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Yolo County's Accelerated Anaerobic and Aerobic Composting (Full-Scale Controlled Landfill Bioreactor) Project

Ramin Yazdani, Project Manager

Yolo Count Planning and Public Works Department

Division of Integrated Waste Management

Ramin.Yazdani@yolocounty.org (530) 666-8848

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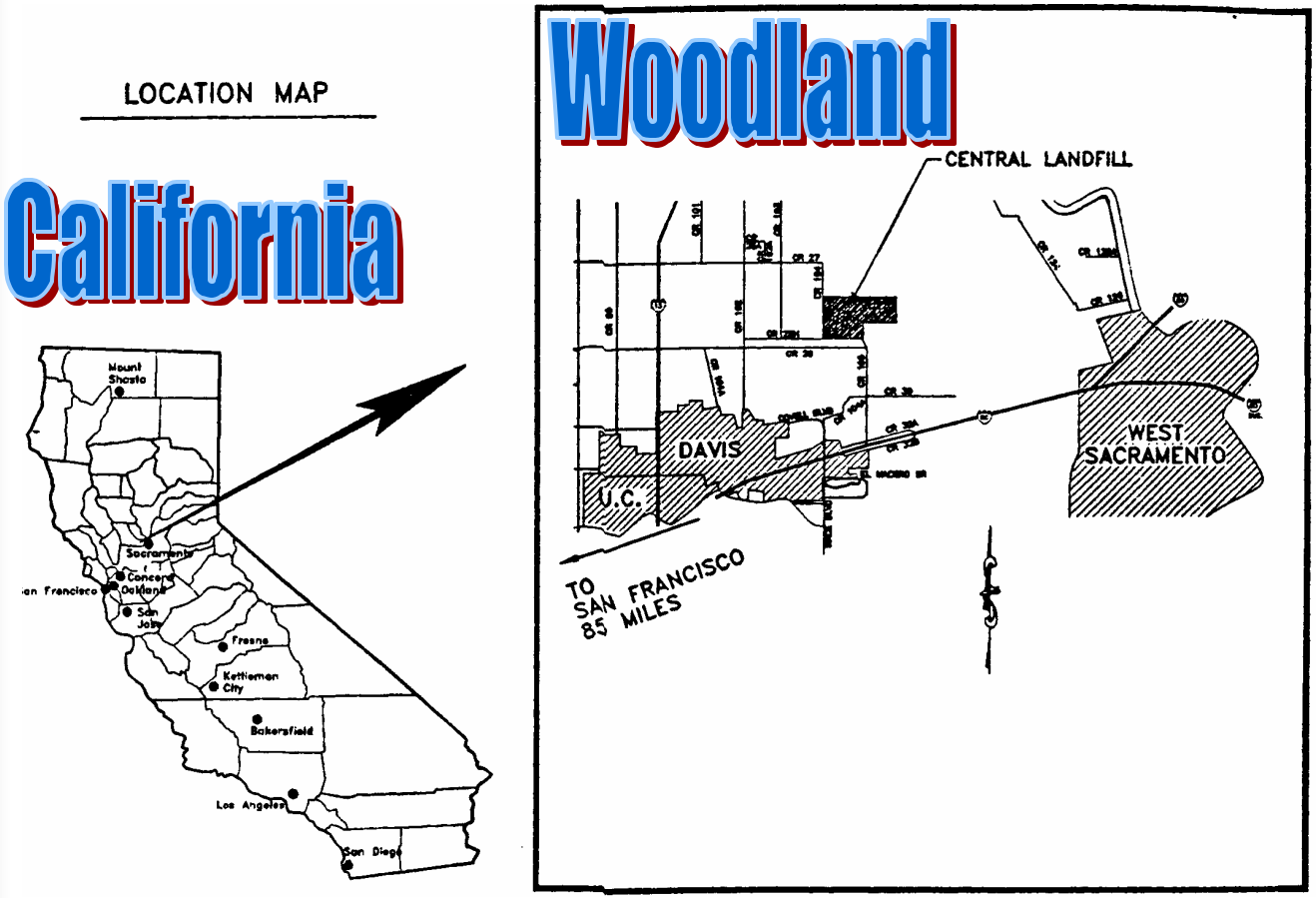
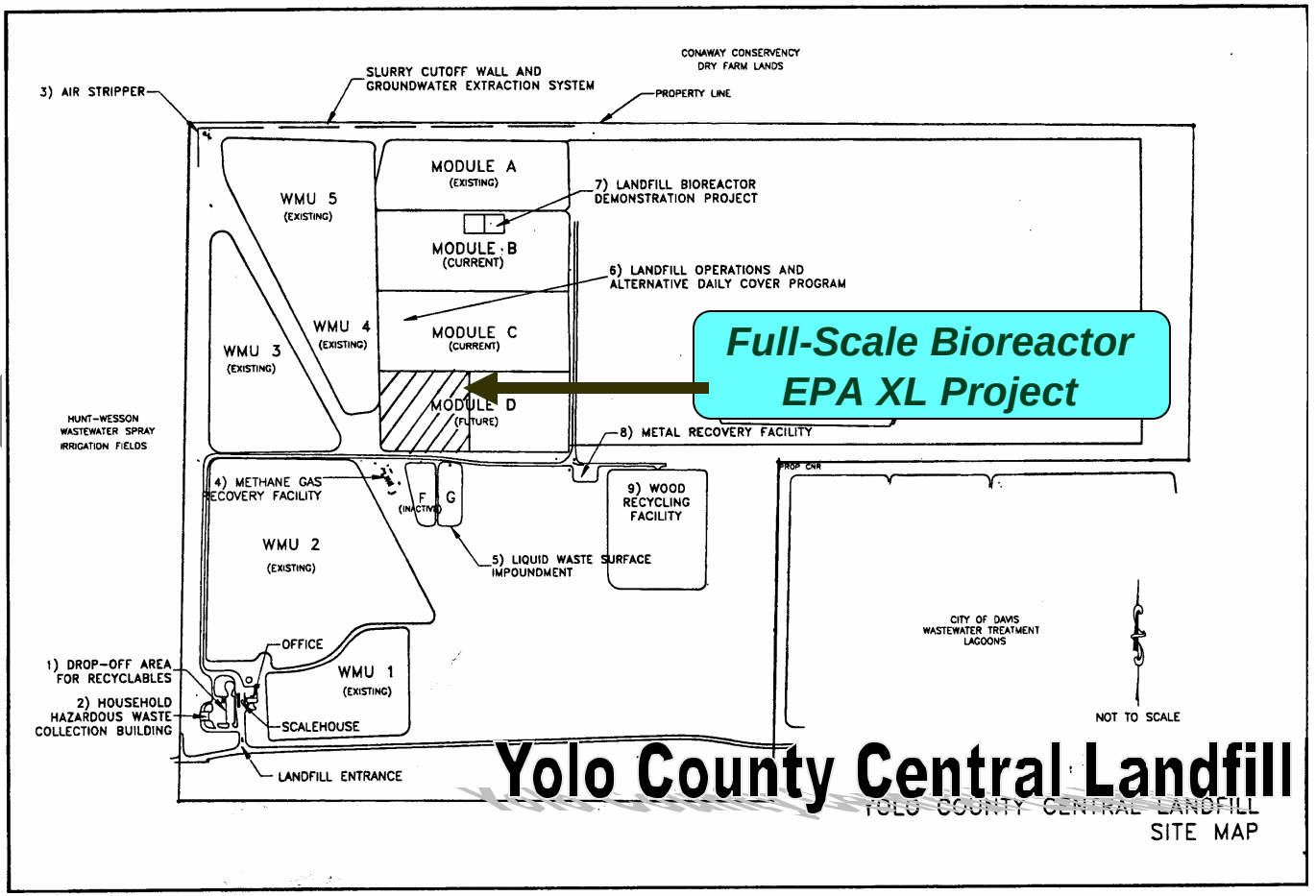
Presentation

- Project Site
- Design differences
- Project partners
- Project Goals and Objectives
- Achievements to Date
- Design and Construction Challenges
- Economics
- Future Tasks
- Conclusions

