

# ***Use of a Long-term Air Injection/Soil Vapor Extraction Pilot Study as an Effective Closure Strategy***

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# Outline

- ***Site History & Conditions***
- ***Remedial Alternative Evaluation***
- ***Development of a Closure Strategy***
- ***Pilot Study***
- ***Current Status***



## *Site History*

- *Former railroad maintenance and fueling depot*
- *Built in the early 1900s*
- *Taken out of service in early 1980s*
- *Environmental assessments since 1990s*

## ***Regulatory Setting***

- *LPST Program*

## ***Physiography***

- *Texas Gulf Coastal Plain*

## ***Geology & Hydrogeology***

- *Sands and Clays*



# ***Assessment History***

- ***Area of Affected Soil & Groundwater***



# *Assessment History*

- *Area of Affected Soil & Groundwater*
- *COC - #2 Diesel*
- *Limited LNAPL on-site*

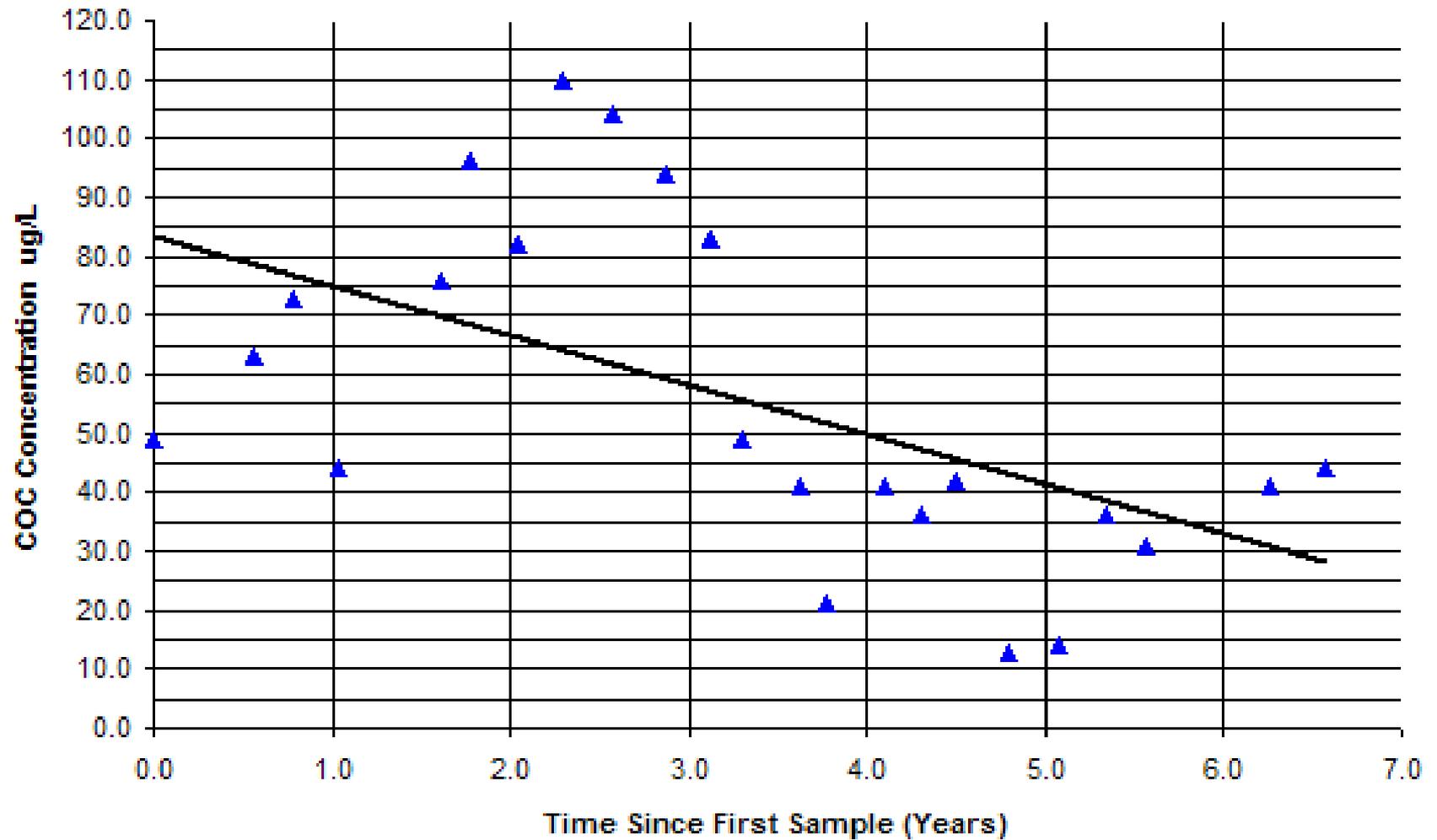




## *Assessment History*

- *Area of Affected Soil & Groundwater*
- *COC - #2 Diesel*
