YOLO COUNTY BIOREACTOR LANDFILL PROJECT XL
Stakeholder Meeting

June 5, 2000 2:00-5:00 PM
at Esparto Library

County of Yolo

Planning & Public Works Department

Division of Integrated Waste Management

292 West Beamer Street, Woodland, CA 95695

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http://www.yolocounty.org/

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United States Environmental Protection Agency

"...to protect human health and to safeguard the natural environment..."

Presentation

- ✔ ***Define Terms Used***
- ✔ ***Current Project History and Partners***
- ✔ ***Project Results***
- ✔ ***Proposed Full-scale Bioreactor Project XL***
- ✔ ***Issues Identified to Date***
- ✔ ***Stakeholder Process Proposed***

Define Terms Used-Composting

- **What is composting?**
  - Conversion of the organic waste to useable nutrients
- **How is it done?**
  - Using a Natural Process the “Friendly Bugs” (Bacteria) do all the work
- **How many types of “Bugs” are there?**
  - Two Types: Aerobic and Anaerobic Bacteria

Define Terms Used-Composting

- **What is the difference between them?**
  - Aerobic Bacteria Need Oxygen
  - Anaerobic Bacteria DO NOT Need Oxygen
- **How do we keep them happy?**
  - By providing them with their needs and maintaining the right living condition
  - They need Water, Nutrients, Heat, and our Attention!

Define Terms Used-Composting

- **What do these "bugs" produce?**
  - Aerobic "Bugs" produce Carbon Dioxide gas and Heat
  - Anaerobic "Bugs" produce Methane gas (like natural gas used for cooking) and Carbon Dioxide (we exhale)
- **What could we do with these products?**
  - Methane gas could be used beneficially as a renewable energy resource (liquid fuel or electricity)
  - Carbon Dioxide could also be used beneficially in greenhouses to increase plant growth or produce dry ice
  - Heat generated could be used beneficially

Define Terms Used-Landfill

✔What is a Conventional Landfill?

- **It's not a dump. Trash use to burned and buried in old days**
- **Now it's called a Landfill**
- **Waste is compacted and covered with soil or other equivalent cover material each day to prevent the spread of disease**
- **Below the waste, groundwater is protected by a lining system and is monitored and tested regularly**
- **Perimeter of the landfill site and around buildings within the site is monitored for methane gas migration and must be controlled**
- **Groundwater, liquid that has come in contact with trash (leachate), and gas produced by the waste is tested and monitored frequently**
- **Landfill surface is monitored for gas emission above the final cover and emission must be controlled**
- **Final cover is placed on top of the landfill and groundwater, leachate and landfill gas are monitored for 30 years after the closure**

Define Terms Used-Bioreactor

✔What is a Bioreactor Landfill?

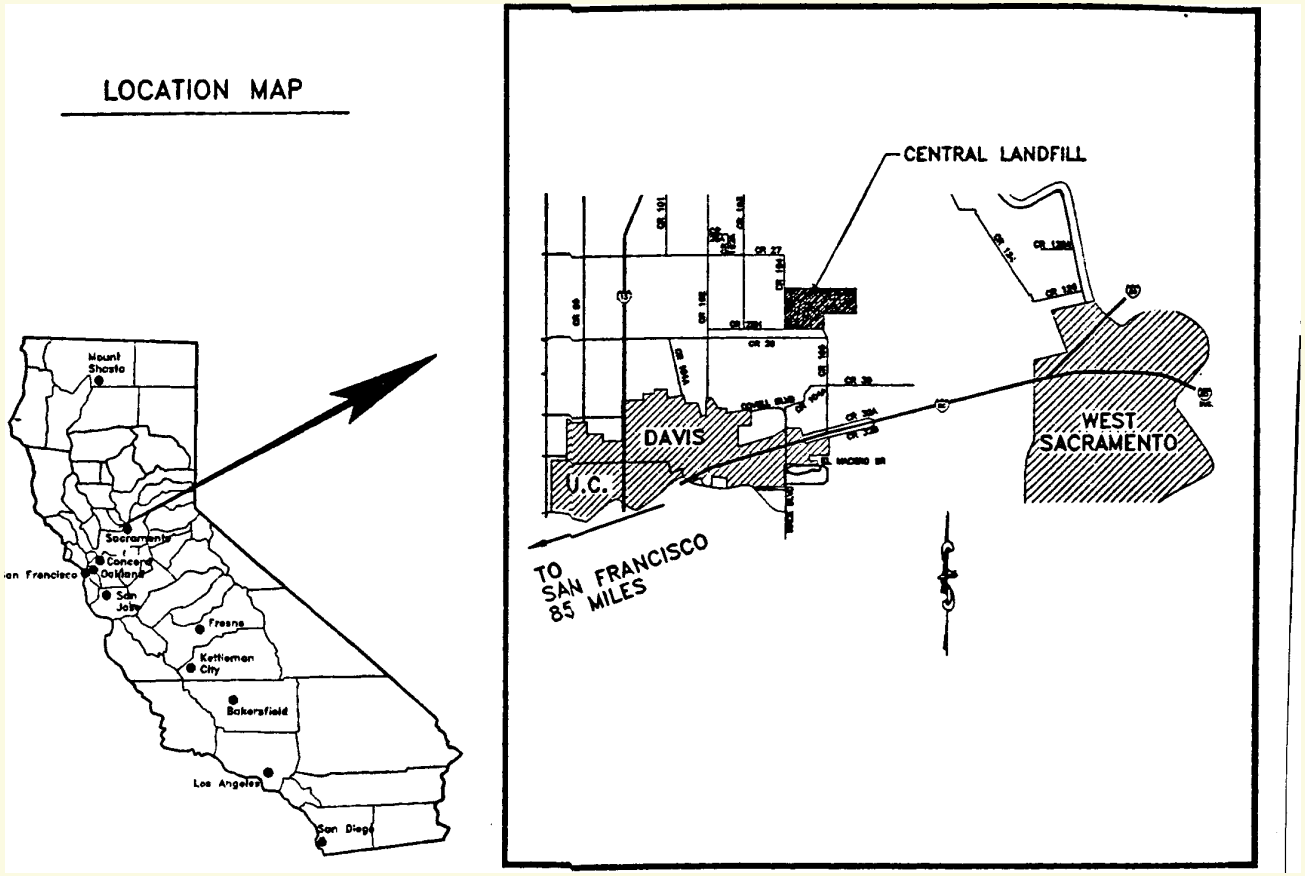
- You have to do all that you normally do for a Conventional Landfill **PLUS MORE**
  - **Add controlled quantities of liquid to keep "Bugs" Happy**
  - **Addition of this liquid will maximize the waste decomposition**
  - **Recirculate this (leachate) to provide the "Bugs" with their needs- nutrients, heat, and water**
  - **Monitor landfill temperature and moisture continuously**
  - **Monitor liquid level on top of the bottom liner and within the waste continuously to prevent excess of liquid build up**
  - **Sample and test liquid and gas from the landfill more frequently than the Conventional landfill to ensure that the "Bugs" are Happy**