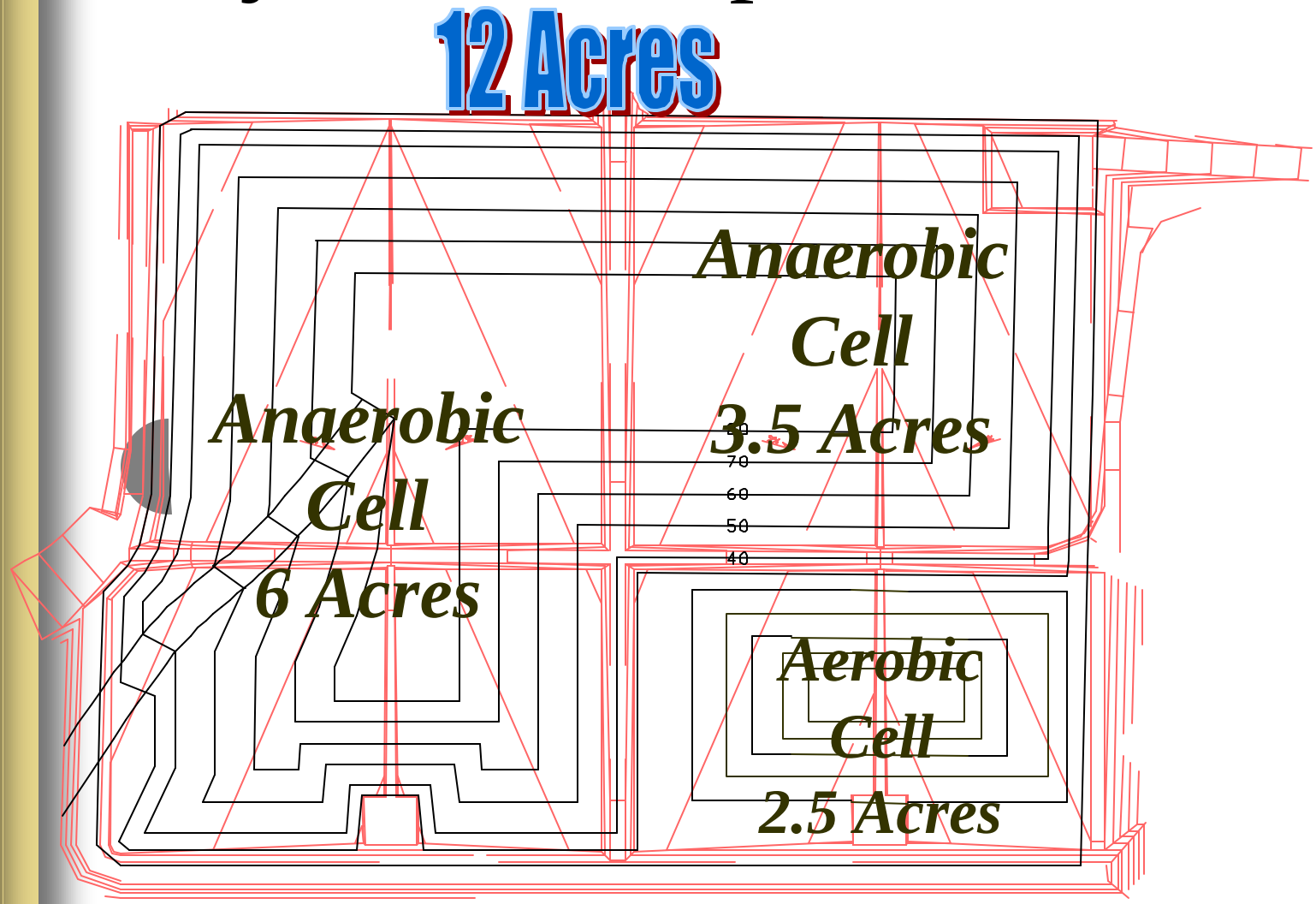
Project Location Map



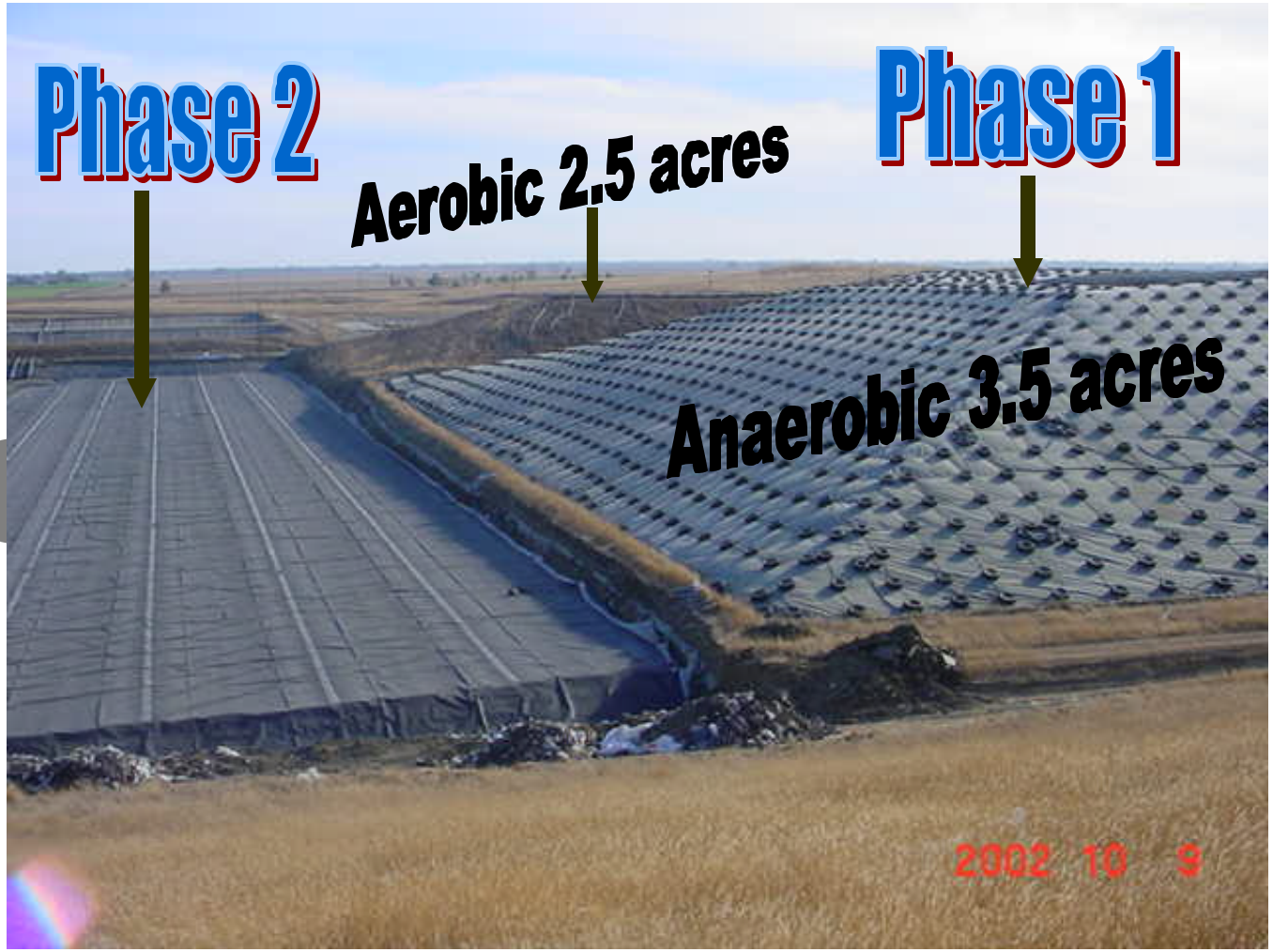
Project Site Map



Project Site Map



Project Phase 1 & 2



Project Site Map

Design Differences from a Conventional Landfill

- **Primary composite liner better than Subtitle D and CA Title 27 prescriptive standards**
- **Clay permeability better (6×10^{-9} cm/sec) than 1×1^{-7} cm/sec**
- **Secondary containment (40 mil HDPE) to protect groundwater**
- **Leak testing of primary liner system to locate pin holes**

Design Differences from a Conventional Landfill

- **No soil cover used within the waste mass as daily or intermediate cover**
- **Horizontal gas collection system installed at 40 to 80 feet at each lift**
- **Install pressurized horizontal leachate injection lines within the same trench as the gas collection system**
- **Install temperature, pressure transducers, tubes, and moisture sensors to collect real time data**
- **Use real time monitoring (SCADA) system**

Project Partners & Funding

- **Project Partners:**
  - Yolo County-DIWM ($2,753,000)
  - California Energy Commission-PIER ($1,154,250)
  - National Energy Technology Laboratory, U.S. DOE ($563,000)
  - California Integrated Waste Management Board ($400,000)
  - Institute for Environmental Management (Tech. Support)
  - U.S. Environmental Protection Agency
  - Solid Waste Association of North America
  - California State Regional Water Quality Control Board
  - California State Water Resources Control Board
  - California Air Resources Control Board
  - Yolo-Solano Air Quality Management District
  - Yolo County Environmental Health

Project Goals and Objectives

- **Collect technical and economic data to demonstrate full-scale operation as beneficial**
- **Provide technical solution to permitting and regulatory constrains in the commercialization of this technology**
- **U.S. EPA XL project (“eXcellence and Leadership”)**

Regulatory Requirements

- **What is EPA Project XL?**
  - **Project XL, stands for "eXcellence and Leadership"**
  - **It is a national pilot program that tests innovative ways of achieving better and more cost-effective public health and environmental protection**
  - **Under EPA Project XL Yolo County can obtain state and federal regulatory flexibility to implement innovative Full-scale Bioreactor**
  - **The goal is to engage those parties affected by environmental regulations and policies to find solutions that work better than those currently mandated**
  - **What is learned will be applied broadly to improve public health and environmental protection**

EPA XL Project Schedule

- Project XL application submitted in 1999
- Permits issued by CA State Agencies-6/2000
- Final Project Agreement signed-9/2000
- Federal rule making completed by EPA-8/2001
- Construction (2000-2002)
- Data collection and reporting (2001-2005)

Project Objectives

- **Full-scale operation to accelerate waste decomposition through liquid addition without liquid head build up over the base liner**
- **Efficient capture of nearly all methane generated without an impact to the local air quality**
- **Document capital and operation's cost of project - commercialization**

