SmartSite™ Optimization Program Experience and Lessons Learned

by

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SAIC SmartSite™

SYSTEMS OPTIMIZATION

SmartSite™ Approach

- Program Elements Approach:
  - ✓ Treatment approach
  - ✓ Mechanical system components
  - ✓ Operations and maintenance
  - ✓ Environmental and treatment system monitoring
  - ✓ Administrative and regulatory

Olivetti Office - Optimization of all elements of this complex groundwater and soil remediation program resulted in annual cost savings of approximately $110K, and reduced time to closure by up to 5 years.

- Systems Engineering Approach to Analysis:
  - ✓ Interdisciplinary team approach
  - ✓ Evaluates all aspects of the program
  - ✓ Analysis of interrelated problems and solutions

O-FIELD Landfill - Systems approach to analysis of performance and costs of packed tower supported elimination of the tower and associated GAC, O&M, and monitoring, yielding annual savings of $55K.

SmartSite™ Approach (cont.)

- **Formal, Documented Approach:**
  - ✓ Structured program review process
  - ✓ *SmartSite*® Optimization Manual
  - ✓ Data collection modules
  - ✓ Formal QA/QC program
  - ✓ Standardized reporting
- **Detailed Engineering and Costing Analysis:**
  - ✓ Engineering analysis documents all assumptions.
  - ✓ Costing worksheets provide detailed rollup of all cost factors in an interactive format.

Formal and Detailed Engineering and Cost Analysis Provides Analysis Tool in Support of Business Decision Making

Loring Air Force Base- Optimization results and recommendations used in CERCLA five-year review documents.

SITE Program - Achieving performance-based metrics including >95 % mass removal efficiency and assuring no off-site impacts was critical to optimizing this innovative co-metabolic bioremediation program.

Key SmartSite™ Program Features

- Programmatic approach provides logical framework for complex analysis
- Systems engineering analysis evaluates interrelated cost and performance factors
- Integration of emerging and proven technologies yields high value at low cost
- Use of modern IT tools to integrate operations, maintenance, and monitoring data improves and simplifies management
- Fully documented, performance-based results support continued improvements

SmartSite™ Optimization – A Team Effort

Summary of Results at Example Federal Sites

- General Observations:
  - Budgets are fairly inflexible and *investments* difficult due to contracting methods.
  - Changing O&M contractors not uncommon.
  - Absence of profit driver.
  - Primarily CERCLA vs RCRA sites.
  - Contract compliance versus cost avoidance is strong performance driver.
  - Generally greater management involvement.

Project	Annual Savings	Return on Investment	Life Cycle Savings
US Navy Fridley NIROP	$160K	2.5 Yrs.	$1.4M
Former Naval Ordnance Plant	$210K	1.9 Yrs.	$2.6M
US Army Aberdeen P.G.	$460K	2.6 Yrs.	$4.3M
US Air Force Site No. 1	$74K	4.0 Yrs.	$320K
Lang Superfund Site	$350K	0.9 Yrs.	$3.6M
South Jersey Clothing Superfund Site	$29K	1.0 Yrs	$500K
Higgins Farm Superfund Site	$23K	1.3 Yrs	$460K
Vineland Chemical Superfund Site	$660K	1.05 Yrs.	$9.7M
US Air Force Site No. 2	$358K	0.2 Yrs.	$970K
US Air Force Site No. 3	$110K	1.2 Yrs.	$410K
TOTAL	$2.43M		$24.3M

Summary of Results at Commercial Sites

- General Observations:
  - Remedial program commonly integrated with operating production systems.
  - Budgets are more flexible and investments with high ROI are expected.
  - Changing O&M contractors uncommon.
  - Immediate results oriented.
  - Cost avoidance/profitability is strong performance driver.
  - Generally streamlined management involvement.

Project	Annual Savings	Return on Investment	Life Cycle Savings
Olivetti Supplies, Inc.	$110K	1.5 Yrs.	$1.3M
Kodak Corp. Sterling 3	$147K	1.4 Yrs.	$1.6M
AstraZeneca	$90K	3.0 Yrs.	$400K
Matlack	$41K	2.1 Yrs.	$820K
Former Refinery No.1	$162K	2.4 Yrs.	$350k
Former Refinery No.2	$270K	3.1 Yrs.	$2.7M
Former Chemical Manufacturing Plant	$364K	3.1 Yrs.	$3.9M
TOTAL	$1.2M		$11.0M

Example Project Overview – O Field Landfill

- Optimization and engineering of leachate collection and monitoring system of a major landfill at Region III CERCLA Superfund Site
- Chemical warfare agents landfill at Aberdeen Proving Ground, MD
- Pump and treat of solvents and metals plume from landfill
- 14 extraction wells, metals/solids removal, packed tower aeration, UV oxidation, GAC polishing, bio-monitoring, discharge to Chesapeake Bay
- Extensive Groundwater/Air Monitoring Program
- Security issues
- Independent LTO/LTM Contractor
- $1.7M/yr annual budget