- *Limited LNAPL on-site*
- *Affected off-site monitoring well*

## *Benzene in Groundwater MW-8 (downgradient, off-site)*



## ***Regulatory Drivers***



- ***Off-site Recalcitrant Benzene***
- ***On-site LNAPL***

## ***Risk Management***

- ★ ***Adjacent Residential Property***

# *Remedial Alternative Evaluation*

- *Good Historical Assessment*
  - *~20 Monitoring Wells*
  - *Soil and Groundwater Sampling*
  - *Fingerprinting of LNAPL*
  - *CPT/ROST*
- *Pilot Testing*
  - *Multiple Events and Technologies*
  - *Oxygen Depleted Subsurface*





# *Development of Remedial Strategy*

- *Complicating Site Constraints*
- *Closure vs. Maintenance*
- *More Pilot Testing ?*

*..... Full Scale System ?*

*.....or Pilot Study ???*



# *Pilot Study*

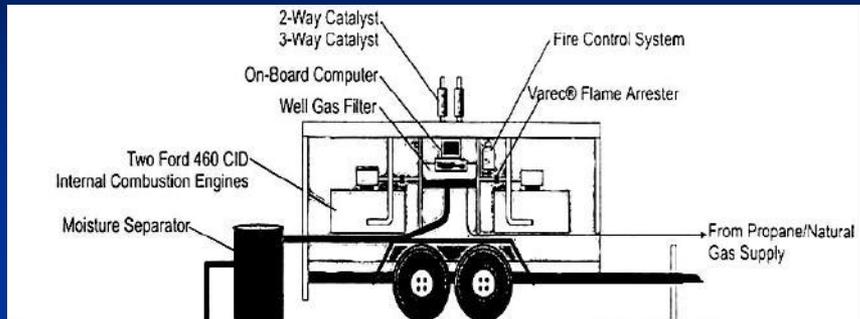
- *Conceptual Remedial Plan*
  - *Stand Alone System*
  - *Similar Equipment Used During Pilot Testing*
  - *Low Capital Investment*
  - *Limited Physical Improvements*
  - *Addresses Site Constraints*