Achievements to Date

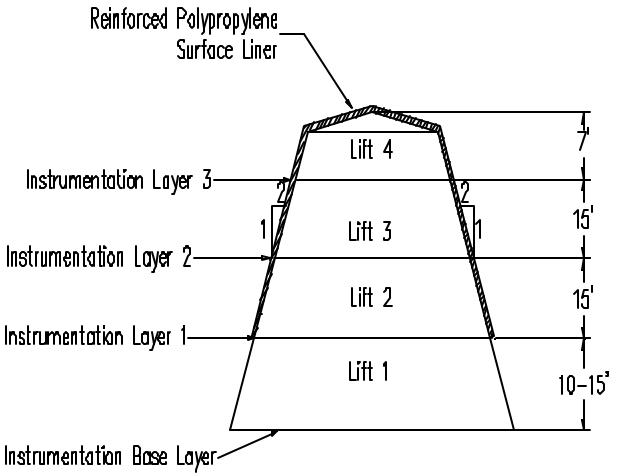
- **Construction of base liner system**

Achievements to Date

- **Construction of landfill waste filling**

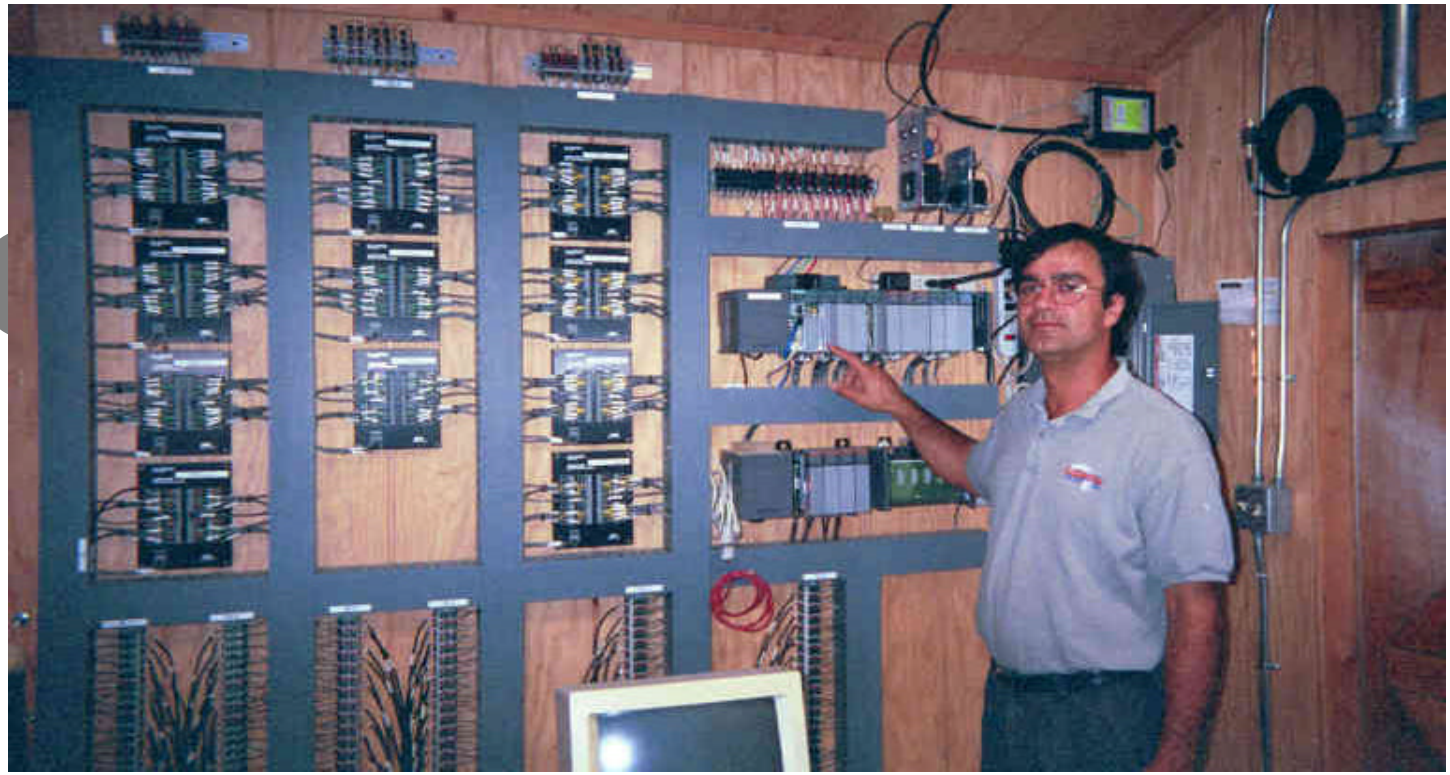
Achievements to Date