Example Optimization Alternatives – O Field Landfill

Problem or Program Element	Solution	Annual Cost Savings (x 1,000)
Well Field Management	Install Additional Wells, Optimize Well Field Pumping Rates	$ 36
Groundwater Extraction System Pump Performance and Extraction System Fouling	Replace Pumps and Water Level Controls	$ 31
Lime Feed system	Replace Bag Lime with Bulk Sodium Hydroxide Feed	$ 28
Upflow Sand Filter	Replace Sand Filter	$ 28
Air Stripping Tower	Discontinue Use But Do Not Remove the AST	$ 55
Sludge Management	Replace Drums with Bulk Sludge Storage and Handling	$ 36
Effluent Monitoring Water Conditioning System	Upgrade System Construction, Replace Chiller Unit	$ 31

Example Optimization Alternatives – O Field Landfill (cont'd)

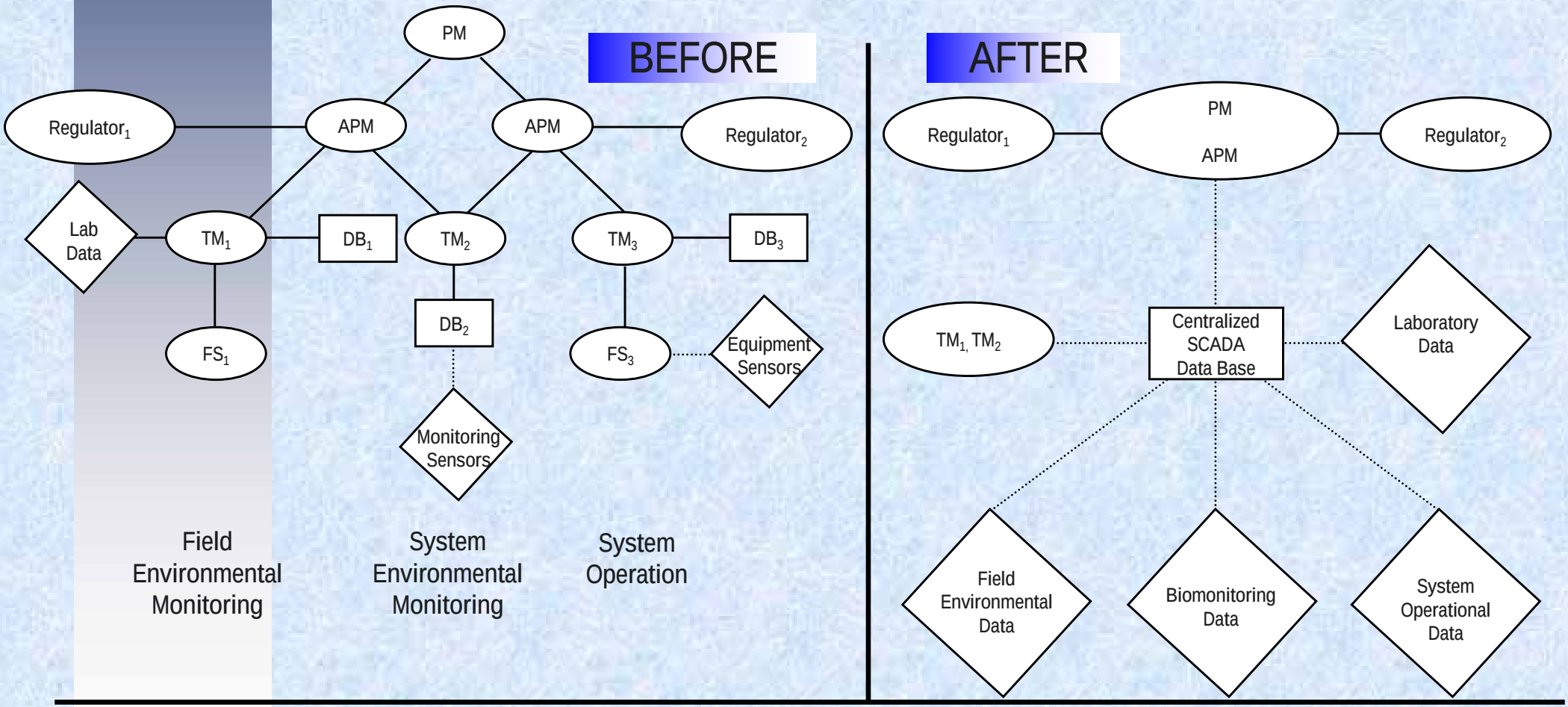
Problem or Program Element	Solution	Annual Cost Savings (x 1,000)
Well Field Control and Monitoring	Install and Execute SCADA Supported O&M	$ 31
GWTF Control and Monitoring	Install and Execute SCADA Supported O&M	$ 54
Well Field Environmental Monitoring Program	Reduce Number and Frequency of Sampling	$ 47
GWTF Environmental Monitoring Program	Develop Reliable Off-Gas Monitoring Program Using Field Methods	$ 17
Data Management and Reporting	Develop SCADA Supported and Standardized/Automated Data Analyses and Report Generation	$ 69
Other	Reduce GAC Loading, Upgrade Emergency Generator, Execute SCADA-Supported O&M	$ 11
	Total Savings	$ 458 [1]

[1] Represents approximately 40 percent of annual O&M budget and provides a return on investment (ROI) of approximately 2.6 years.