# *The Technology*

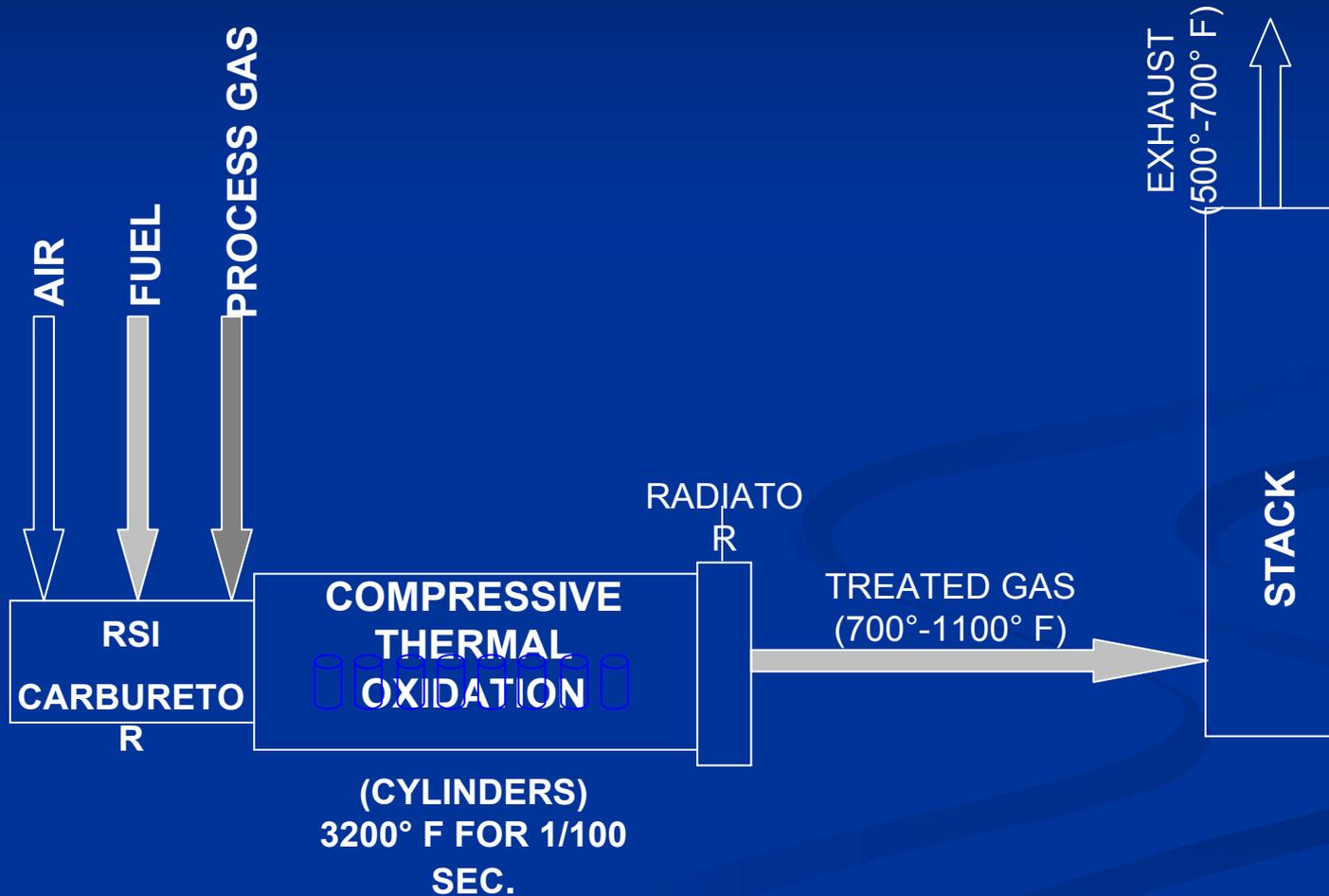


U.S. Patent: 4,846,134; 4,979,886  
Canadian Patent: 1,287,805

# The Technology

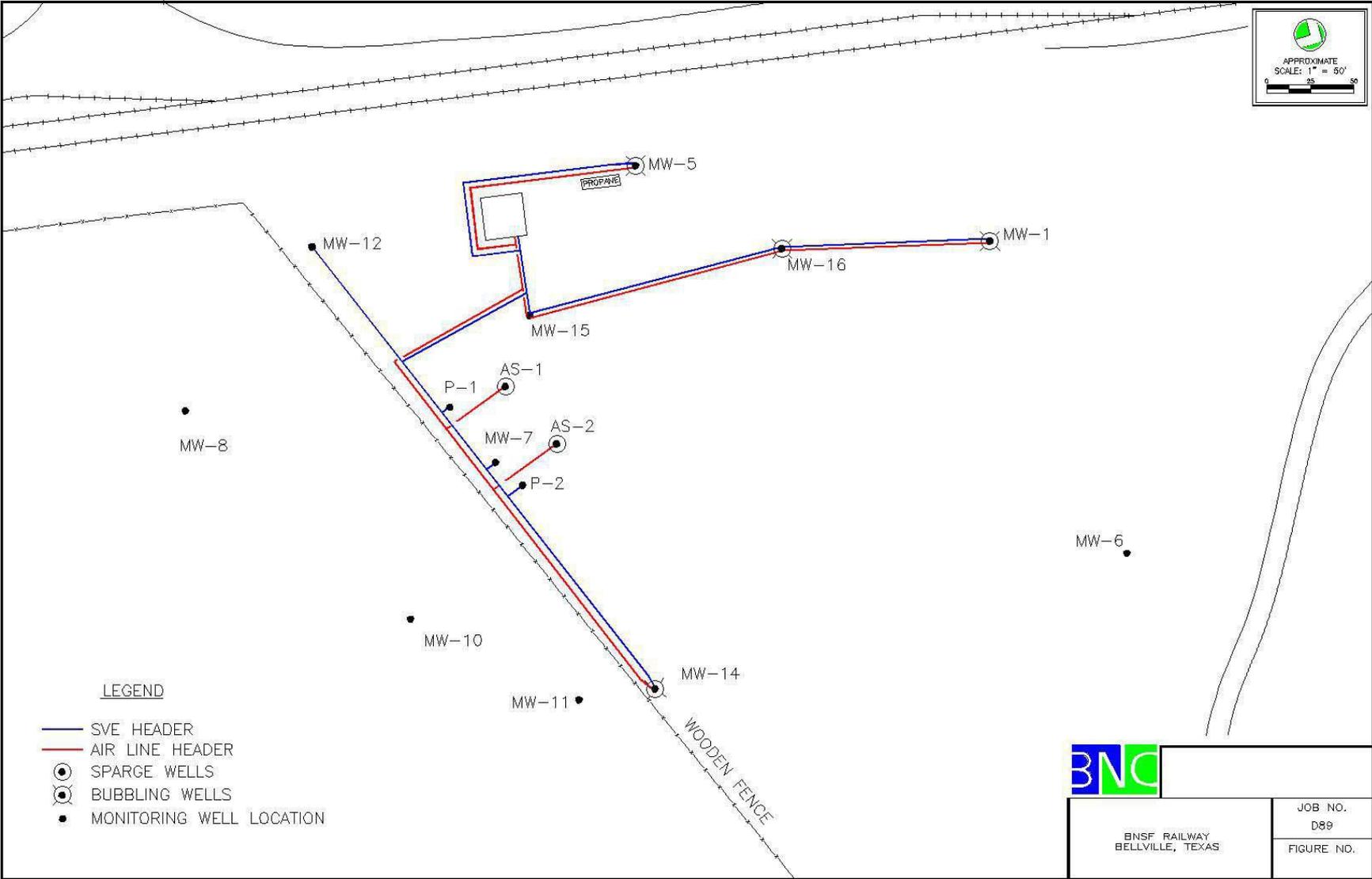
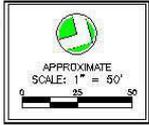


# The Technology



# *The Technology*

- Successful AFCEE Demonstration Project
- ICE technology easily integrated
- Capable of achieving stringent air discharge limitations (> 99.9% destruction efficiency)
- Low cost per pound for TVH
  - \$0.04 to \$0.46
- Auxiliary fuel required (propane or natural gas)
- Soil vapor extraction flow rate dependent on site conditions
- Weekly O&M required