Define Terms Used-Bioreactor

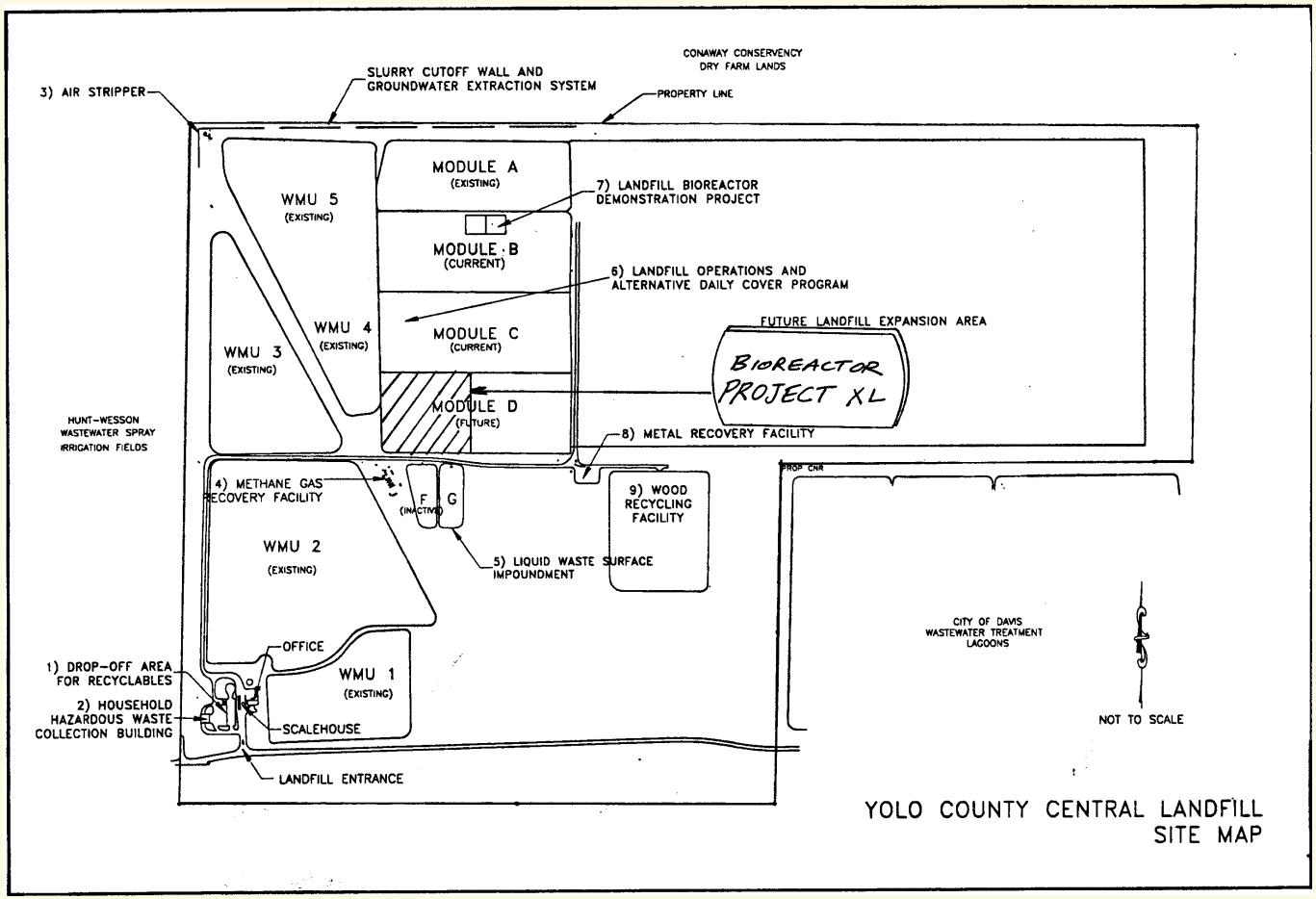
✔What is a Bioreactor Landfill?

- You have to do all that you normally do for a Conventional Landfill **PLUS MORE**
  - **Start collection of landfill gas earlier than a conventional landfill**
  - **Use a permeable layer for gas collection on bottom and top of the landfill to control landfill gas migration**
  - **Landfill is monitored and data is collected continuously to inform the operator**
  - **Operating a Bioreactor Landfill is similar to a waste water treatment facility rather than a Conventional Landfill**

Project Location Map



Project Site Map



Site Background

- **Description of Yolo County Central Landfill**
  - Current Design Capacity, 25 million C.Y.
  - Current Operating life
    - Opened 1975
    - Planned closure 2021
  - Containment system - single composite liner, leachate collection and removal system
  - Landfill gas collection system
  - Waste characteristics (Residential and Commercial Waste)

CEC Bioreactor Demonstration Cells

✔Project Objectives

- Demonstrate that Water Addition can Substantially Accelerate Waste Decomposition and Landfill Gas Generation
- Monitor Biological Conditions Within the Landfill
- Estimate the Potential for Landfill Life Extension
- Better Understand the Movement of Moisture in the Landfill
- Assess the Performance of Shredded Tires for Landfill Gas Transfer and Leachate Injection
- Provide Interested Parties & Regulatory Agencies with Information on the Technology

CEC Bioreactor Demonstration Cells

- **CONSTRUCTION PHASE SUPPORT (1995)**
  - California Energy Commission, $250,000
  - Yolo County, $125,000
  - Sacramento County, $125,000
  - California Integrated Waste Management Board, $63,000
  - TOTAL PROJECT COST $563,000

CEC Bioreactor Demonstration Cells

- **MONITOING PHASE SUPPORT (since 1996)**
  - Western Regional Biomass Energy Program (USDOE), $50,000
  - Urban Consortium Energy Task Force (USDOE), $110,000
  - Yolo County, $115,000
  - Current Funding for 1999-2001 from NETL-DOE $460,000
  - TOTAL PROJECT COST $735,000

CEC Bioreactor Demonstration Cells

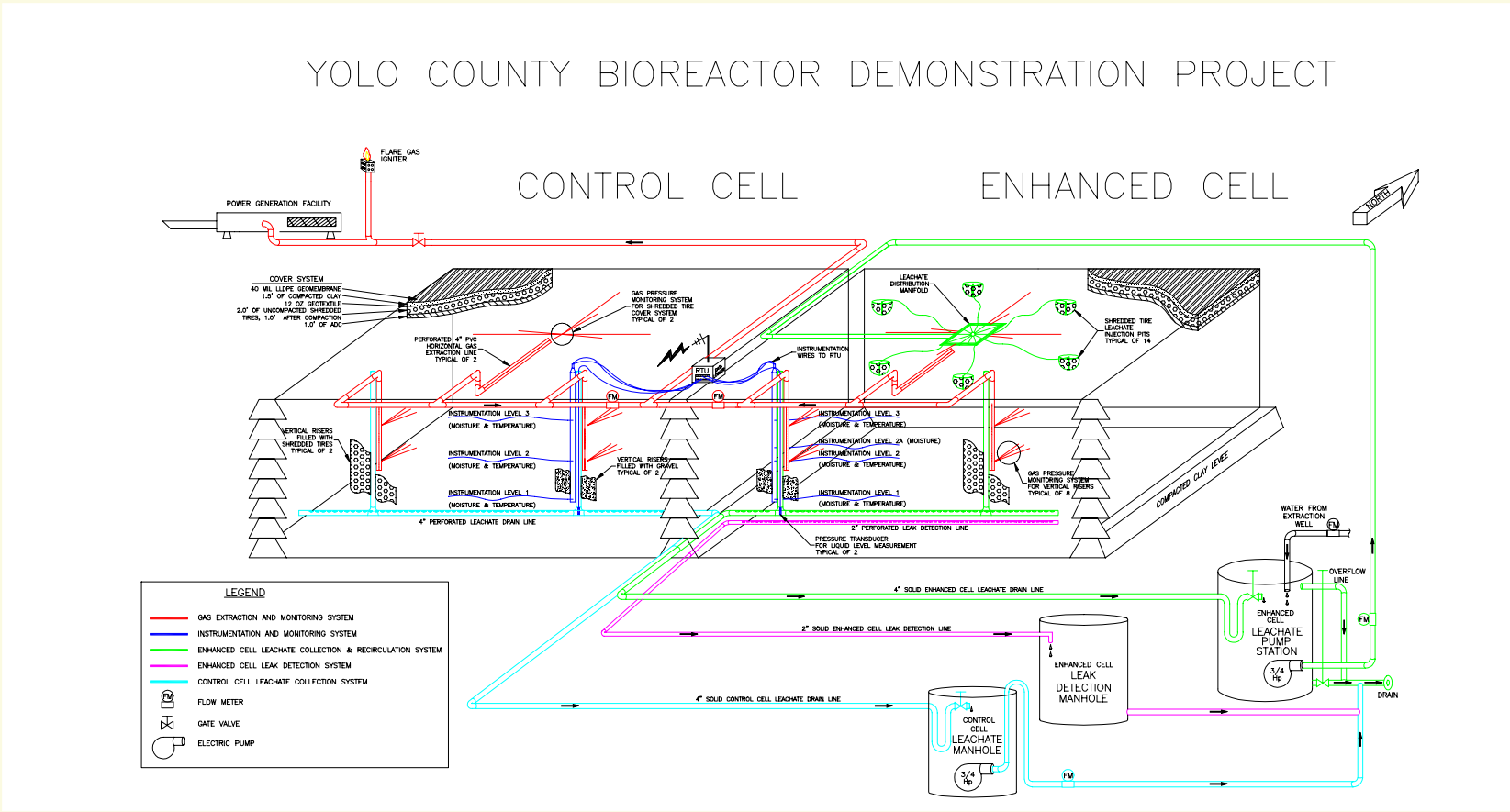
- ✔BASIC FEATURES OF THE PROJECT
  - ***Two Test Cells (Control & Enhanced)***
  - ***Base Layer Containment, Sub. Title D***
  - ***Leak Detection System, Double Liner***
  - ***Compacted Clay Sidewalls***
  - ***Municipal Solid Waste***
  - ***Instrumentation in Waste Mass***
  - ***Gas and Liquid Collection and Measurement***
  - ***Leachate Injection System***
  - ***Final Cap System***