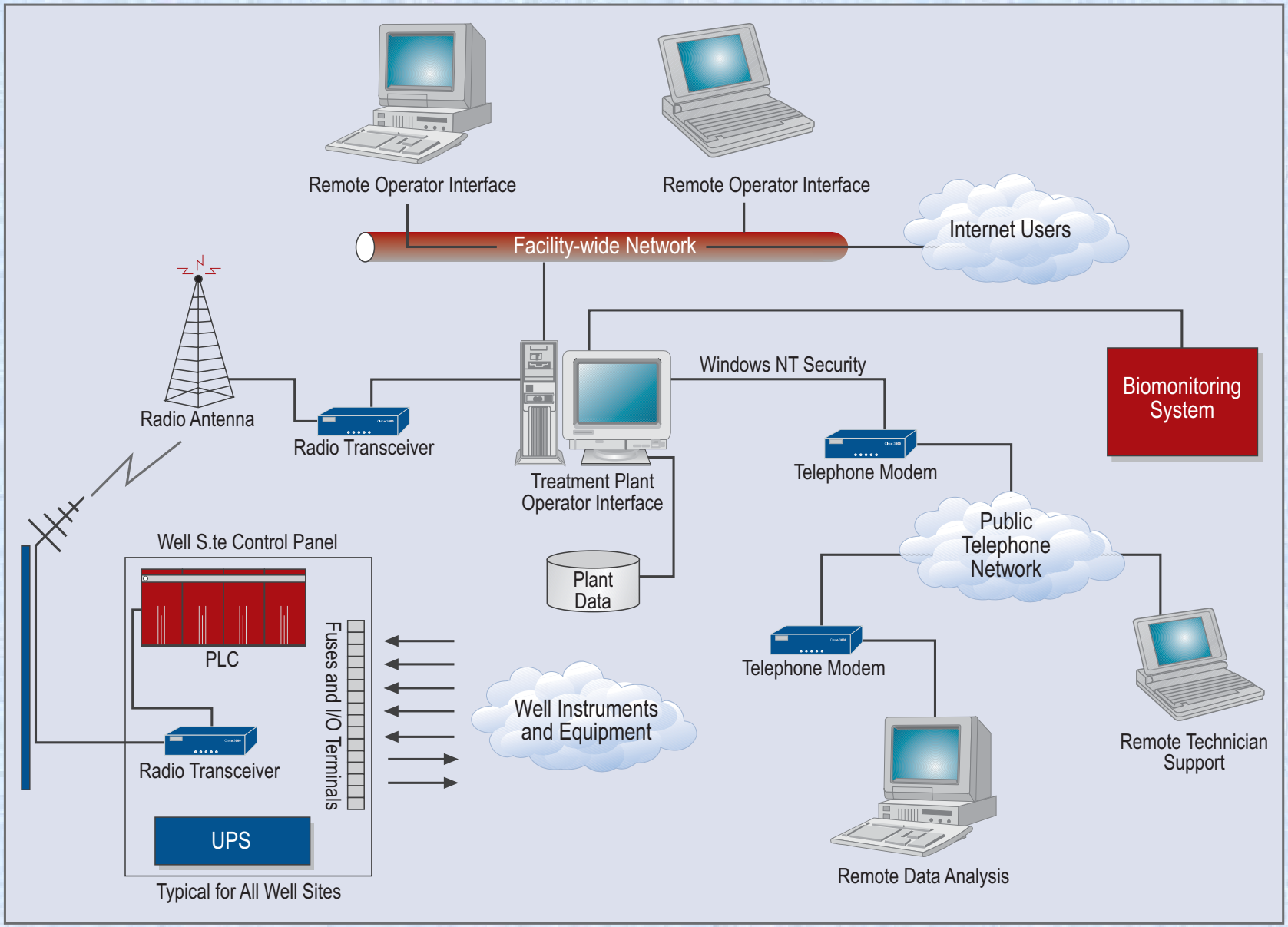
Example Relationships Between Program Optimization Alternatives and Resultant Cost Savings – O Field Landfill

Alternative	Resultant Cost Saving	Annual Cost Savings (x 1,000)[1]
Optimize Well Field Management	Reduce Well Field and Pump O&M	$ 3.6
• Install Additional Wells	Reduce Weekend Operations	$ 1.7
•Optimize Well field Pumping Rates	Reduce Sludge Management/Disposal	$ 1.9
	Provide Treatment Capacity for IDW - Eliminate Off-Site Disposal	$ 28.4
	Total Savings	**$ 35.6**
Upgrade Lime Feed System	Reduce Normal O&M Costs	$ 20.2
• Replace Bag Lime With Liquid Sodium Hydroxide Feed	Reduce Compensatory Overtime Due to Downtime	$ 10.2
	Reduce Pump Replacement	$ 1.4
	Reduce Sludge Management/Disposal	$ 1.2
	Reduce Utility Costs	$ 2.6
	Increase Chemical Costs	$ -7.5
	Total Savings	**$ 28.1**