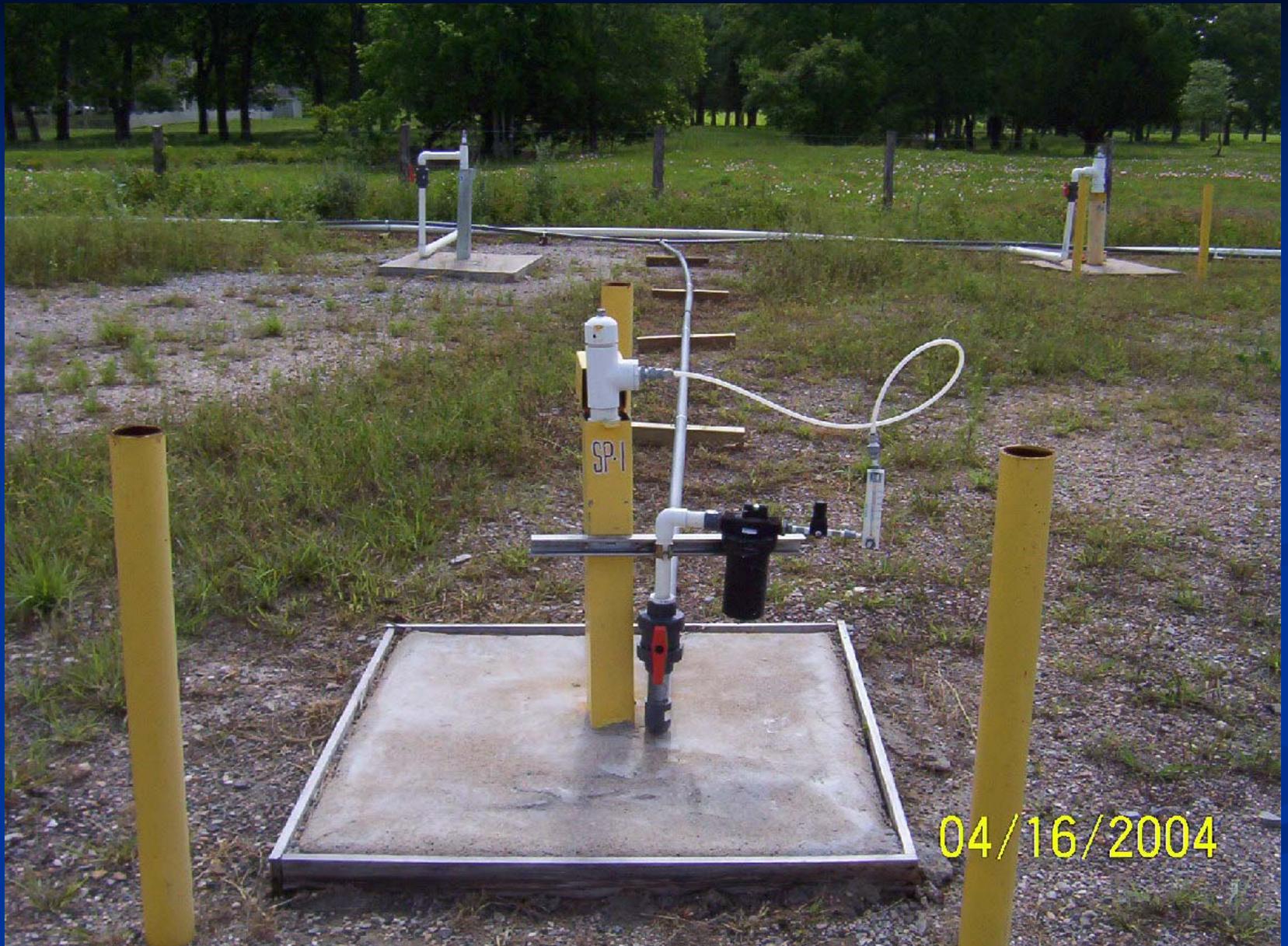
**LEGEND**

- SVE HEADER
- AIR LINE HEADER
- SPARGE WELLS
- ⊙ BUBBLING WELLS
- MONITORING WELL LOCATION



BNSF RAILWAY BELLVILLE, TEXAS	JOB NO. D89
	FIGURE NO.

