Financial Aspects of Optimization

Estimating Cost Savings from the Optimization of Long-Term Monitoring Programs at U.S. Air Force Bases

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Overview

- Optimization approaches used at USAF Sites
- Methodology for estimating cost savings under an optimized monitoring program
- Case studies and examples
- Lessons learned and next steps
- Questions and answers

LTM Optimization Approaches Used at Air Force Sites

- **AFCEE Long-Term Monitoring Optimization Guide** - provides general guidance on conducting LTM optimization studies
- **Monitoring and Remediation Optimization System (MAROS)** - a decision support software tool that uses statistical methods applied to site-specific data
- **Geostatistical Temporal/Spatial (GTS) Algorithm** – used to identify spatial and temporal redundancies in existing monitoring networks
- **Other methods**

Geostatistical Temporal/Spatial (GTS) Algorithm

- **Inputs** – Site- or plume-specific information such as:
  - Well ID and location
  - Sample date
  - Constituents of concern, measurement value, and quantitation limit
  - Screen depth, interval, aquifer zone and
  - Other relevant information.
- **Process** – Use statistical and geostatistical methods to identify spatial and temporal redundancies in an existing monitoring network
- **Outputs** - Optimized monitoring plan that indicates specific wells to be sampled and their sampling frequency
- **Cost Savings** – 30 to 60 percent