Data and Information Transfer Analyses – O Field Landfill



Final SCADA Configuration – O Field Landfill



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Summary of Results – O Field Landfill

- 18 alternatives for improvement identified and evaluated
- Life-cycle optimization of system design, operation, and maintenance will reduce O&M costs by 40 % (460K/yr) with a ROI of 2.6 yrs, and $4.3M over the life of the program.
- Monitoring costs reduced by 25% ($17.5K/yr)
- Recommendations incorporated into the 5 yr CERCLA report
- SAIC awarded and completed design/installation of advanced SCADA system
- Numerous alternatives already implemented

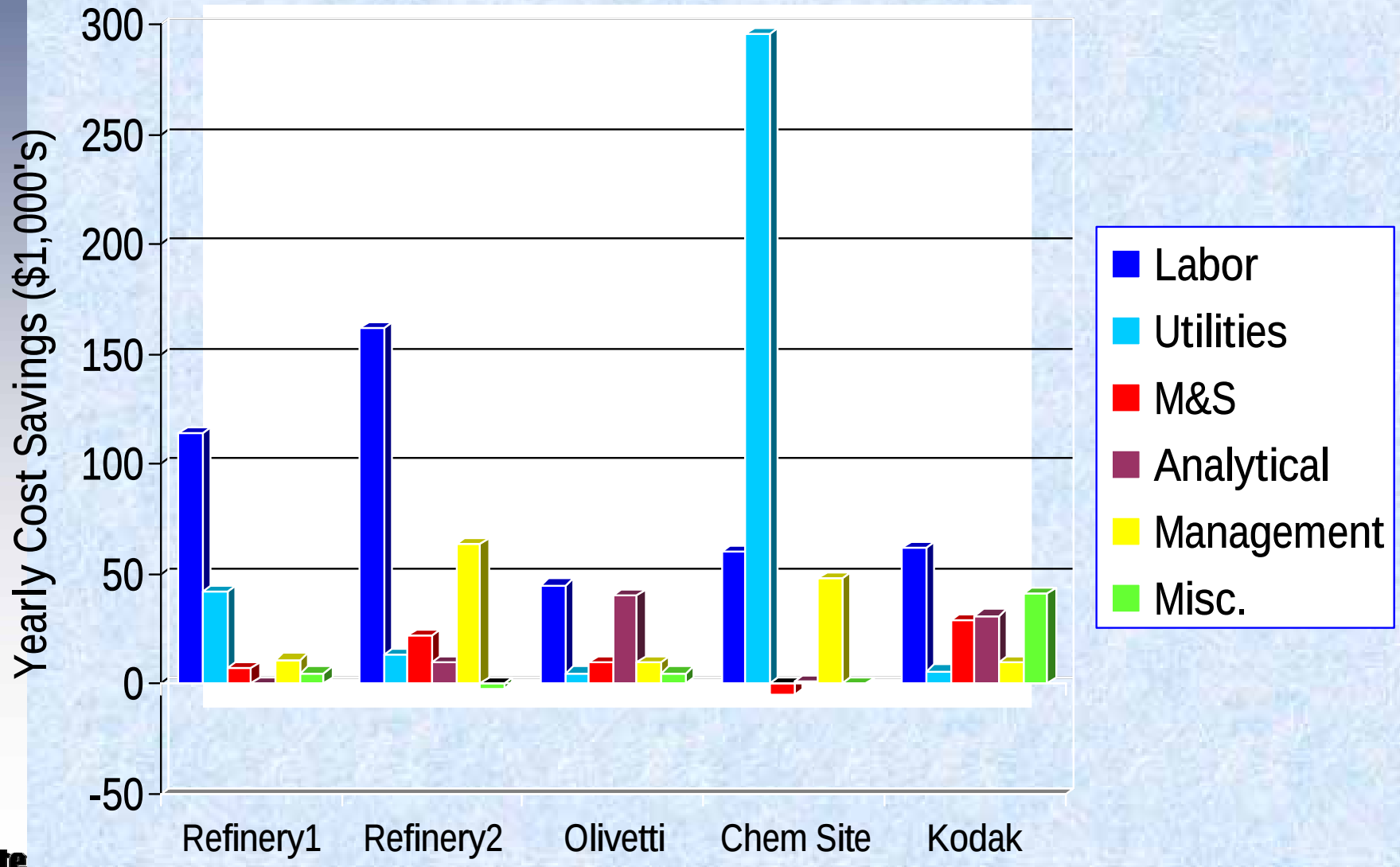
Optimization of Groundwater Monitoring Programs

- Olivetti Supplies - Negotiated reduced sampling requirements
- Aberdeen Proving Grounds – Utilized automated data collection
- Carswell Air Force Base – Application of powerful modeling and mathematical analysis