- **Construction of the instrumentation system**

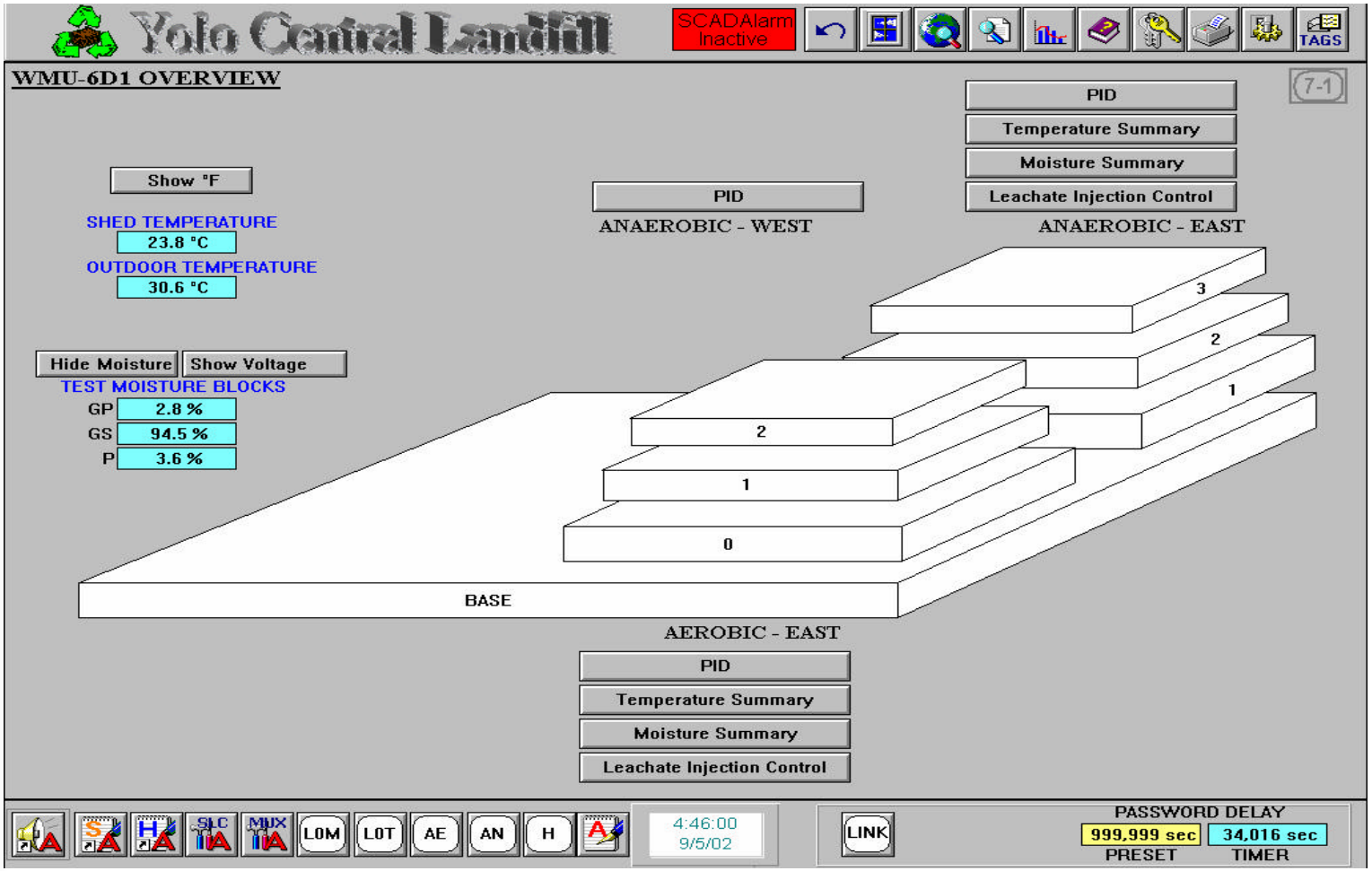


Achievements to Date

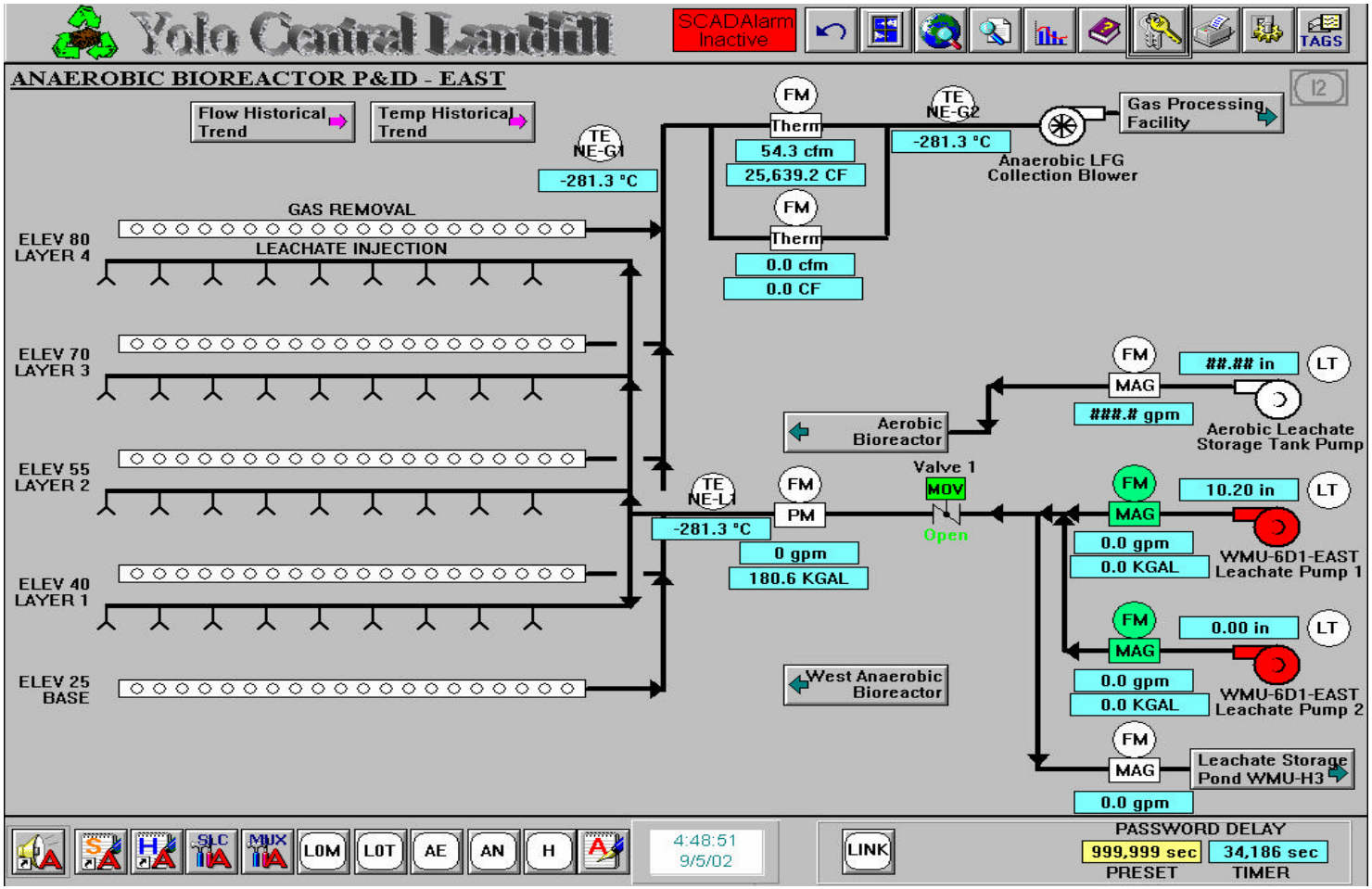
- **Construction of the SCADA System**



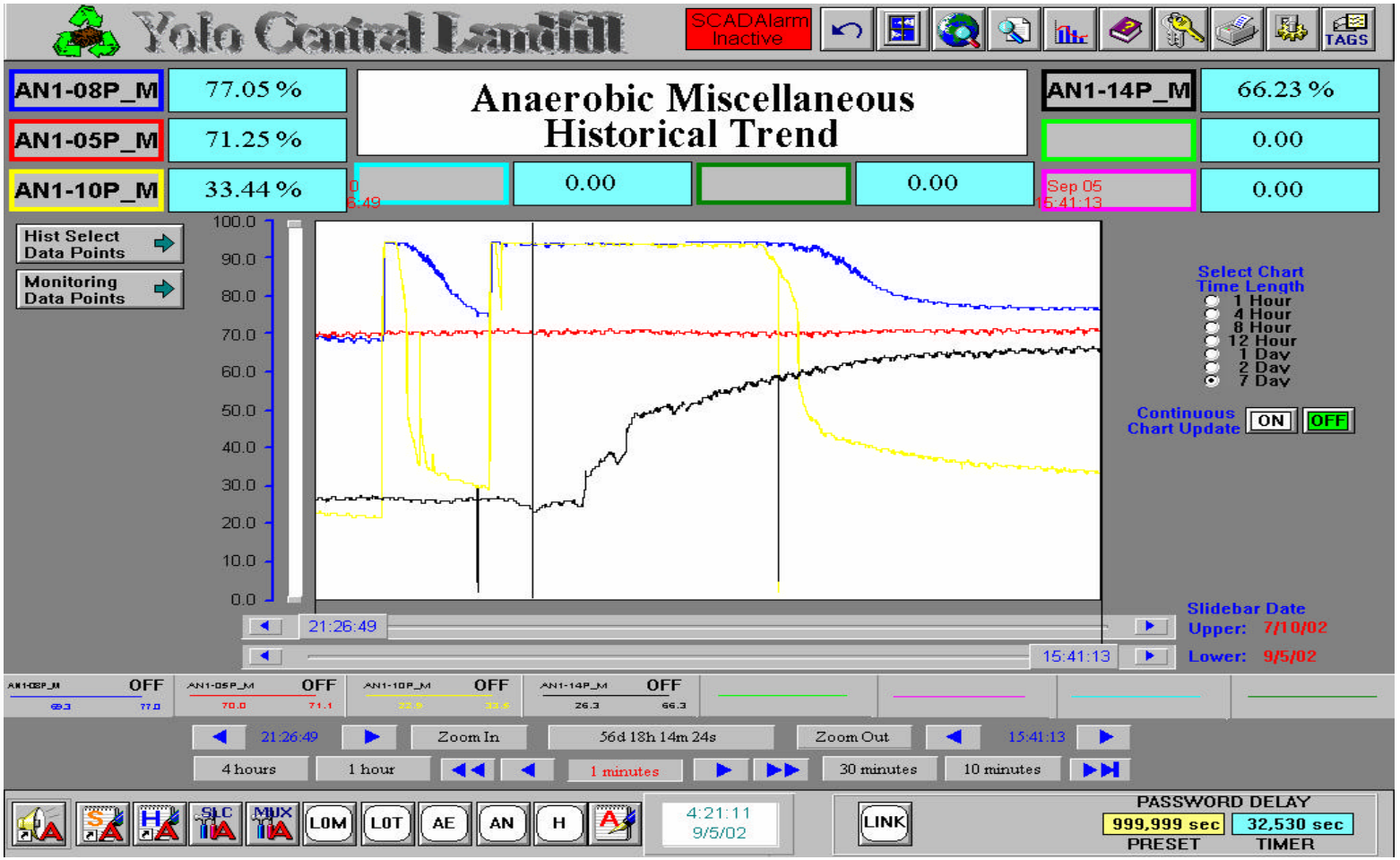
SCADA System for Bioreactor