CEC Bioreactor Demonstration Cells

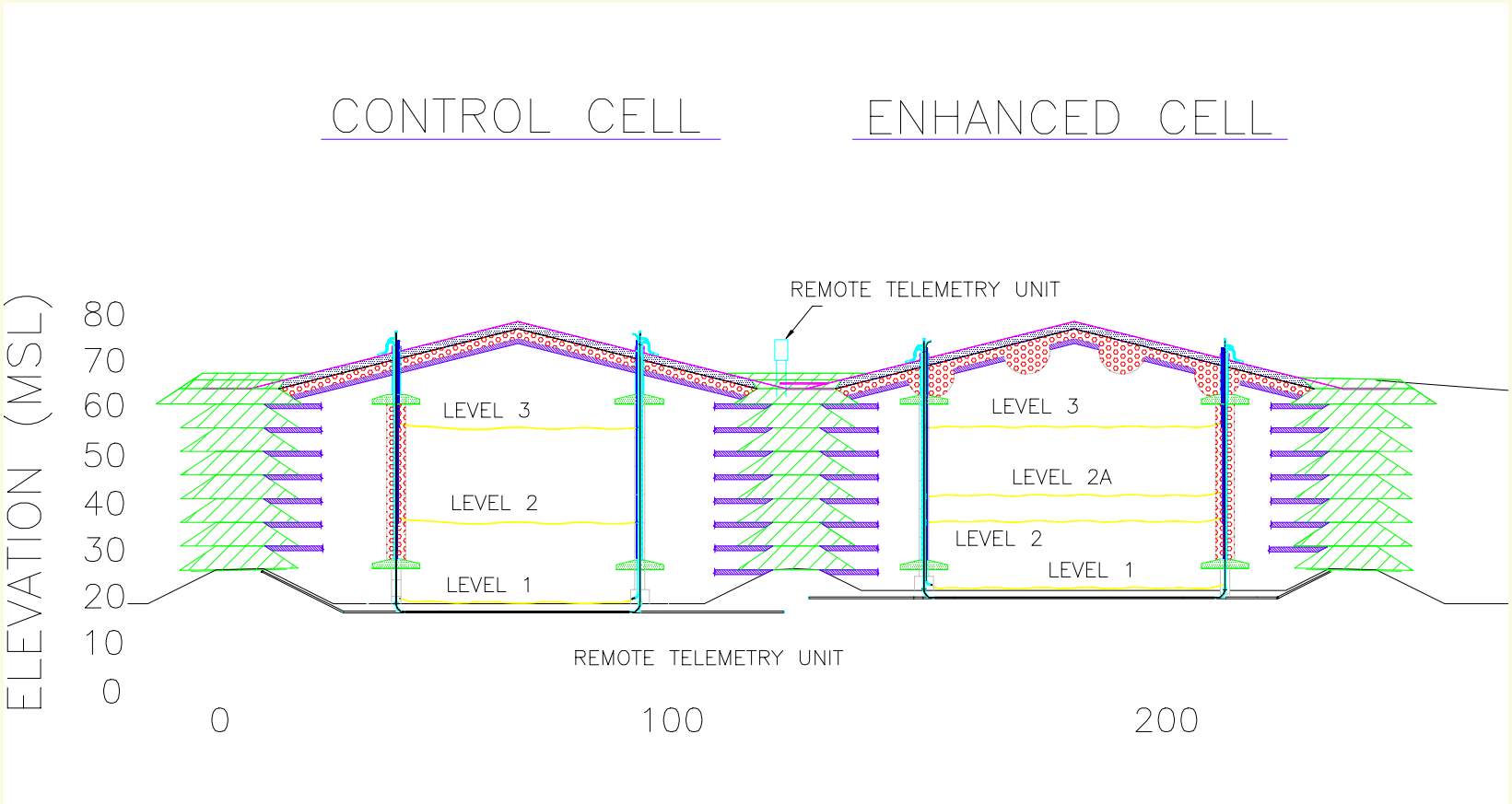
- ***CEC DEMONSTRATION CELLS CONSTRUCTION DATA SUMMARY***

	CONTROL CELL	ENHANCED CELL
CELL FOOT PRINT (ACRES)	0.27	0.27
WASTE AVERAGE DEPTH (FEET)	43	40
SOLID WASTE (TONS)	8,737	8,568
ALTERNATIVE DAILY COVER GREEN WASTE (TONS)	1,454	1,336
IN PLACE WASTE COMPACTION (POUNDS PER C.Y.)	1,014	1,027
WASTE TIRES USED (TONS)	200	295

