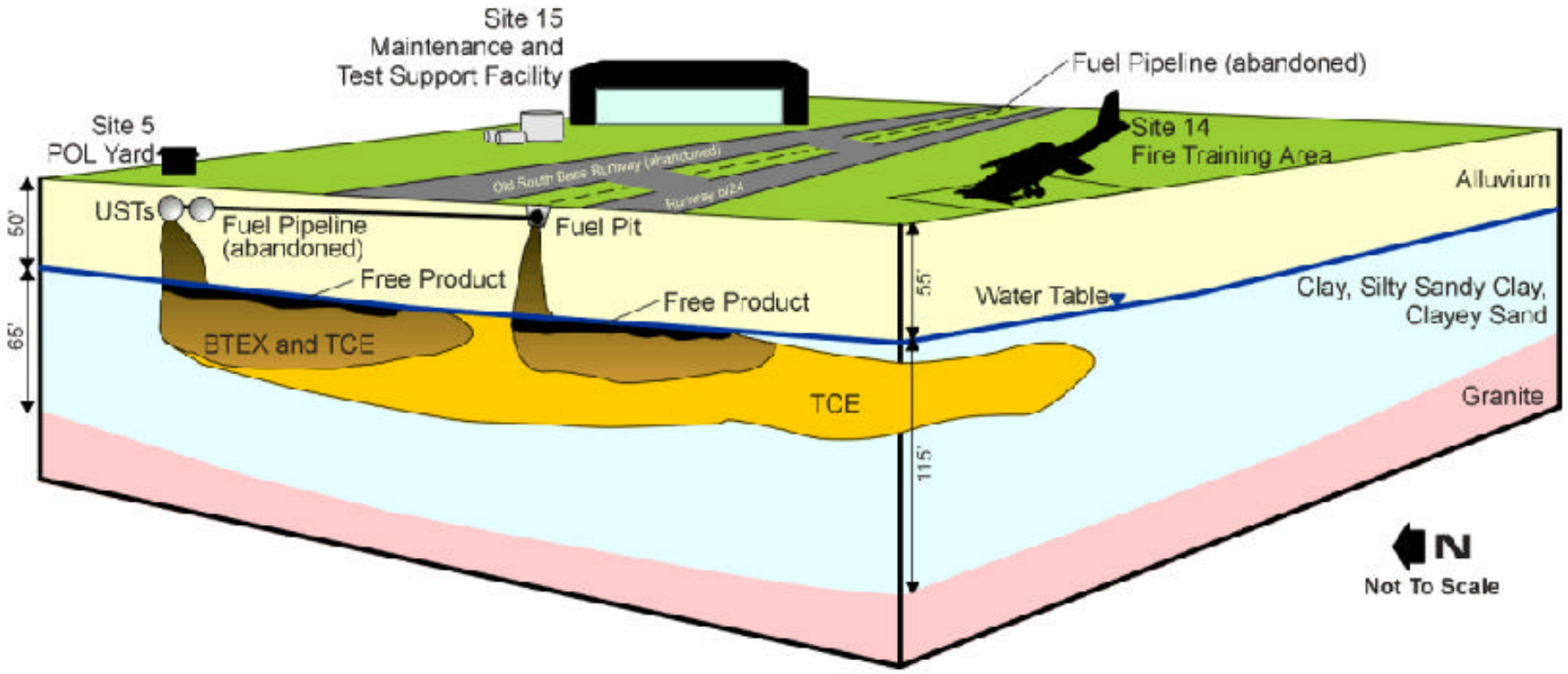
Edward AFB
RPO Final Report

OPPORTUNITY TO OPTIMIZE SITES 5/15	Implementation Cost	Annual Cost Avoidance after Implementation	Cost Savings over Project life Cycle 30Yr	Change in time to meet Cleanup Goals	Difficulty of Implementation
Develop proposal for TI Waiver -	$ 120 K	$ 365K	$ 10.9M	Reduced > 30 yr.	High
Establish site specific risk-based cleanup goals	$ 100K	TBD	TBD	TBD	High – Linked to TI Waiver
Enhanced TCE biodegradation	$ 90K	$ 125K	$ 3.8M	Reduced ~ 10 yr.	Moderate (Implemented Summer 2000)
Implement Bioslurper technology	$ 300K	$ 150K	$ 3.0M 20 Yr operation	Some reduction ~ 10 %	Low

Cost of Edwards RPO Phase II Study = $ 112K

Edwards AFB Site 5/15 Conceptual Site Model



Tinker AFB
RPO Final Report

- **Evaluated TCE Source Under Bldg. 3001**
- **Pump and Treat system is containing plume and removing ~130 lb VOC per month.**
- **This RPO SVE Pilot Study recovered 517 lb of VOC in 6 days.**
- **A further six month SVE continuous operation evaluation requested by the installation**

Tinker AFB
RPO Final Report

- Estimated VOC mass removal expected **15,500lb**
  - Equivalent to 10 yr. P&T (at 130lb/month)
- **6 Month Pilot Test Goals**
  - Assess the impact of SVE-VOC removal on:
    - Plume Dynamics
    - Plume life expectancy above ARARs

Kelly AFB
RPO Final Report

- Determined that P&T system was not capturing plume
  - Contamination entering Leon Creek
- Proposed Solution
  - Extraction trench (Cost $430K)
  - Reactive Barrier - i.e. Fe (Cost $3.3M)

McClellan AFB RPO Final Report

- P&T System containing plume
- SVE operation optimized
- Recommendations
  - Replace catalytic oxidation with GAC $42K/yr
  - Optimize P&T shut-down 3 wells $24K/yr
  - Optimize SVE and GW monitoring $33K/yr
  - Potential savings $99K/yr
- McClellan RPO study cost $232K

Other DoD Installations Under RPO Evaluation

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AF Installations

- Eielson AFB
- Elmendorf AFB
- Tinker AFB
- Hill AFB
- 2 AFBCA Bases
- 4 AFMC Bases
- Dover

DLA Installations

- DDHU
- DDJC- Sharpe
- DDJC-Tracy
- DDMT
- DSCR
- DDC

Completed or in Progress **Starting in FY01**

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RPO

TOOLS

FY2001 Scheduled Tool Development Activities

	PARTNER
■ Remote Sensor assessment	- EPA
■ Diffusion Sampler (inorganics, MNA)	- USGS
■ Diffusion Samplers (VOC) Implementation	- ITRC, EPA, USGS, DLA NFESC
■ MAROS Beta Test	- EPA
■ Hands On Training	- Multi

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Thank You for Listening

Questions & Answers

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If you have any questions or require RPO assistance

Contact the HQ AFCEE/ERT RPO POC

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