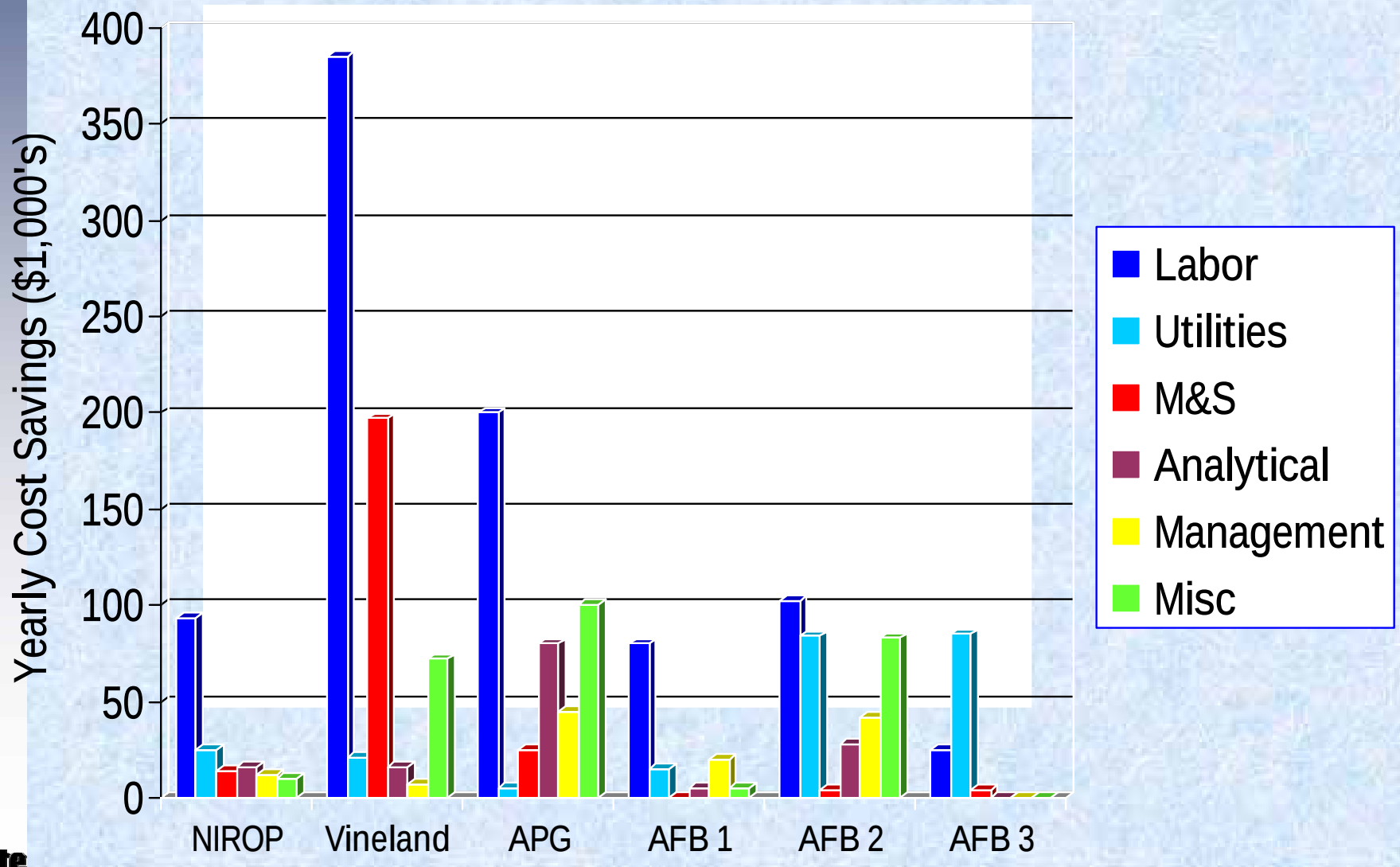
Optimization has achieved savings through revised regulatory decision, enhanced sampling, and use of automated data collection

Site	Developed Alternative	Annual Cost	Annual Cost Savings	ROI (Yrs)
Former Naval Ordnance Plant, PA	✓ Developed streamlined "key well" sampling program to reduce number of frequency in sampling	$250K	$105K	.025
MMR, Cape Cod, MA, Sitewide Monitoring Program	✓ Reduce sampling locations and frequency of sampling	$650K	$244K	0.6
Loring Air Force Base, ME—landfill monitoring	✓ Reduce sampling frequency and parameter	$7.2K	$1.8K	4.2
NIROP, Fridley, MN—Groundwater P&T system	✓ Reduce sampling locations and frequency ✓ Change method of analysis	$67K	$26.6K	0.8
Loring Air Force Base, ME—Groundwater discharge to surface water	✓ Replace standard well sampling with diffusion gas sampling and on-site analysis	$100K	$50K	0.5
Aberdeen Proving Grounds—O-Field Landfill Monitoring	✓ Reduce sampling locations and frequency; amend analytical protocols ✓ Install automated data collection	$350K $144K	$17.5K $54K	1.7 2.7
Olivetti Supplies, Inc., Harrisburg, PA—Groundwater P&T System	✓ Negotiated regulatory requirements to replace laboratory with on-site analysis ✓ Installed remote/automated monitoring equipment	$104K	$28K	1.5
Carswell AFB, Basewide LTM	✓ Used Kriging/autocorrelation to reduce sampling number	$235K	$86K	0.15
SSCOM Natick	✓ Used numerical modeling/time series analysis to reduce number and frequency of sampling	$400K	$132K	0.8