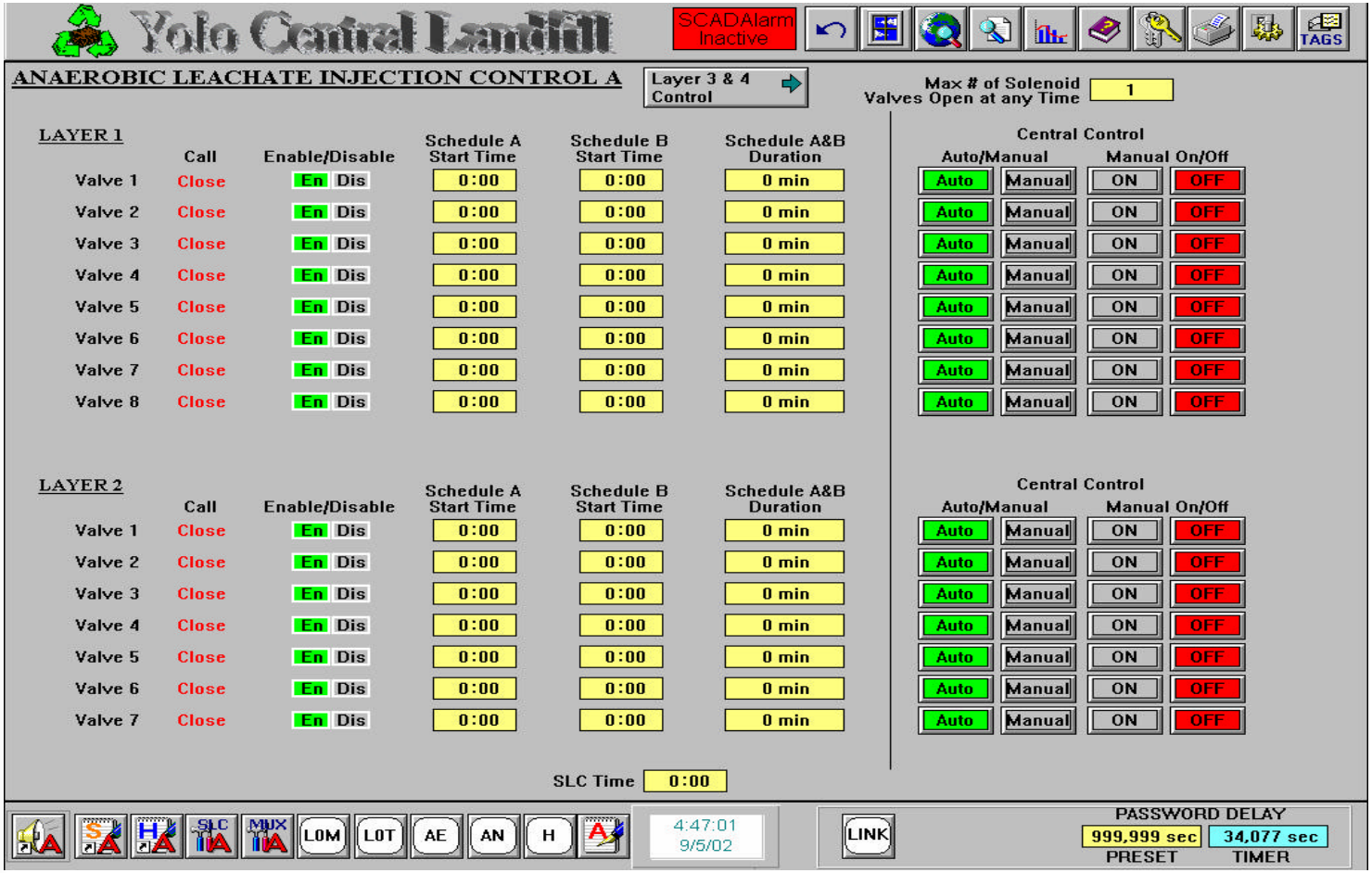
SCADA-Leachate Injection System



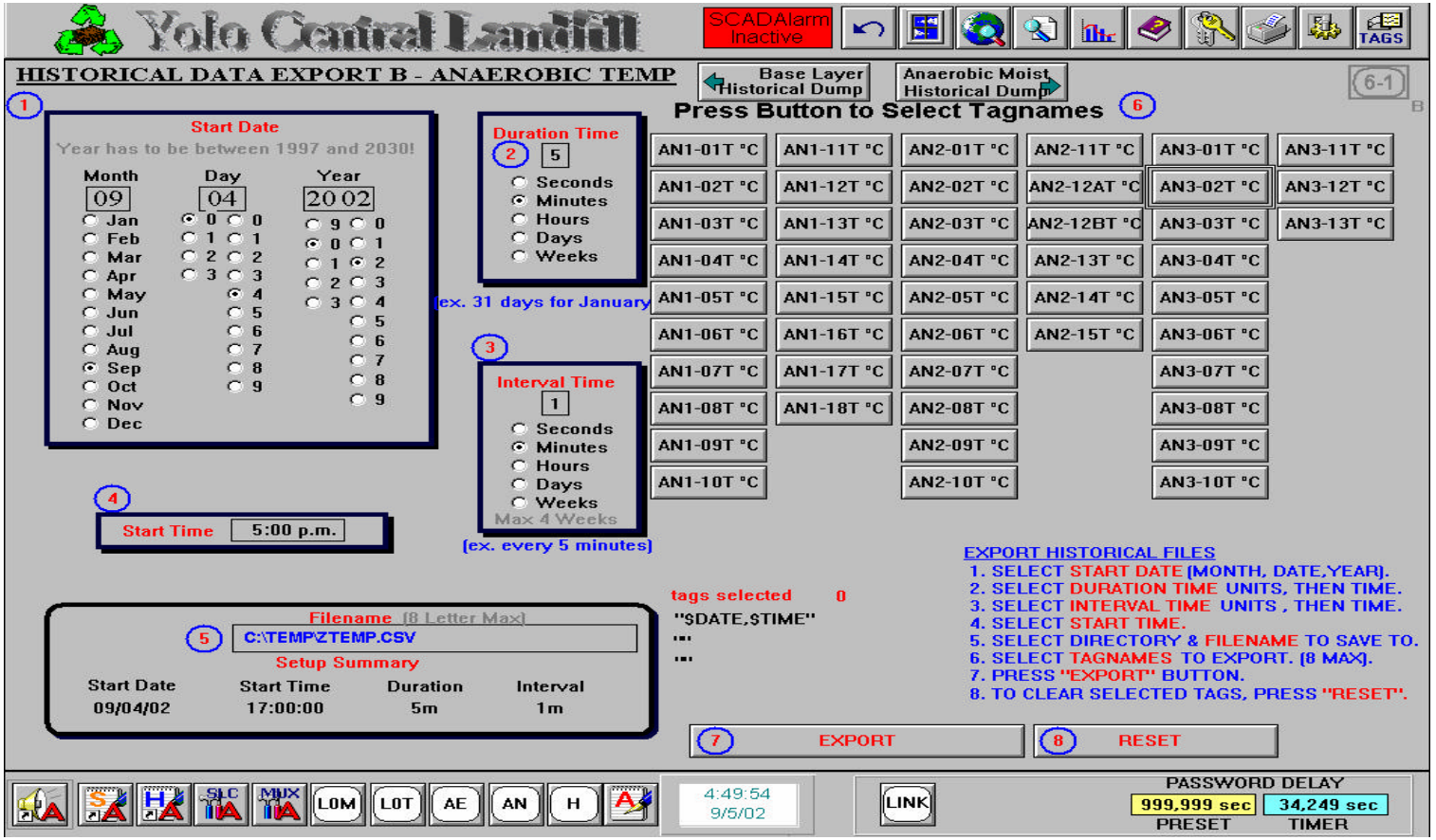
SCADA Real Time Data



SCADA Control for Leachate Injection System

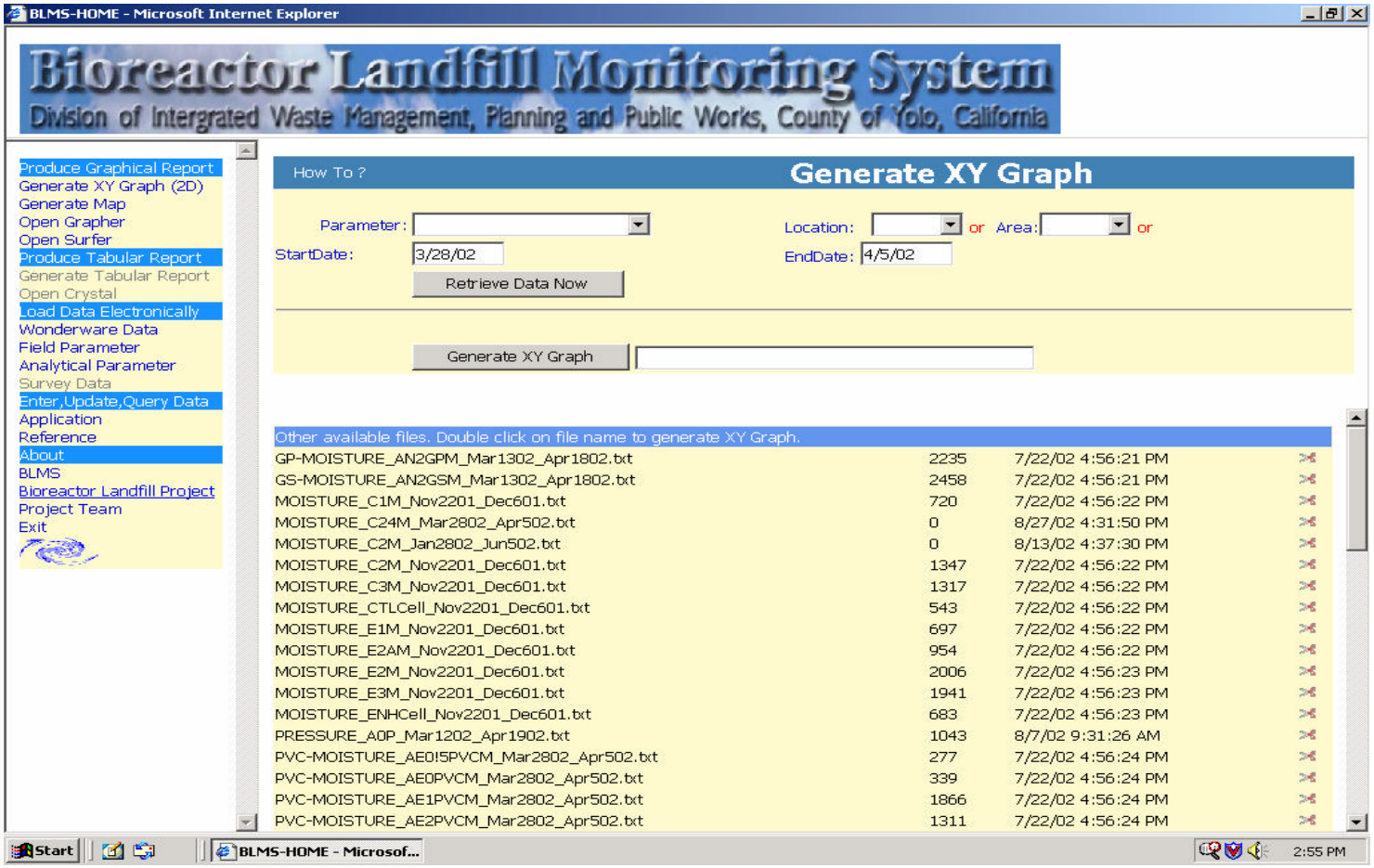


SCADA- Real Time Data Export to Database