CEC Bioreactor Demonstration Cells



CEC Bioreactor Demonstration Cells



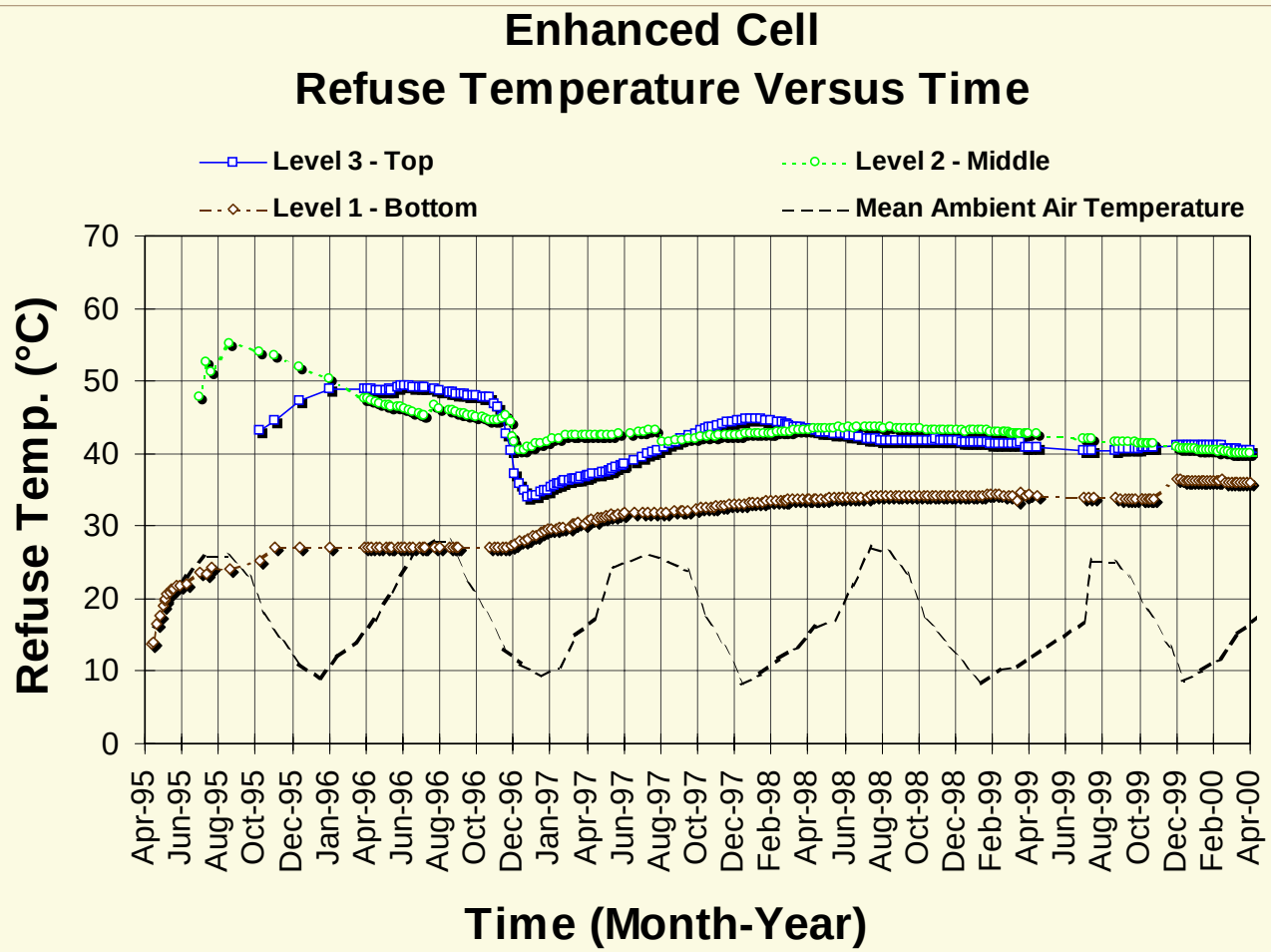
CEC Bioreactor Demonstration Cells

- ***DEMONSTRATION CELL SLIDE SHOW***

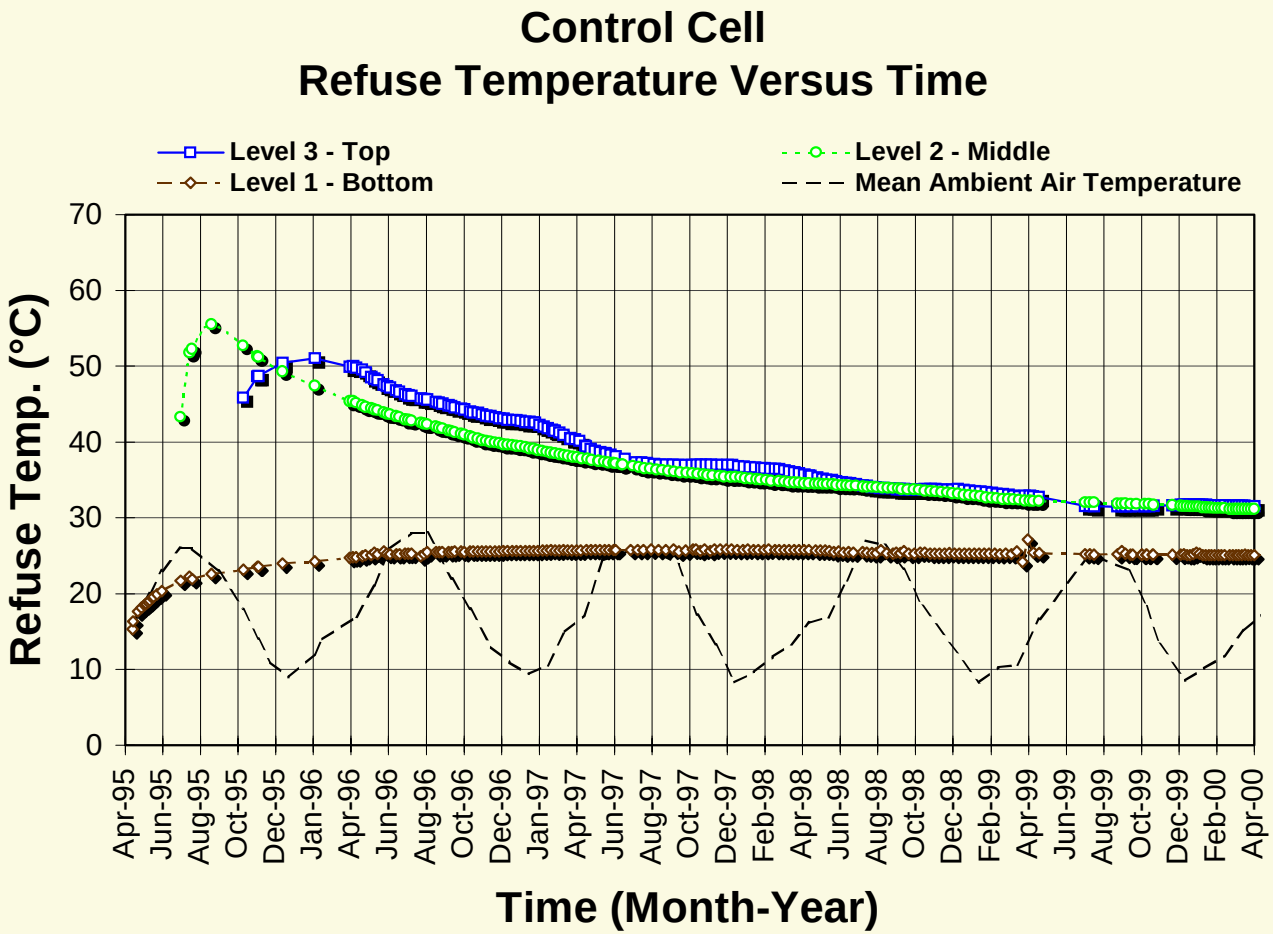
CEC Bioreactor Demonstration Cells

- ✔ OPERATIONS & MONITORING PROGRAM WORK PLAN
  - ***Addition of Liquid to Enhanced Cell***
  - ***Liquid Volumes***
  - ***Leachate Depth***
  - ***Leachate Composition***
  - ***Waste Moisture Condition***
  - ***Waste Temperature***
  - ***Landfill Gas Production***
  - ***Landfill Gas Composition***
  - ***Landfill Gas Pressures***
  - ***Landfill Settlement***
  - ***Data Analysis and Interpretation***