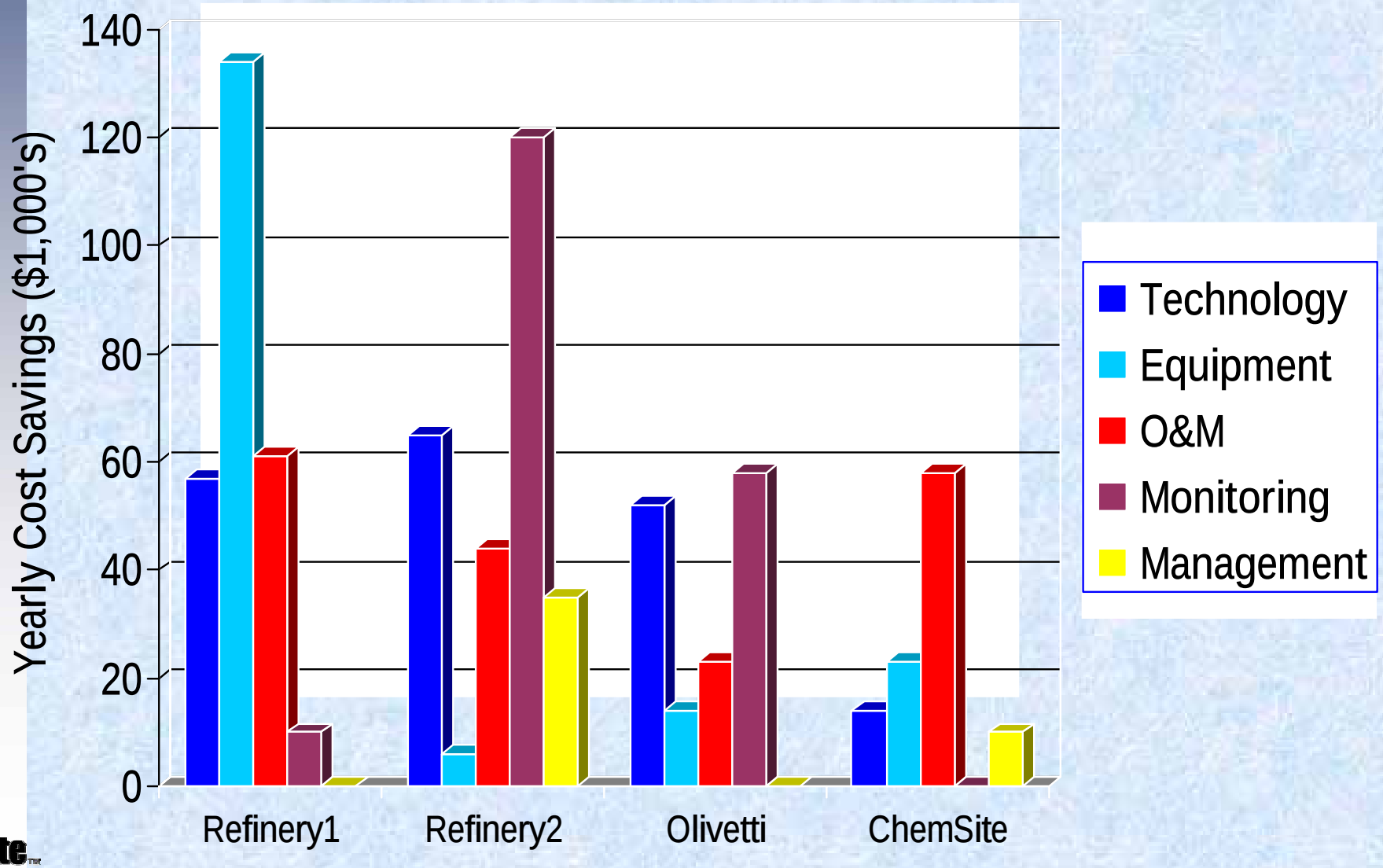
Savings by Cost Category at Example Commercial Sites