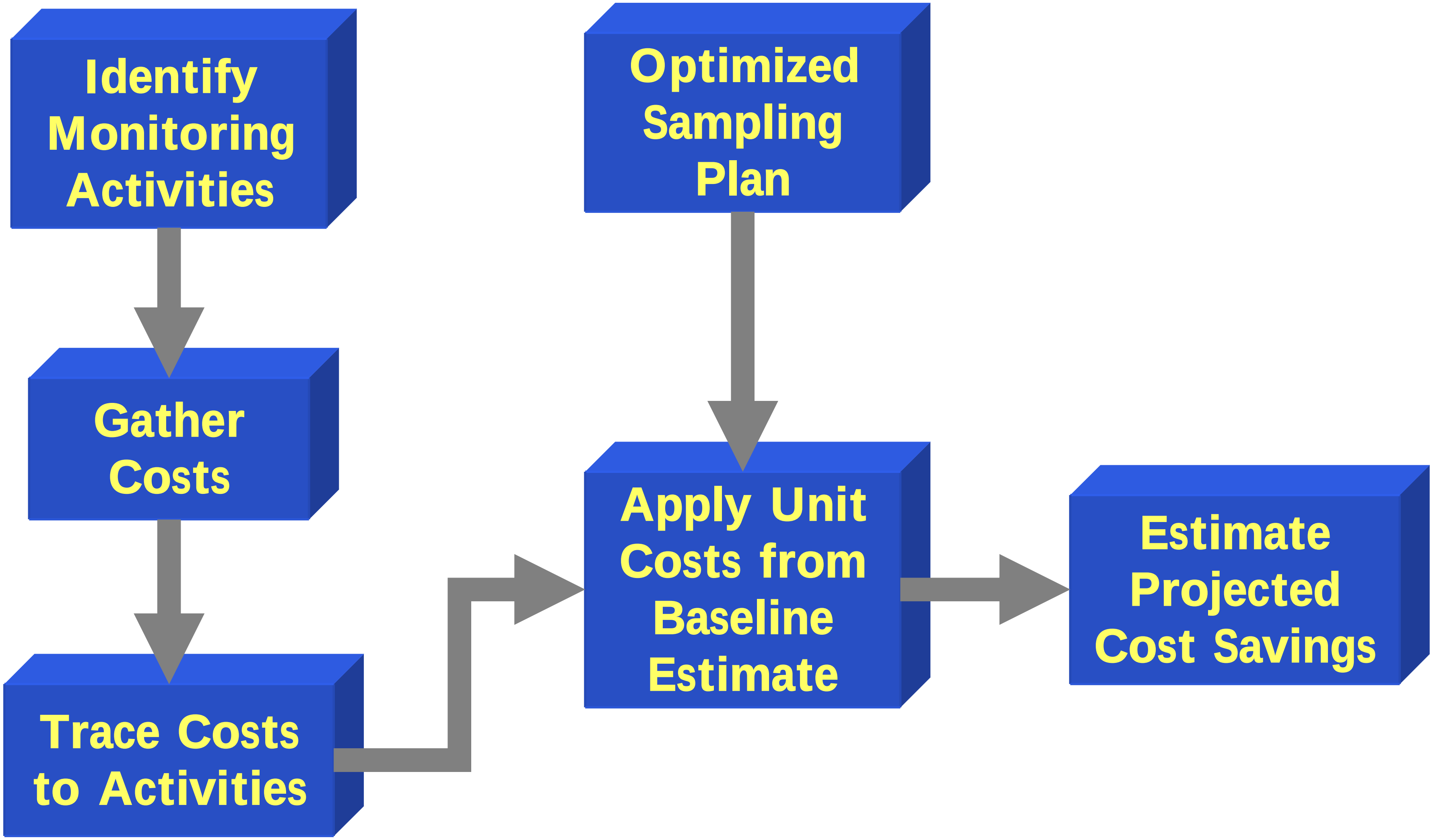
Estimating Cost Savings

Objective

- Estimate cost savings – on an average annual basis - projected under the optimized monitoring program

Approach

Baseline Costs ***Optimized Program Costs***



Estimating Baseline (Current) Monitoring Costs

Inputs and Cost Categories

- List of wells monitored
- Samples collected annually at each well (including QC samples)
- Non-labor costs
  - Analytical costs (broken down by analyte and method used)
  - Materials and equipment costs (e.g., rentals and expendable items)
  - Sample shipping costs
- Labor costs for …
  - Field sample collection and field measurements
  - Chemistry data management
  - Updating/revising documents/databases
  - Meetings and preparing reports
  - Professional site visits and QA/QC audits
  - Project management and administration

Response of Unit Costs to Changes in Sampling

Total Baseline Cost = Variable Cost + Fixed Cost

- "Variable" costs change in proportion to the level of sampling and analysis activity. Variable costs are unitized (e.g., on a per well or per sample basis)

- "Fixed" costs generally are associated with project management and reporting activities. Some costs are accounted for as "semi-fixed" costs – they are less sensitive to changes in monitoring activity.

Estimating Monitoring Costs Under the Optimized Program

- Use outputs from optimization study (list of critical wells, COCs, sampling frequency) as inputs to costs estimate.
- Calculate *variable costs* using unitized costs from the baseline estimate
- Calculate *fixed and semi-fixed costs* using fixed costs from the baseline estimate – making adjustments based on professional judgment and/or in consultation with O&M contractor

Estimating Cost Savings

$$\left[\frac{Baseline - Optimized}{Baseline}\right]100 = \%\ \mathrm{Reduction}$$