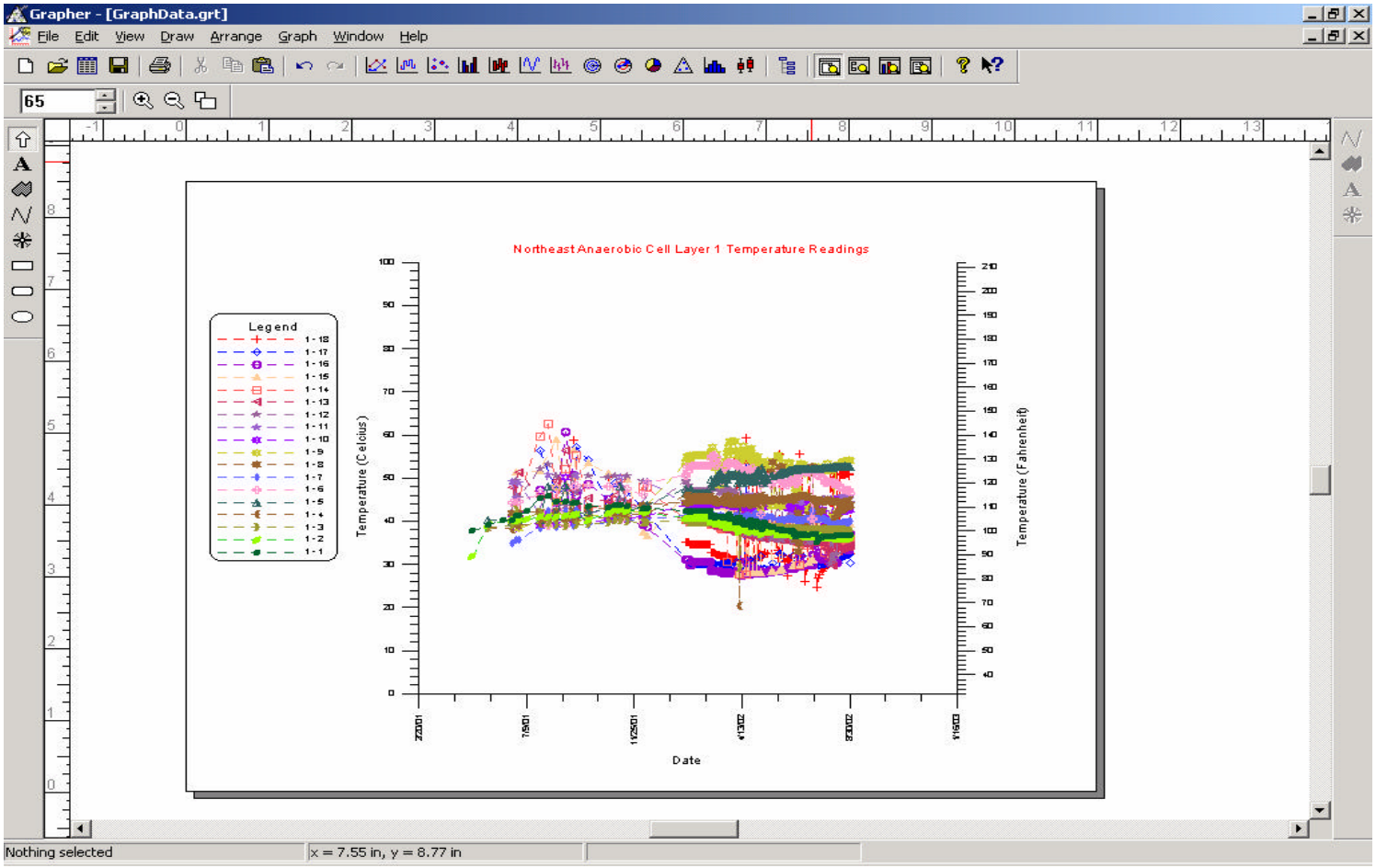


Yolo Bioreactor Home Page

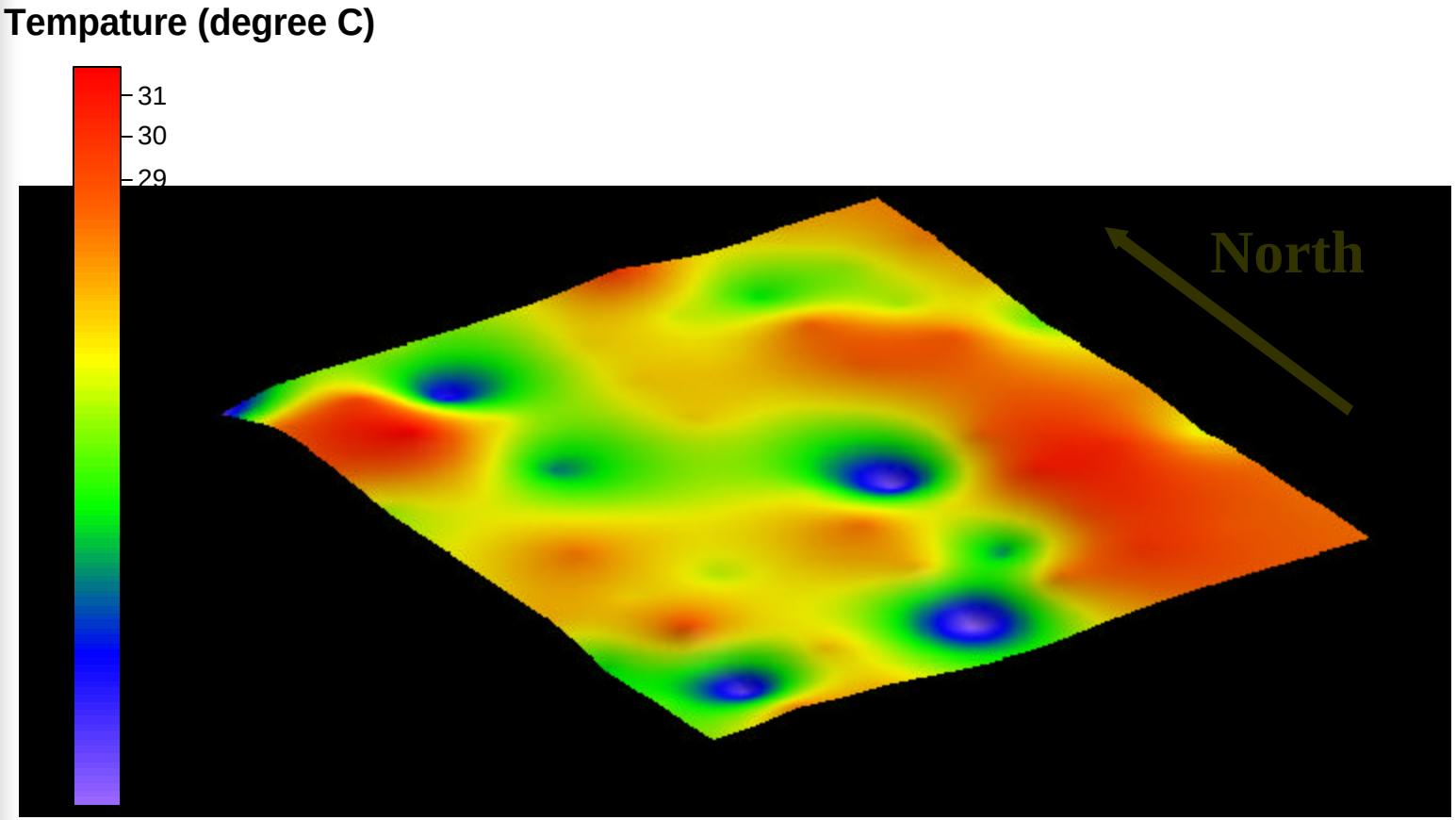
Yolo Bioreactor-Web Based Data Extraction and Graphing



Yolo Bioreactor-Sample 2D Graphs from Database



Bioreactor Bottom Liner Temp.