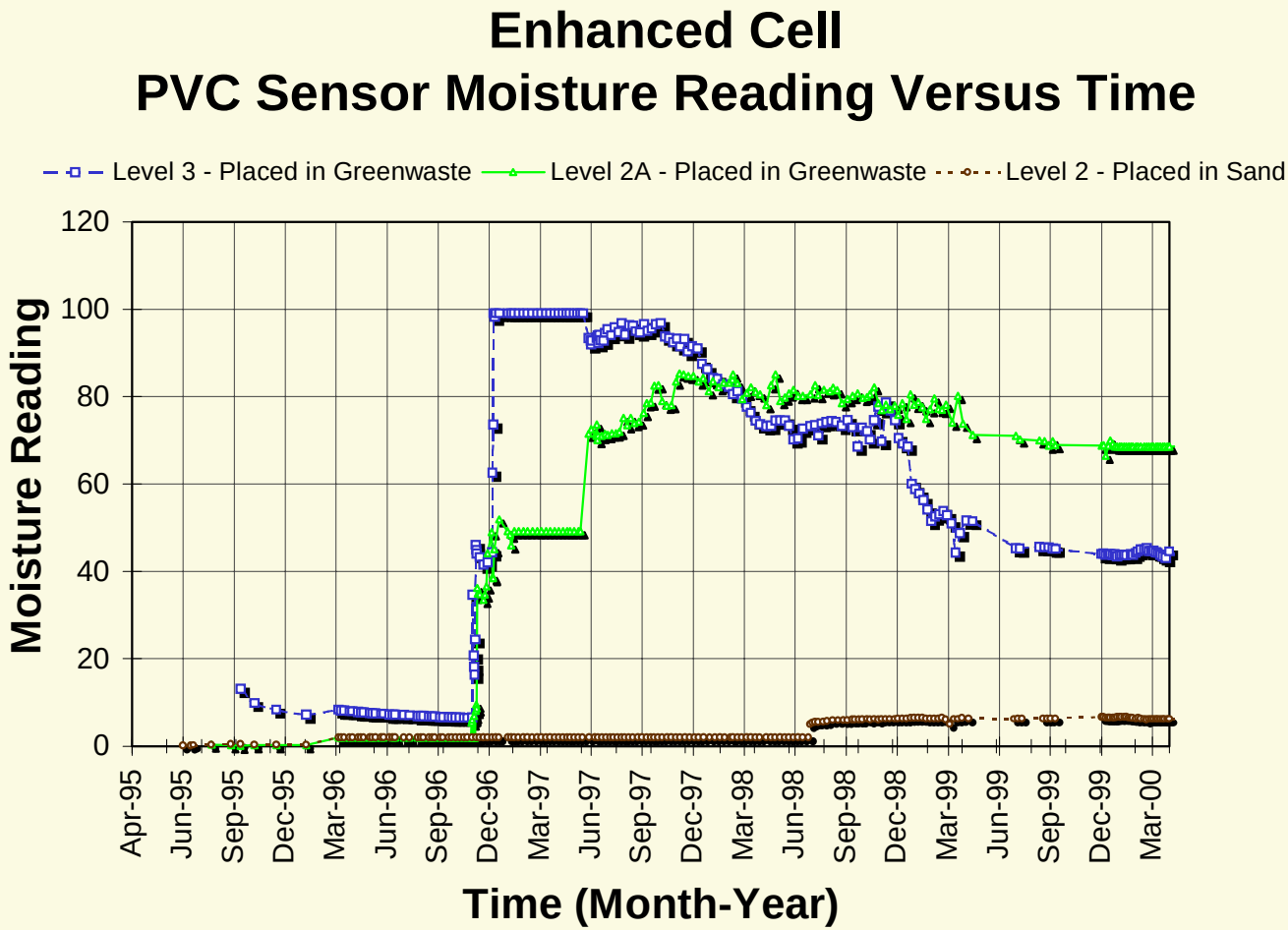
Project Results-Temperature



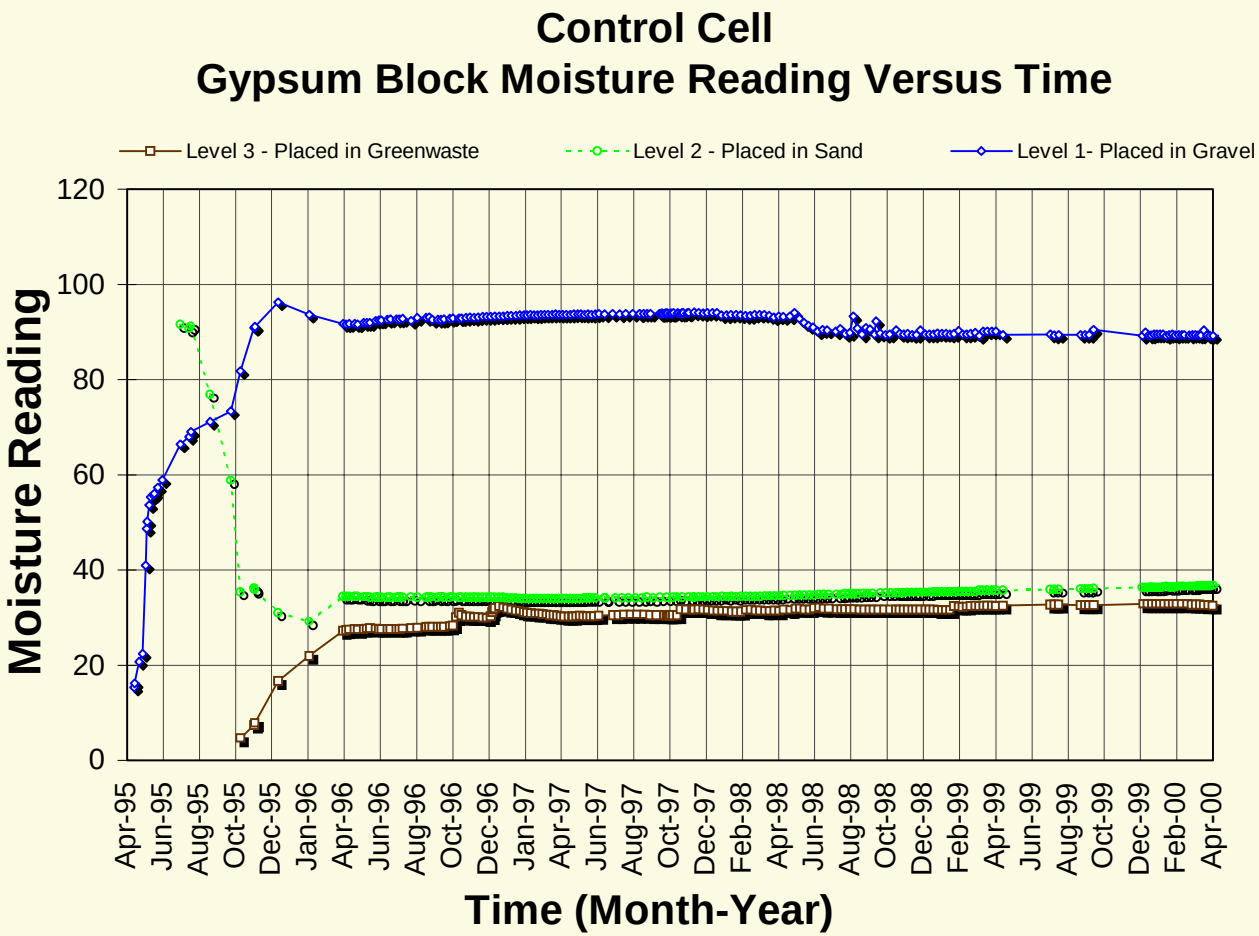
Project Results-Temperature



Project Results-Moisture



Project Results-Moisture