Example Output for Cost Savings Analysis

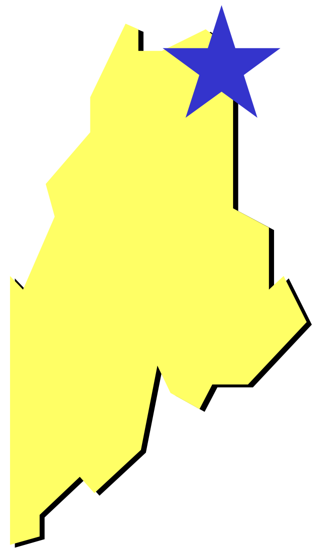
Estimate of Cost Savings			
	Baseline	Optimization 1 (Benzene)	Optimization 2 (All COCS)
Wells Monitored	**113**	**85**	**97**
Samples Collected Annually	**3,306**	**1,690**	**1,926**
Annual Costs			
Analytical Cost for Annual Sampling	$177,545	$90,410	$102,717
Sampling and Analysis Labor Costs	$184,787	$94,443	$107,660
Sample Shipping Costs	$16,550	$8,300	$9,471
Materials and Equipment Costs	$9,532	$7,120	$7,473
Subtotal Sampling and Analysis Costs	**$388,413**	**$200,273**	**$227,322**
Chemistry Data Management	$223,851	$114,408	$130,420
Reports and Meetings	$127,090	$107,529	$110,391
Update & Revise Documents	$21,500	$21,500	$21,500
Professional Site Visits & QA/QC Audits	$5,180	$3,870	$4,062
Project Management and Administration	$155,406	$116,095	$121,846
Total Annual Project Cost	**$921,442**	**$563,674**	**$615,541**
Potential Cost Savings		**$357,767**	**$305,901**
Percentage Reduction in Annual Monitoring Costs		**38.83%**	**33.20%**

Case Study: Massachusetts Military Reservation (MMR) Cape Cod

- GTS optimization study of LTM at two plumes.
- Substantial cost savings projected based primarily on reduction of global sampling frequency
- Projected annual costs savings
  - Fuel Spill-12: 42%
  - Eastern Briarwood Plume: 36%
- Optimization study would pay for itself within one year of implementation

Case Study: Loring AFB, Maine

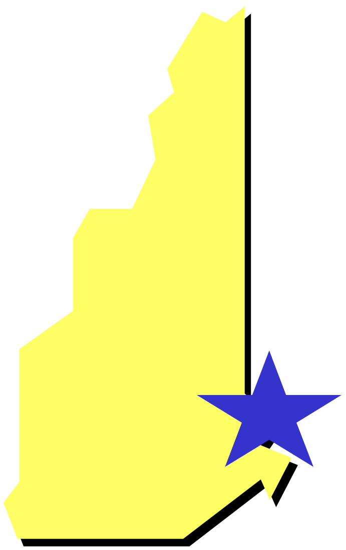
- GTS optimization study of LTM at Operable Unit 12 (OU-12)



- Cost savings projected based reduction of sampling frequency from three-times per year to twice per year, and reduction of wells sampled from 113 to as few as 87.
- Projected annual costs savings: 33 to 38 percent
- Optimization study would pay for itself within one year of implementation

Case Study: Pease AFB, New Hampshire

- GTS optimization study of LTM at Site 49, a 5-acre former UST site contaminated with 1,1-DCE, PCE, and TCE.



- Cost savings projected based reduction of sampling frequency from annual to every two years, and reduction of number of wells sampled from 67 per year to 30 per year.
- Projected annual costs savings: 49 to 52 percent
- Optimization study would pay for itself within one year of implementation

Case Study: Edwards AFB, California

- GTS optimization study of LTM at Sites 37 and 133. Contaminants include metals, solvents, and BTEX.
- Cost savings projected based on
  - Reduction of sampling frequency from annual to once every seven quarters, and
  - Reduction of number of wells sampled from 150 per year to between 53 and 64 per year.
- Projected annual costs savings: 55 to 62 percent
- Optimization study would pay for itself within one year of implementation

Limitations and Lessons Learned

Limitations

- Estimates are best estimates of average annual costs based on available information and professional judgment
- Estimates of baseline are static and do not attempt to project changes that might occur over time (e.g., to the physical system or due to inflation)

Lessons Learned

- Data collection: start early and involve all affected parties.
- More detailed cost break down yields more accurate estimates.

Summary

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- Methodology for developing credible estimates of cost savings from implementing an optimized LTM program.
- Simple cost model can be used to demonstrate the economic benefits of an optimized LTM program
- Outputs expressed in terms of current dollars and percent reduction from baseline.

Next Steps

Questions & Answers

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