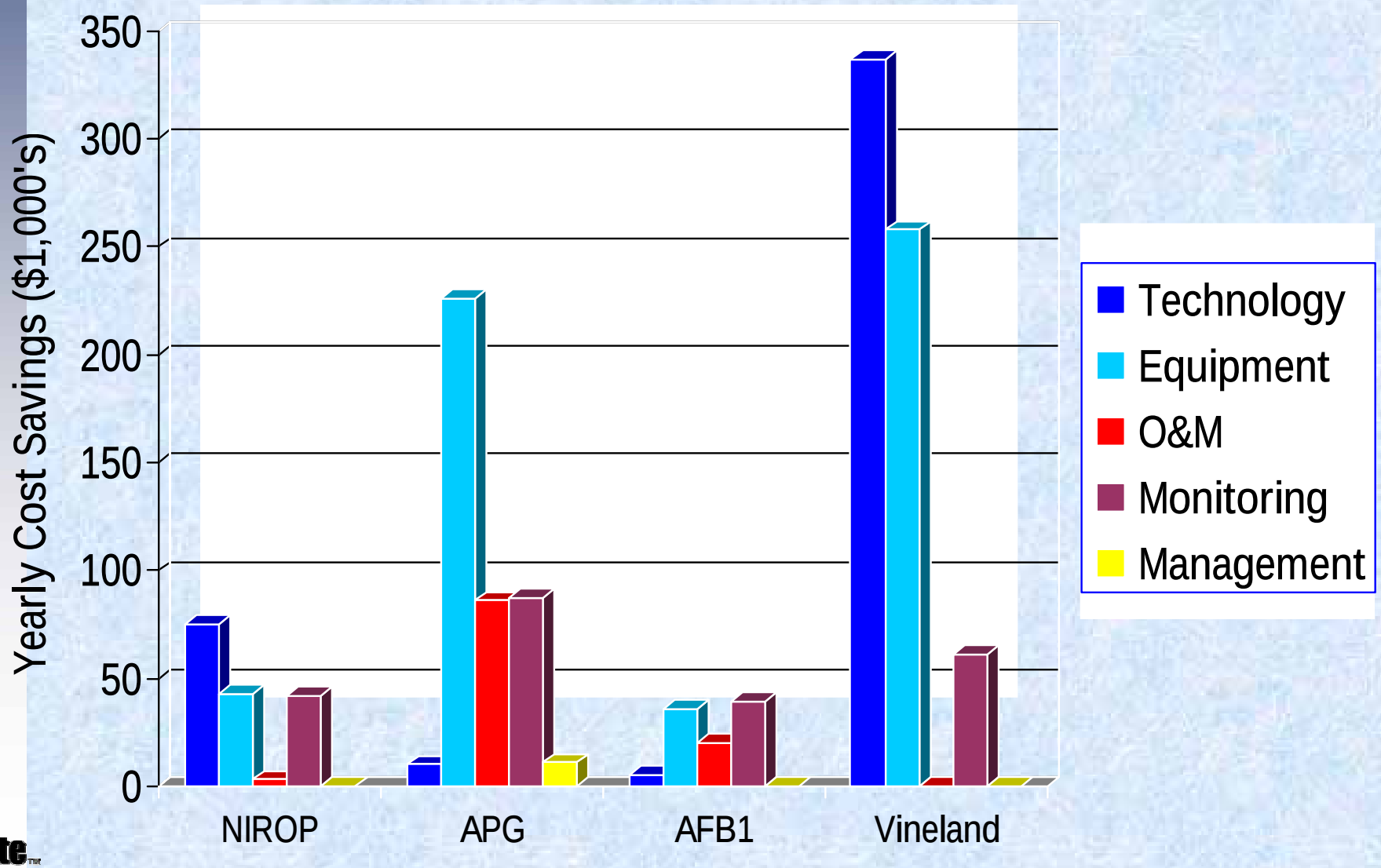
Savings by Cost Category at Example Federal Sites