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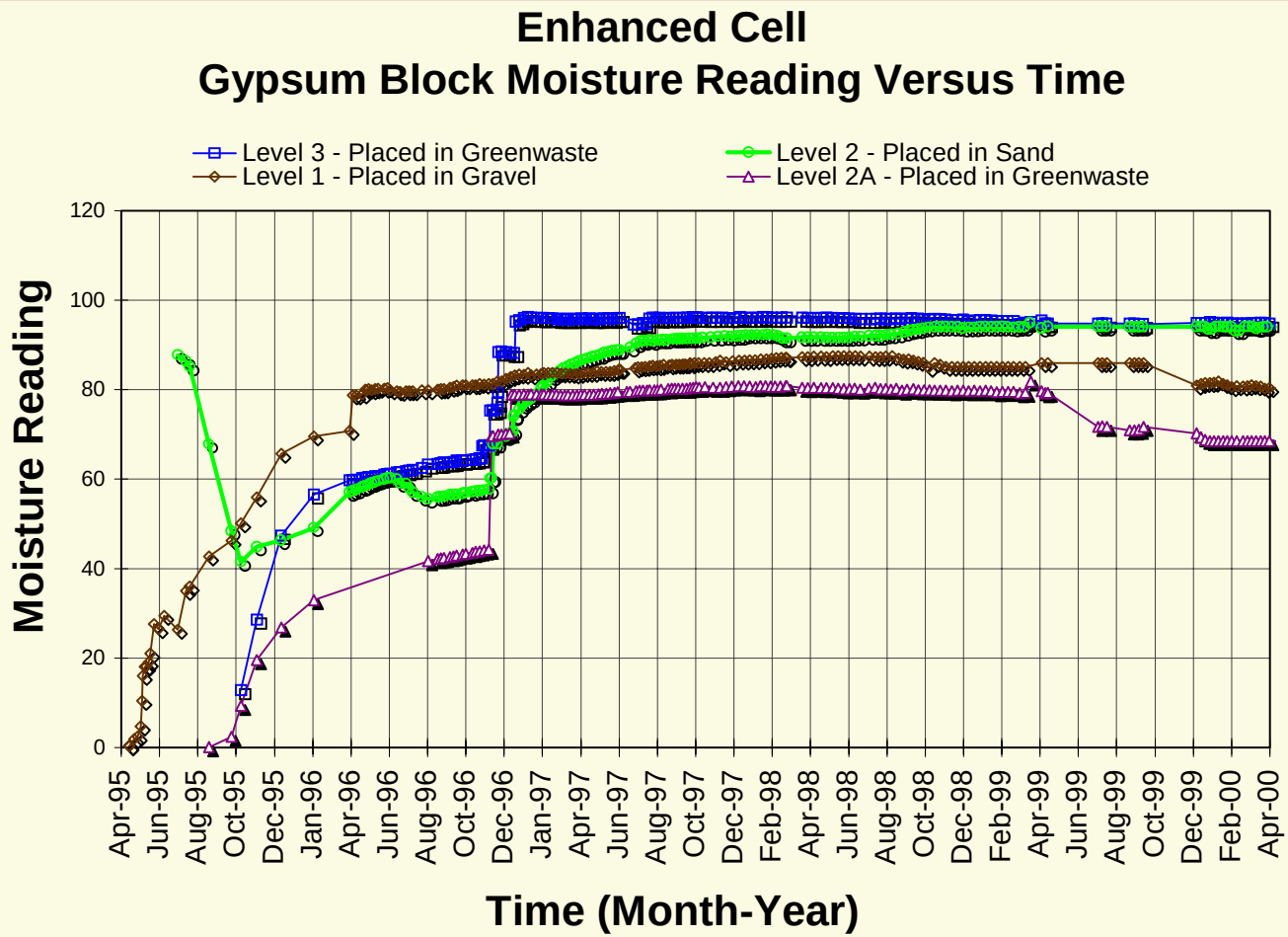
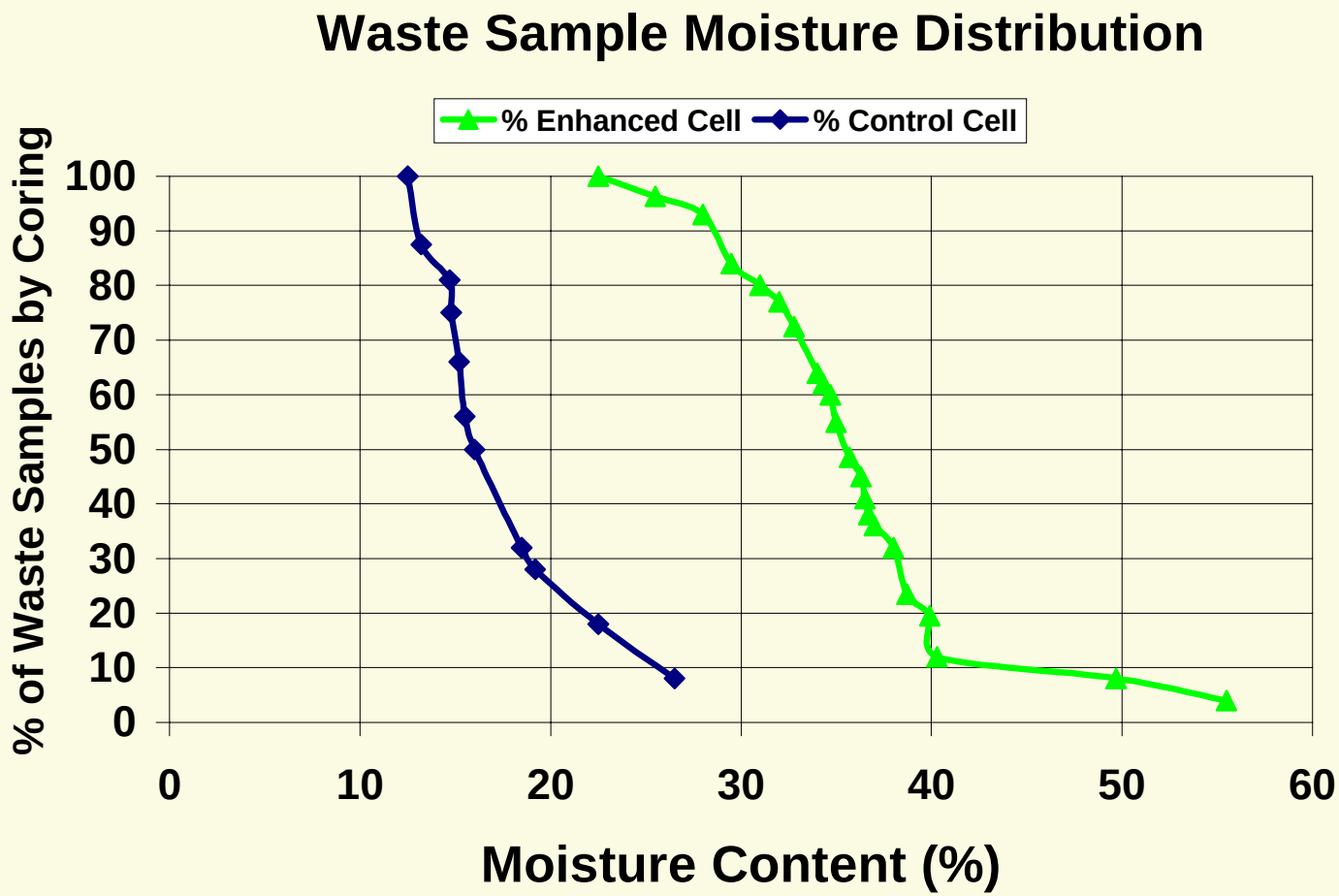
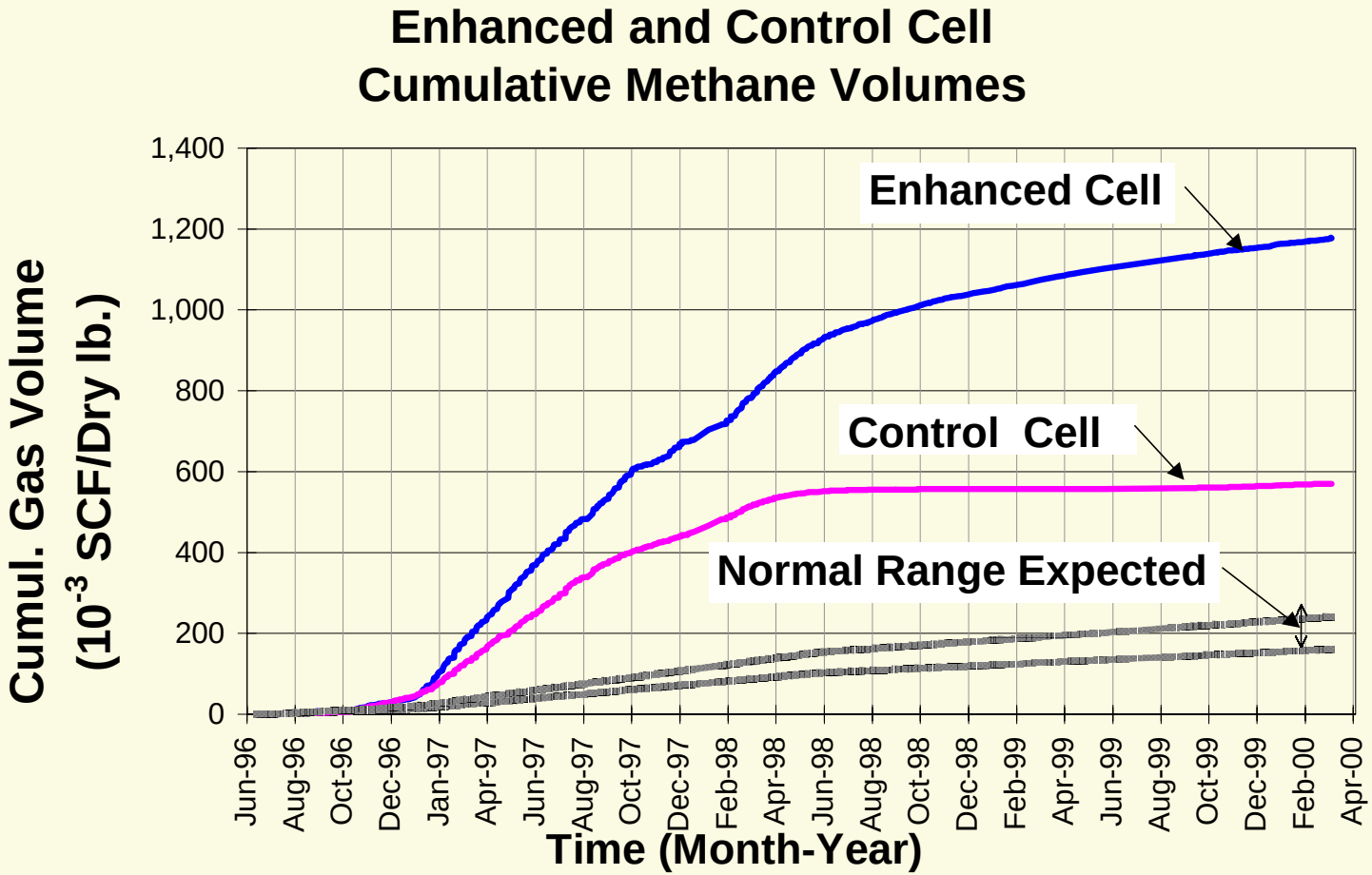