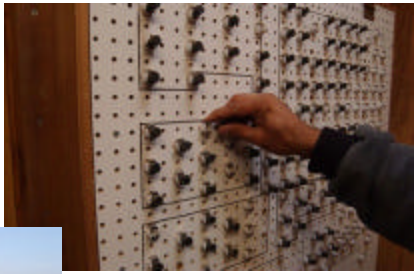
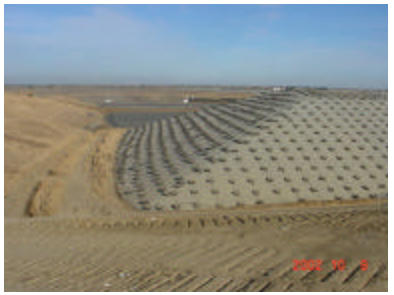


Achievements to Date

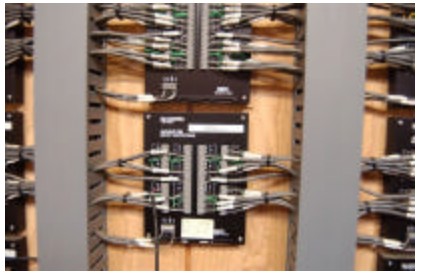
- **Construction of landfill gas collection and removal system**

Achievements to Date

- **Collection of $2x10^6$ SCF fugitive landfill gas (45% methane) from 3.5 acre anaerobic bioreactor before water addition**





Achievements to Date

- **Construction of leachate recirculation and pumping system**
- **Injected of over 850,000 gallons of leachate in the anaerobic 3.5 acre landfill**

Achievements to Date

- **Construction of final cover system**

Achievements to Date

- **First waste sampling and testing**

Achievements to Date

- **First waste Settlement Survey**

Achievements to Date

- **Fugitive methane emissions monitoring using FID/PID Vapor Analyzer (FOXBORO TVA-1000)**

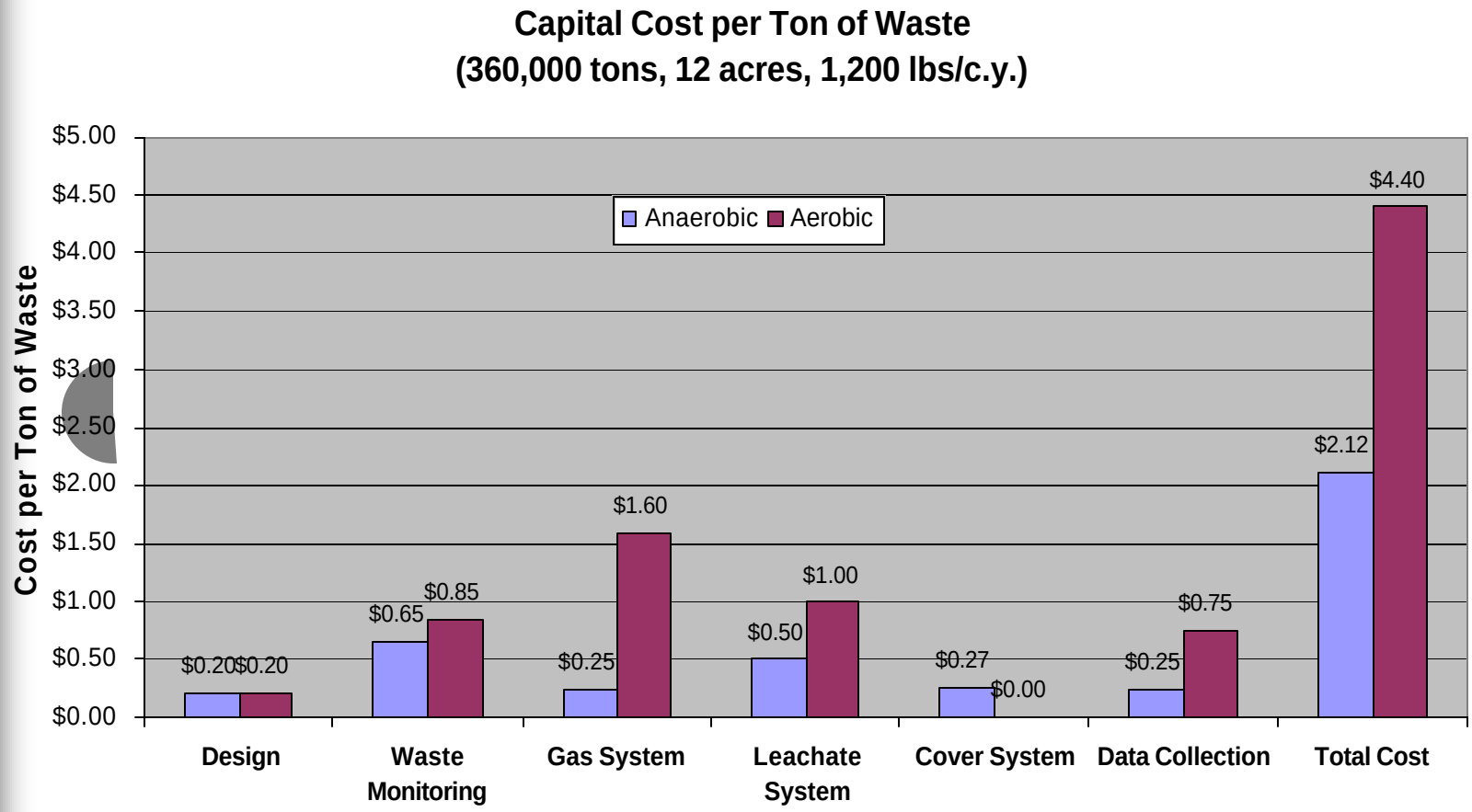
Achievements to Date

- **Landfill gas sampling (LANDTECH GEM-500) and laboratory testing**
- **Leachate sampling and laboratory testing**

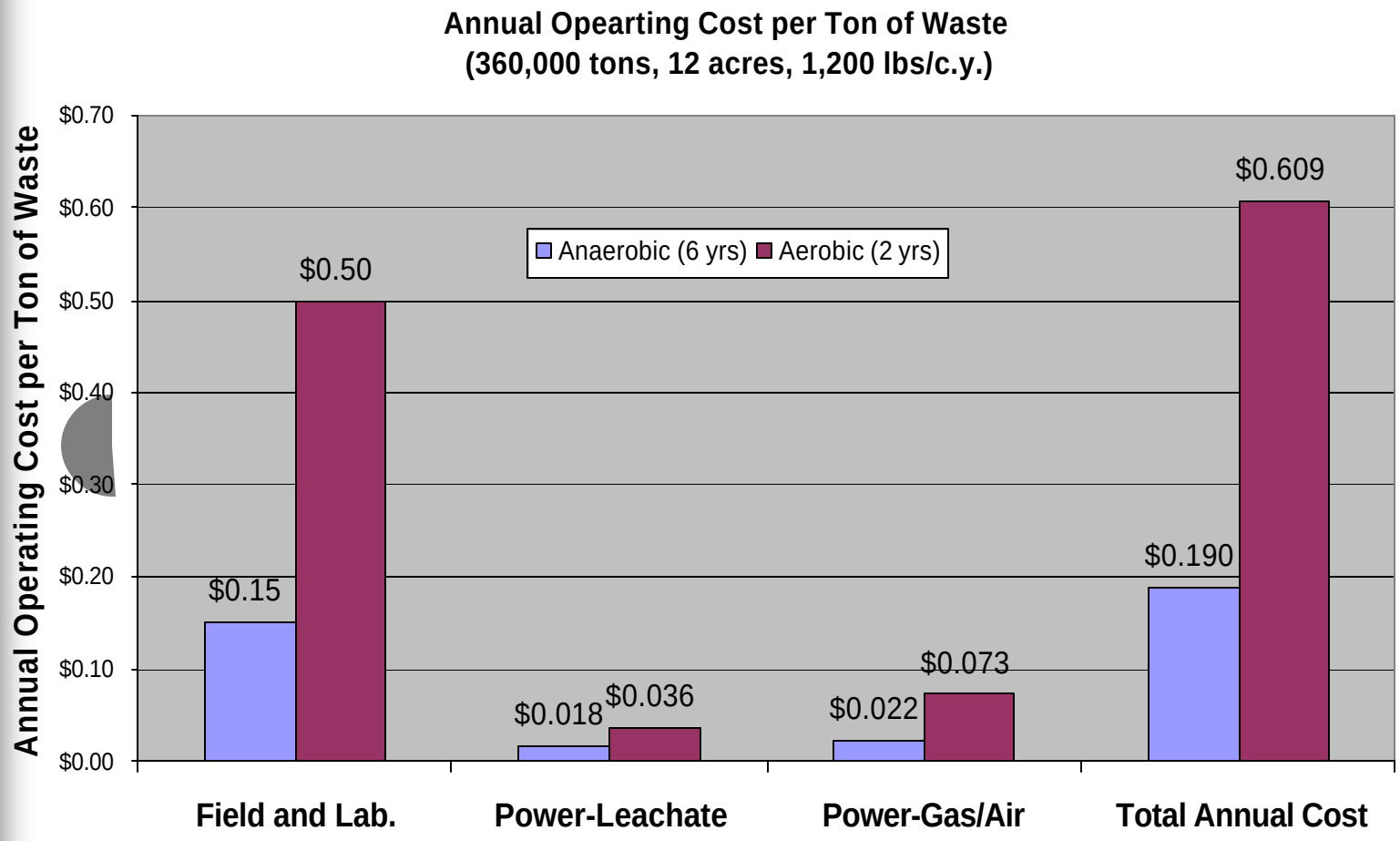
Design and Construction Challenges

- **Liner cap design and construction**
- **Installation of instrumentation after waste filling**
- **Securing installed liner and penetration of pipes through the cap**
- **HDPE Injection lines-drilling and installing fittings**
- **Pressurized Leachate injection system-inspection for leaks**