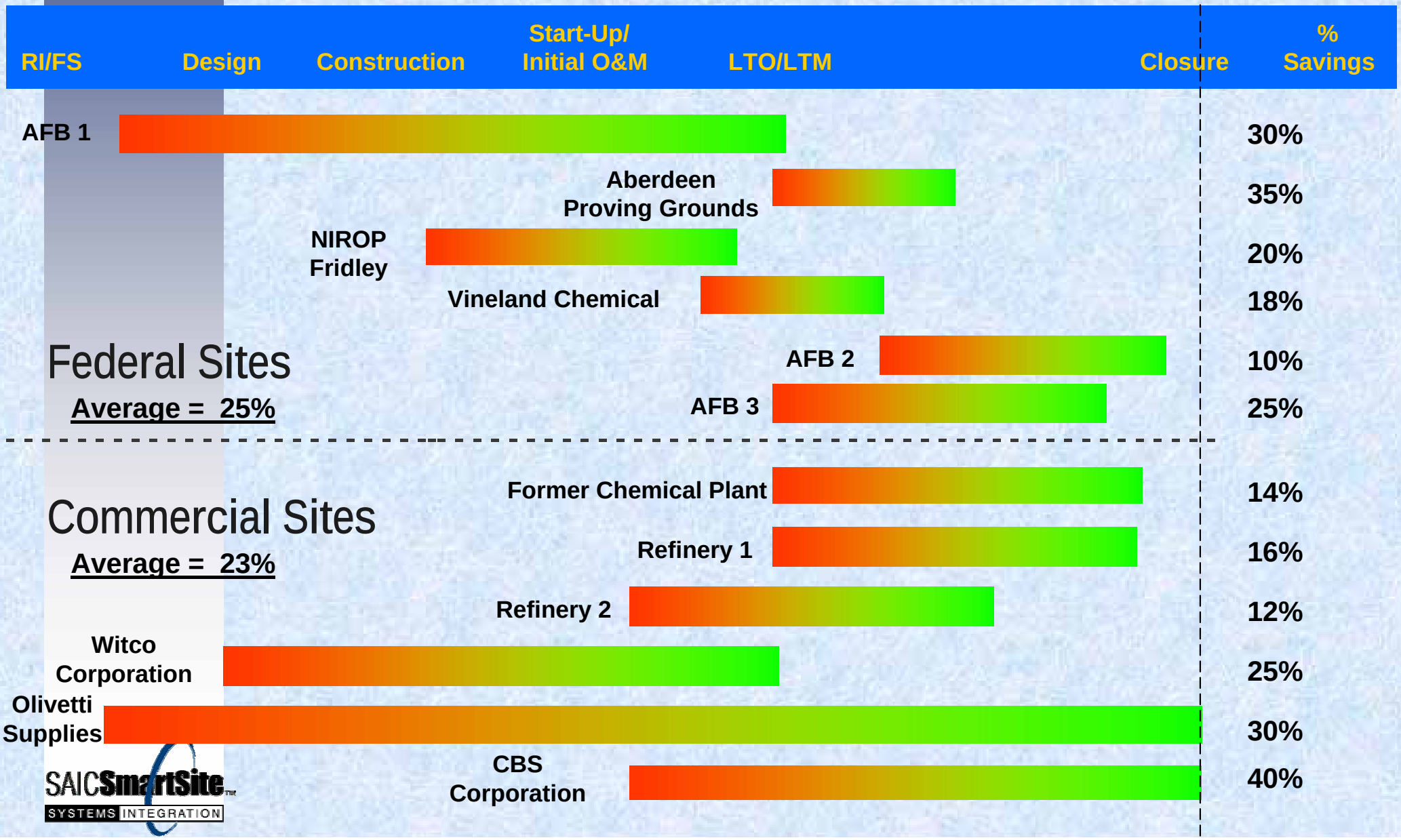
Savings by Activity at Example Commercial Sites



Savings by Activity at Example Federal Sites



Percent Annual Cost Savings Versus Project Phase



Optimization Projects - Rules of Thumb

- Percent savings and ROI increase greatly with program costs > $200K/yr for four years or longer.
- Staged approach to optimization controls project costs.
- Optimization is a joint effort.
- High value alternatives have ROI < 2 years.
- Significant savings result from comprehensive reevaluation of assumed program requirements and objectives.
- SCADA and IT tools provide significant cost reduction nearly every program.

Optimization Projects - Rules of Thumb (cont'd)

- Opportunities for savings identified during the initial site visit generally involve procedures, equipment, and supplies.
- Additional opportunities identified by systems analysis of interrelated activities and costs often involve management and procedures.
- Total savings consist of numerous small vs few large savings.
- Buy-in of the current operators is necessary to assure validity and maximize value of optimization project.
- Operators have improvements conceptualized that have not been communicated or evaluated to determine value.

Non-Monetary Optimization Project Benefits

- Promotes communication of ideas among site team management, operators, and technicians.
- Prompts dedicated reevaluation and affirmation of project goals and objectives.
- Identification of non-obvious cause and effect relationships supports future management.
- Resultant activities based cost analysis provides a tool for ongoing reassessment.

Accessing the Institutional Knowledge Base

- Promote trust through initial explanation of objectives and continued communication and involvement.
- Facilitate operating team's ongoing optimization program.
- Identify and acknowledge existing ideas and continuing contributions to improvements.
- Promote formal and continued involvement in project optimization.
- Give credit and recognition for all results and contributions.
- Be sensitive and use common sense and good people skills.

Summary - SmartSite™ Optimization Program Experience

- Potential savings increase with increasing program scope, complexity, and duration.
- Programmatic approach provides logical basis for analysis and accounting of costs and savings.
- Wide variety of many, small, interrelated vs. few, large, independent savings.
- Systems analysis of interrelated problems and solutions captures maximum savings.
- Information technologies enable more effective interactive site management.
- Savings in all program areas at all program phases.

Summary - SmartSite™ Optimization Program Experience (cont.)

- Potential savings of 15%-30% per yr., ROI <3 yrs.
- Additional nonmonetary and long term benefits include compliance, safety, reliability, and public relations.
- Team effort required and operator buy-in is essential.
- No *cookbooks* or *silver bullets* - Wide range in technology tools and experience required to address wide range in optimization opportunities.
- Changing programs and metrics, and emerging optimization tools promotes continued optimization.
- LTO/LTM = Long-Term Optimization/Long-Term Management.

The End

Thanks!

SAICSmartSite™
SYSTEMS INTEGRATION