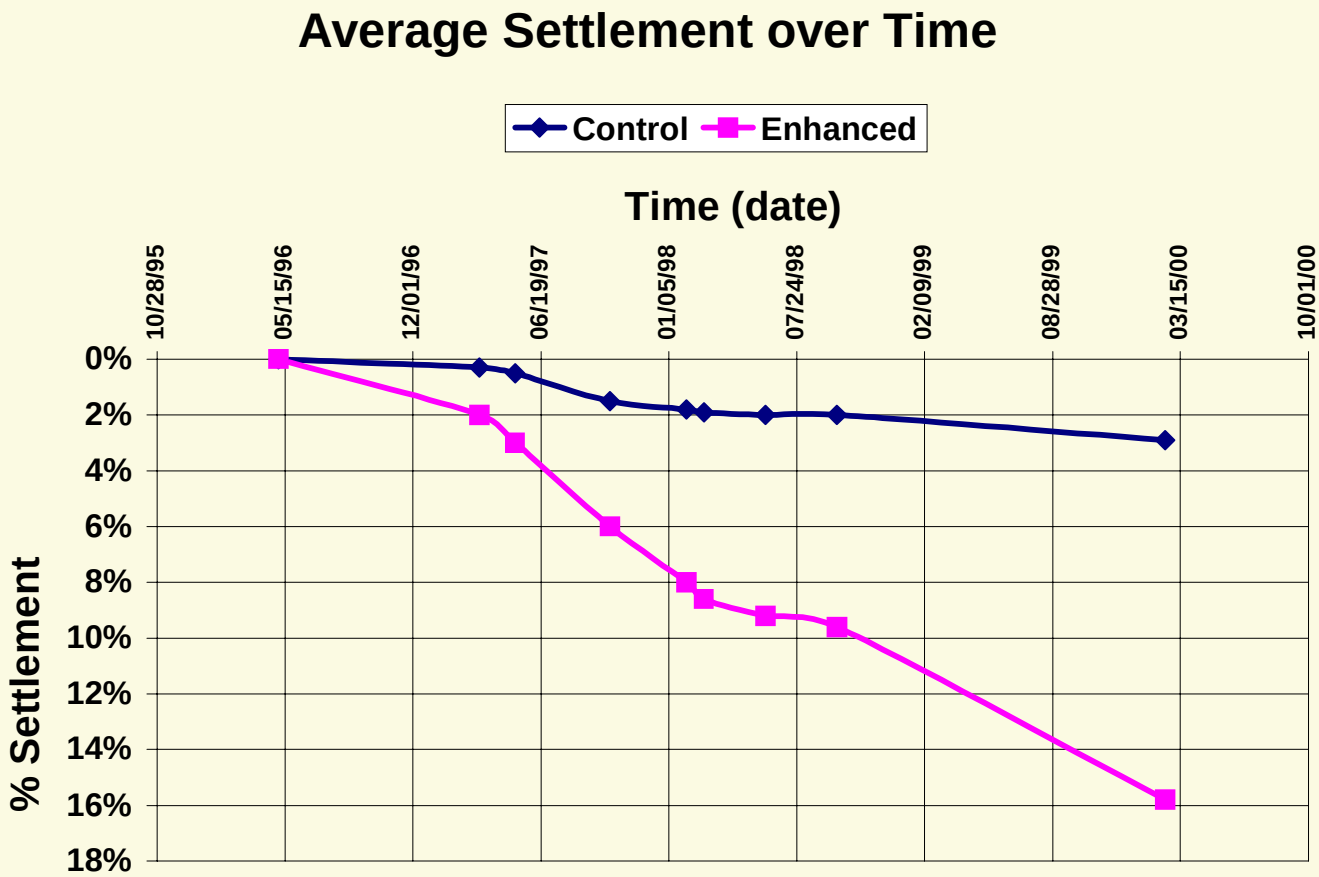
Project Results-Moisture



Project Results-Gas Volumes

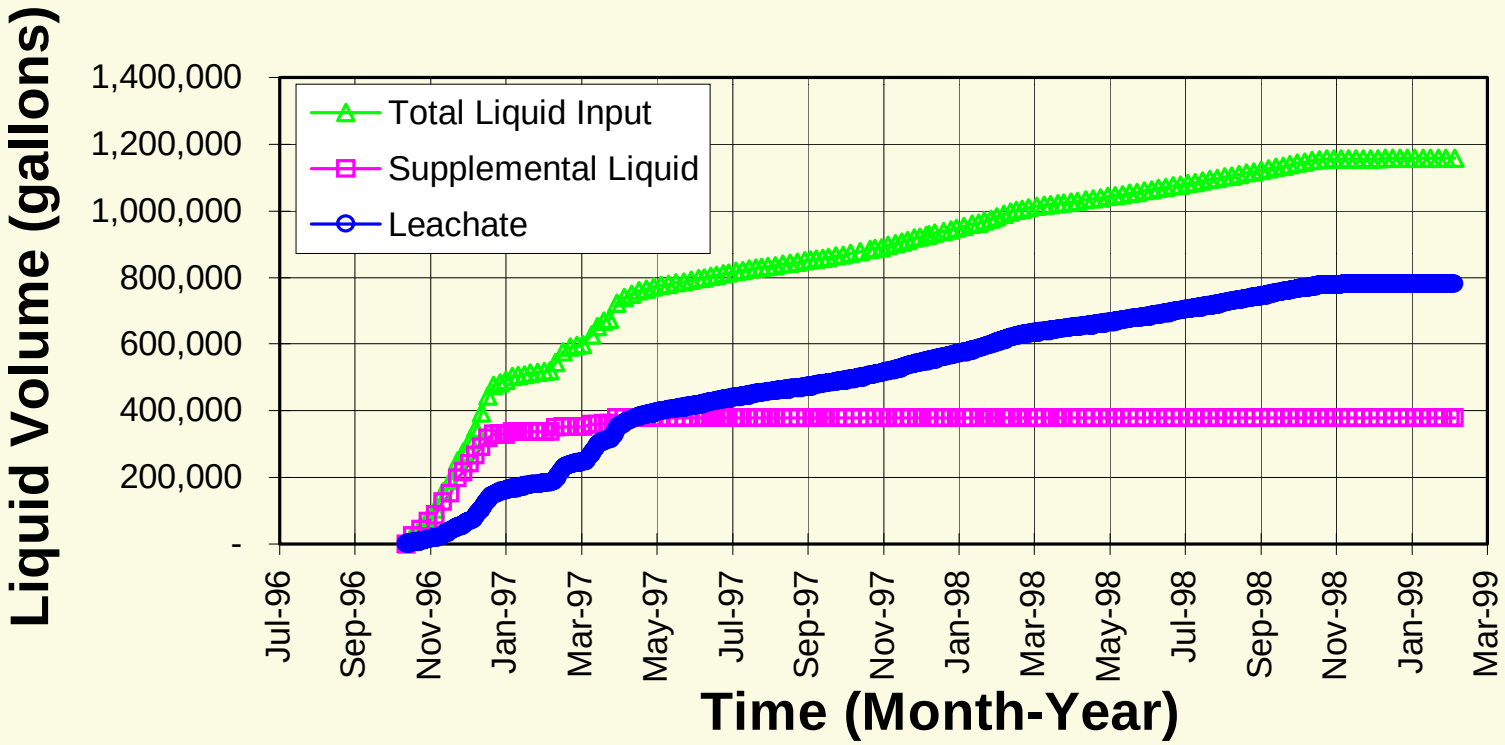


Project Results-Settlement



Project Results-Liquid Volumes

- ***Cumulative Liquid Volumes Versus Time***



Project Results-Leachate Tests

- ***LEACHATE CHEMISTRY FOR ENHANCED CELL***

YEAR	1996	1997	1998	1999
PH	5.8	7.0	7.2	7.2
BOD (mg O/L)	5,020	820	140	80
COD (mg O/L)	20,300	2,860	3,130	2,650
TDS (mg/L)	19,800	7,600	7,500	7,250
TOC (mg/L)	9,830	611	1,130	1,080
Iron (mg/L)	152,000	933	504	206
Manganese (µg/L)	41,900	4,000	1,170	1,060
Calcium (mg/L)	1,400	480	220	198
Toluene (µg/L)	160	75	24	15