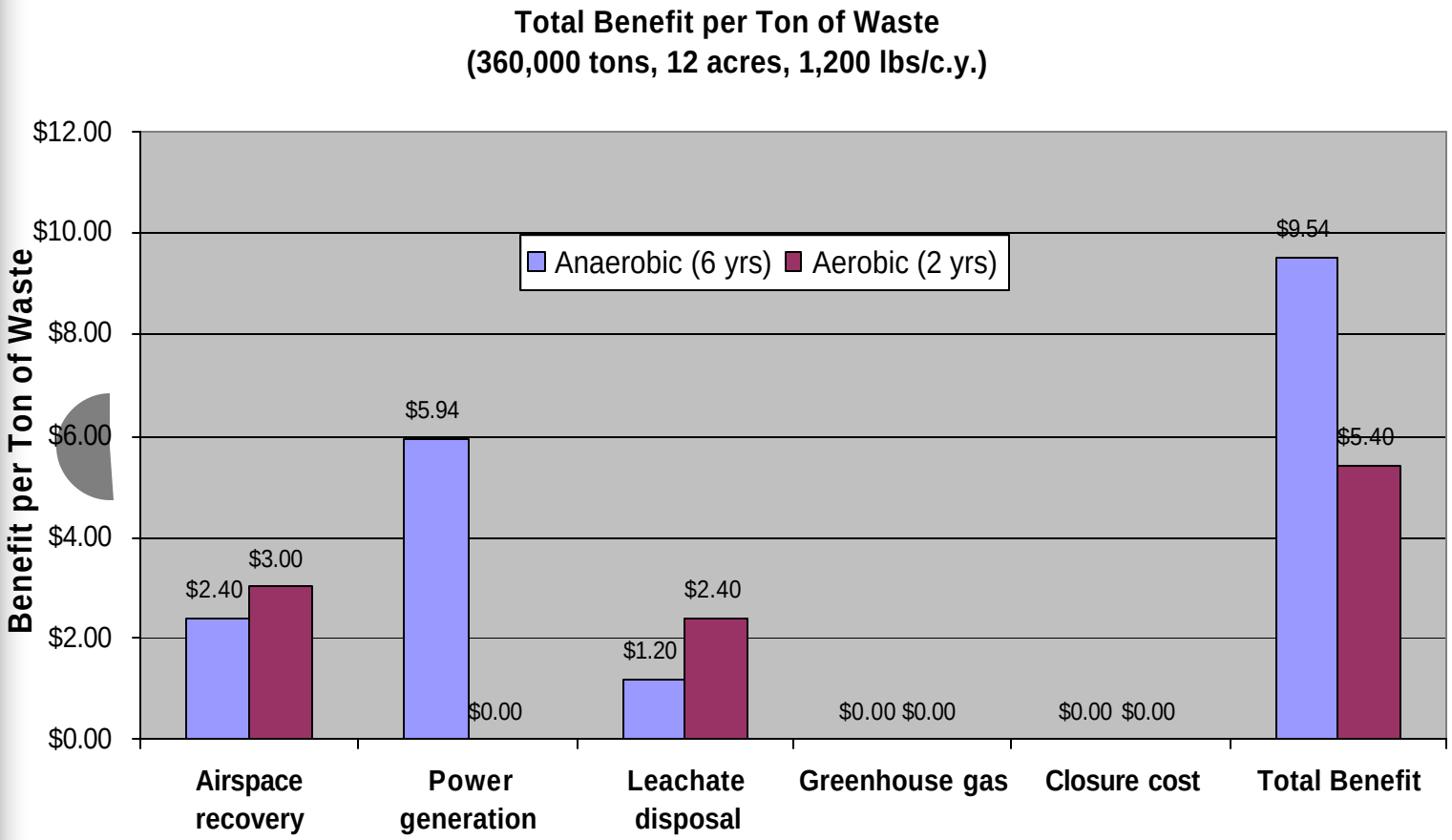
ECONOMICS-
Capital Cost for Bioreactor



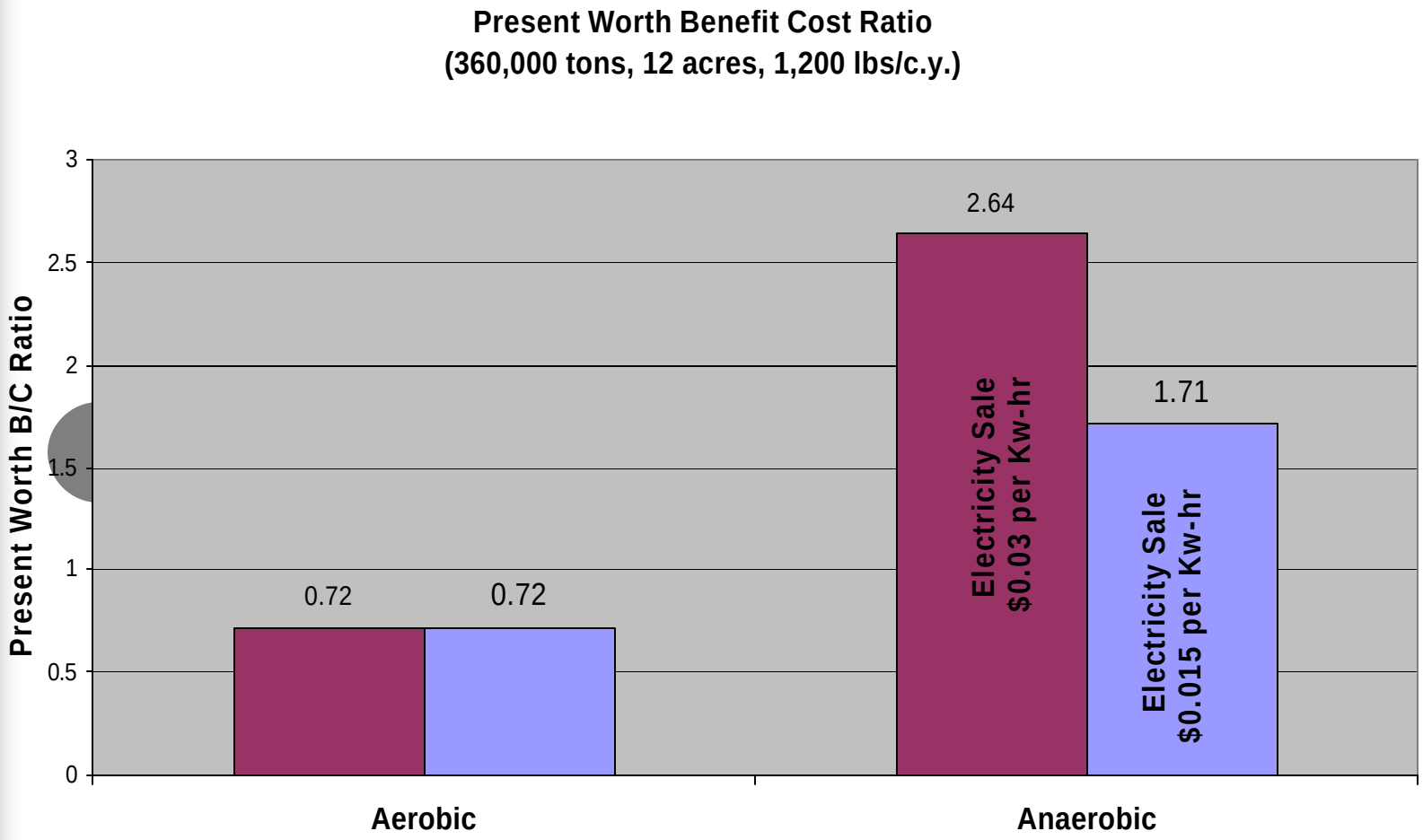
Annual Operating Cost Estimate



Benefits of Bioreactors



Present Worth Benefit/Cost



Remaining Tasks for the 3.5 acre Anaerobic Bioreactor

- **Complete the second surveying event to monitor waste settlement**
- **Conduct the second round of waste sampling and testing**
- **Perform surface scan monitoring for methane emissions**
- **Monitor and sample leachate**
- **Monitor and sample landfill gas**
- **Report results**

Remaining Tasks for the 6 acre Anaerobic Bioreactor

- **Complete installation of instrumentation and monitoring system**
- **Complete installation of the surface liner system**
- **Complete installation of the leachate injection and pumping system**

Remaining Tasks for the 6 acre Anaerobic Bioreactor

- **Complete installation of the landfill gas collection and removal system**
- **Conduct the second round of waste sampling and testing**
- **Complete the first surveying event to monitor waste settlement**
- **Install, and troubleshoot the SCADA system**

Remaining Tasks for the 6 acre Anaerobic Bioreactor

- **Perform surface scan monitoring for methane emissions**
- **Monitor and sample leachate**
- **Monitor and sample landfill gas**
- **Begin operation and report results**

Remaining Tasks for the 2.5 acre Aerobic Bioreactor

- **Complete installation of blower and piping**
- **Complete installation of the biofilter**
- **Begin liquid injection and air suction**
- **Perform surface scan monitoring for methane emissions**
- **Monitor and sample leachate**
- **Monitor and sample biofilter air samples**
- **Begin operation and report results**

Conclusions

- **Bioreactors can be:**
  - **Designed to protect the environment more than the conventional landfills**
  - **Be operated in a safe manner**
  - **Be Constructed with normal equipments**
  - **Instrumentations be installed as filling**
  - **Early gas collection under cover to reduce fugitive emissions via horizontal layers**
  - **Inject leachate slowly to not impact head over the liner within waste lifts**

Conclusions

- **Bioreactors can be:**
  - **Inject leachate horizontally within the waste to distribute moisture**
  - **Be design to be operated by SCADA system**
  - **Collect real-time field data for monitoring and control**
  - **Create a master database for data management and reporting**
  - **Economical to construct and operate**

THE END