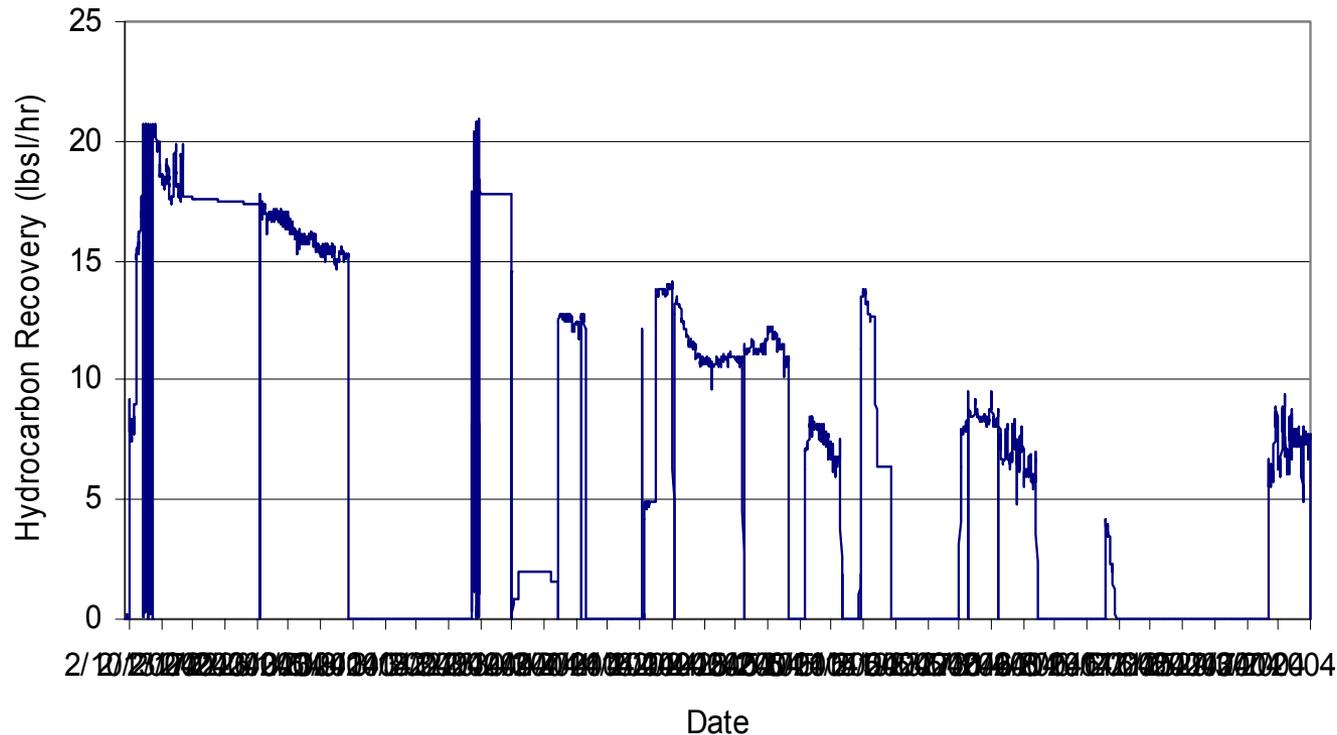






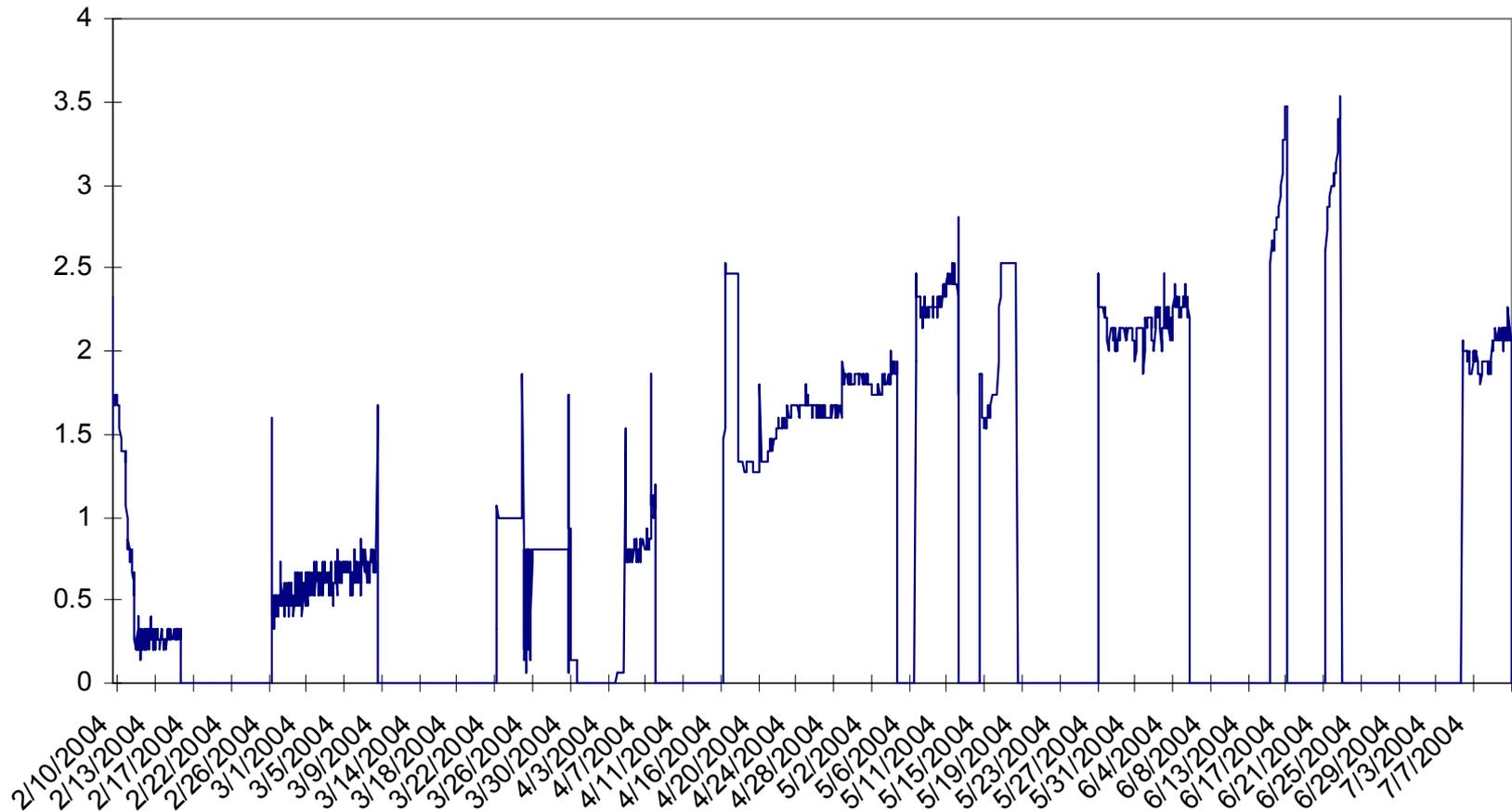
# Hydrocarbon Recovery Rate (lbs/hr)

SVE Hydrocarbon Recovery (lbs/hr)