Lessons Learned to Date

- ✔ **ACCELERATED DECOMPOSITION AND METHANE RECOVERY ACHIEVED BY MOISTURE ADDITION**
- ✔ **MOISTURE DISTRIBUTION ATTAINABLE BY EASILY APPLIED ADDITION METHODS**
- ✔ **SIGNIFICANT SETELLMENT AND LEACHATE CHEMISTRY IMPROVEMENT AFTER SHORT TIME OF LEACHATE RECIRCULATION**
- ✔ **SHREDDED TIRES PERFORM WELL AS LANDFILL GAS TRANSFER AND LEACHATE INJECTION**
- ✔ **DESIGN TO ISOLATE THE LEAK DETECTION SYSTEM FROM THE REST OF THE MODULE**
- ✔ **SHORTEN THE LENGTH AND INCREASE THE SLOPE OF PIPES CARRYING LIQUIDS**

Project XL Proposal

✔What is 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 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

Project XL Proposal

- **Full-scale Demonstration of Bioreactor Concept**
  - Accelerate decomposition of waste
  - Accelerate methane production and improve energy recovery
  - Verify improvement in leachate quality
  - Reduce post-closure risk to air and water
  - Verify hydraulic head on the liner
  - Collect other gas and leachate parameters

Project XL Proposal

- **Project elements**
  - Use of liquid amendments (groundwater, leachate, etc.)
  - Modify the composite liner system design to improve it beyond the mandated state and federal regulations
  - Use alternative cover (for daily and intermediate cover) instead of soil
  - Operate project in two modes - anaerobic and aerobic
  - Install gas collection system during filling to start gas collection shortly after filling
  - Cover waste upon completion of waste filling and start liquid addition

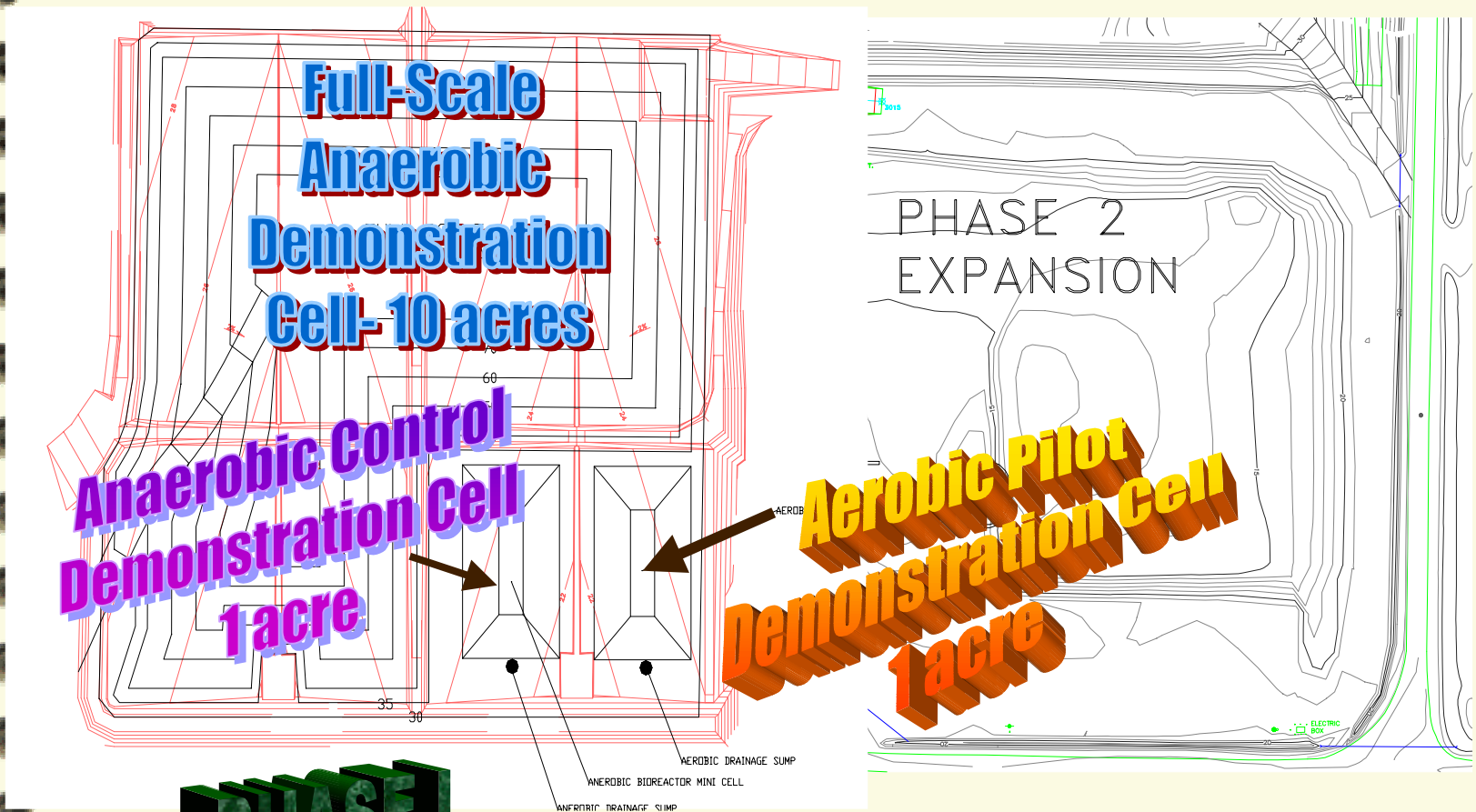
Project XL Proposal

- **Changes to the Proposal dated 2/22/00:**
  - Reduce size of aerobic cell from 6 acres to 1 acre
  - Construct two one acre cells. Aerobic pilot demonstration cell and anaerobic pilot control demonstration cell. This will reduce the construction cost of a levee between the anaerobic and aerobic cells
  - Increase monitoring points for liquid level at the bottom of the landfill and liquid level within the waste mass
  - Increase the monitoring point for other parameters as budget allows
  - Fully automate real time data collection and monitoring for all parameters possible
  - Construct a 10 acre full-scale anaerobic demonstration cell

Project XL Proposal

- ✔ **Requested Flexibility**
  - Liquid application
- ✔ **Superior Environmental Results**
  - More rapid biodegradation and earlier stabilization of waste
  - Extended use of current site and reduced need for new site
  - Improved quality of leachate and reduced risk of groundwater contamination
  - Earlier and more rapid generation of landfill gas resulting in more economical energy recovery

Proposed Full-Scale Bioreactor



Full-Scale Bioreactor Partners

- Project Partners:
  - **U.S. Environmental Protection Agency**
  - **California Integrated Waste Management Board**
  - **California State Regional Water Quality Control Board**
  - **California State Water Resources Control Board**
  - **California Air Resources Control Board**
  - **Solid Waste Association of North America**
  - **Yolo County Environmental Health**
  - **Yolo-Solano Air Quality Management District**
  - **Institute for Environmental Management (IEM)**
  - **National Energy Technology Laboratory, U.S. DOE**

Full-Scale Bioreactor Schedule

- Project Timeline:
  - **Final Project Agreement (FPA) modified -July 2000**
  - **Permits to be issued by Ca. State Agencies-June 2000**
  - **Start Cell filling and Instrumentation Installation-July 2000**
  - **Leachate injection and gas collection system installation to start- September 2000**
  - **Installation of cover system, gas collection, leachate recirculation and pumping system to start-October 2000**
  - **Federal approval to allow water addition-November 2000**
  - **Cover system installation to be completed-February 2001**
  - **Start of Liquid addition and air injection-March 2001**
  - **Data collection and reporting-September 2000 to March 2004**

FPA Issues Identified to Date

- **More Detail Information Requested**
  - Detail design for gas collection and control
  - Detail information for monitoring instrumentation and location
- **Provide Contingency Plan**
  - Landfill fire control
  - Liner leakage and groundwater impact

Stakeholder Process Proposed

- **Do we need another meeting?**
  - Proposed Process:
    - Revise FPA and include all issues identified
    - Stakeholders review the revised FPA
    - Meet only if a major concerns arises that requires a meeting
    - How about progress reporting and annual meeting?
  - Proposed Process:
    - As more information becomes available about the project, it will be posted on EPA Yolo XL Project site on the web
    - An annual report will be complied and distributed to all stakeholders prior to annual meeting