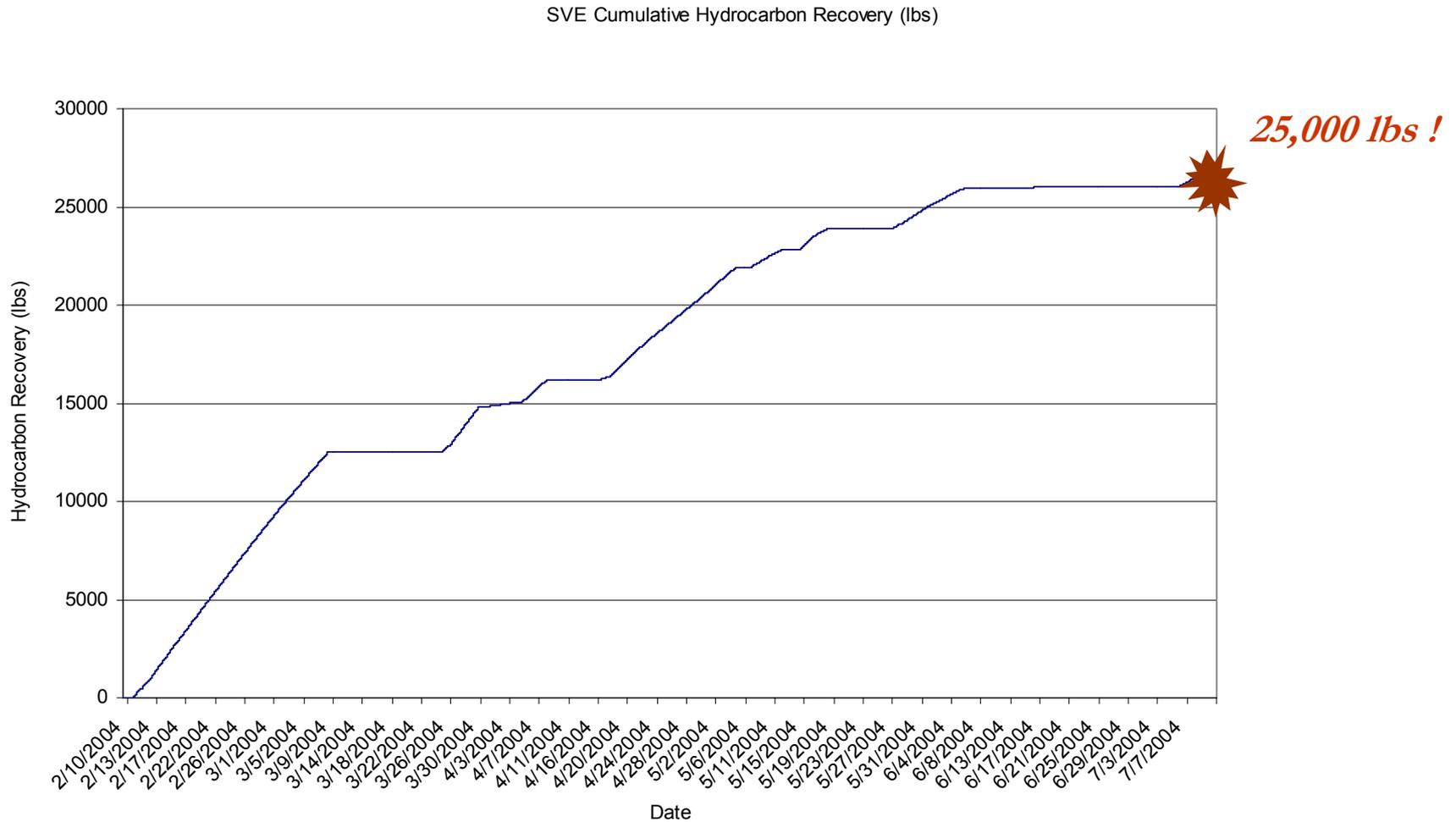


# Propane Fuel Rate (scfm)

Propane Fuel Flow (scfm)



# Hydrocarbon Recovery (lbs)





## ***The Long-Term Pilot Study was successful at:***

- ***Accelerating the natural attenuation process***
- ***Limiting total project expenditures***

## *In Closing...*

### *Points to Take Home*

- *Reliable Technology*
- *Good Return On Investment*
- *Provided Data Identifying Natural Attenuation  
Is An Active Process*
- *Boosted MNA Process And Thus  
Reduced Total Project Costs*