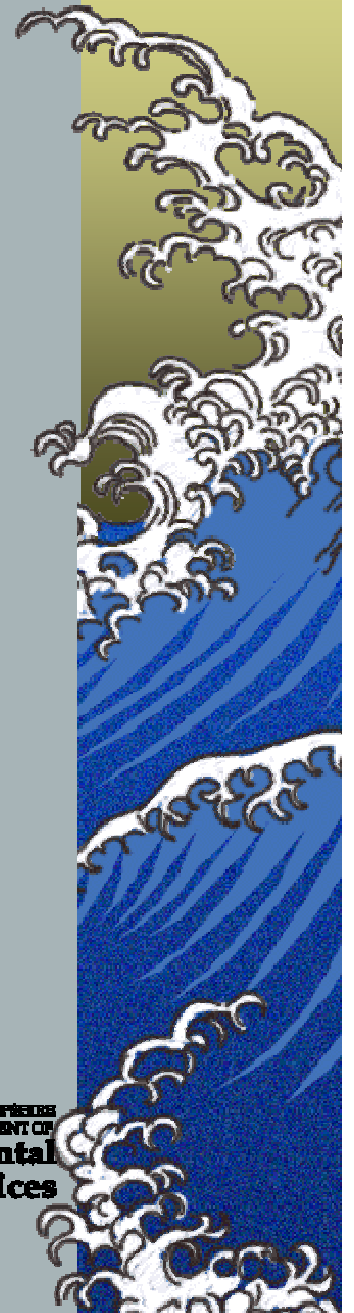


Vapor Release Research



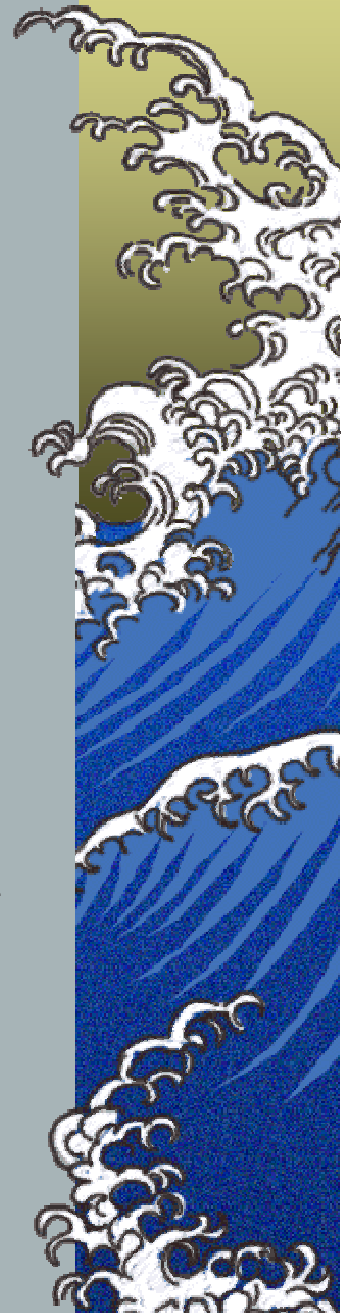
Presented by
Gary S. Lynn, P.E.



MtBE Trends Post Transition

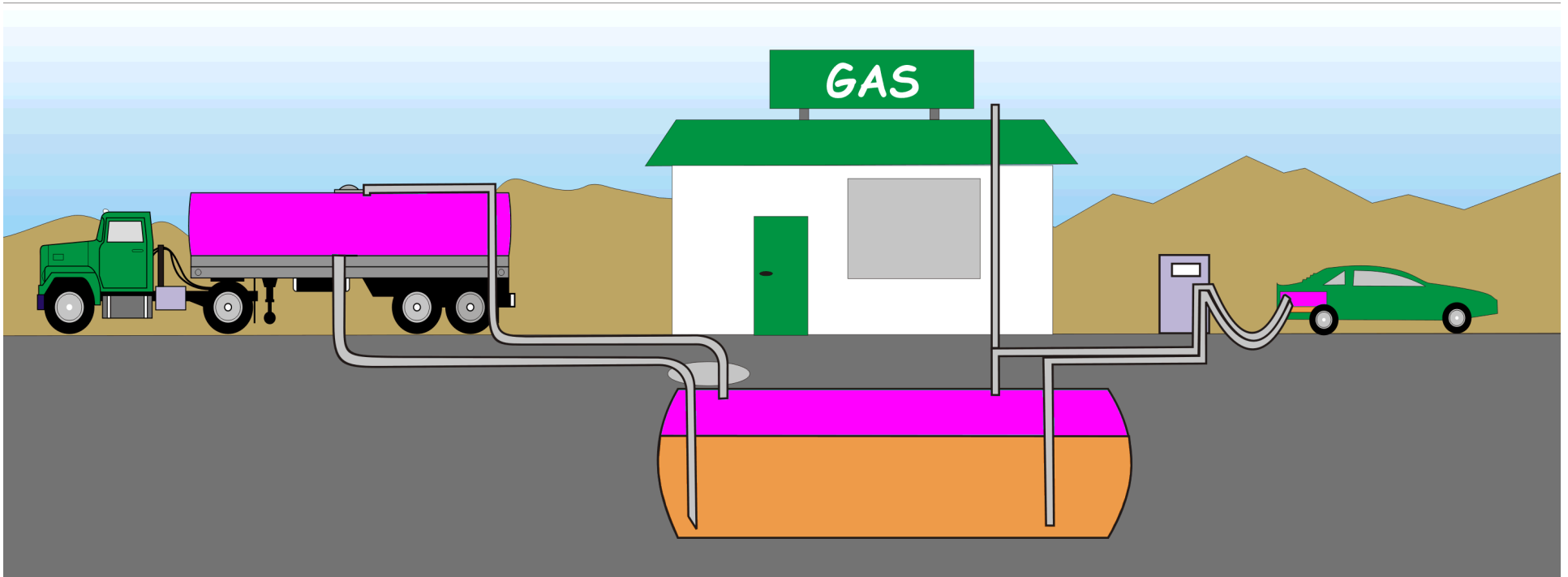
✦ *MtBE Transition Impacts (Statewide)*

- ✦ *29,800 ppb avg. MtBE drop in groundwater at UST facility*
 - ✦ *Well Closest to USTs*
 - ✦ *Before End of 2006*
 - ✦ *110 of 116 sites or 95% of sites*
- ✦ *2,600 ppb avg. increase @ remaining 6 sites*
- ✦ *Detached plumes coming*



UST Pressurization

Stage I - Vapor Recovery Slower than UST Filling



Stage II - Higher Volume of Vapors Recovered than Liquid Pumped ($A/L > 1$).

Courtesy Gilbarco/Veeder Root

Leaky ATG



Sheen on water



Dry Break Leak

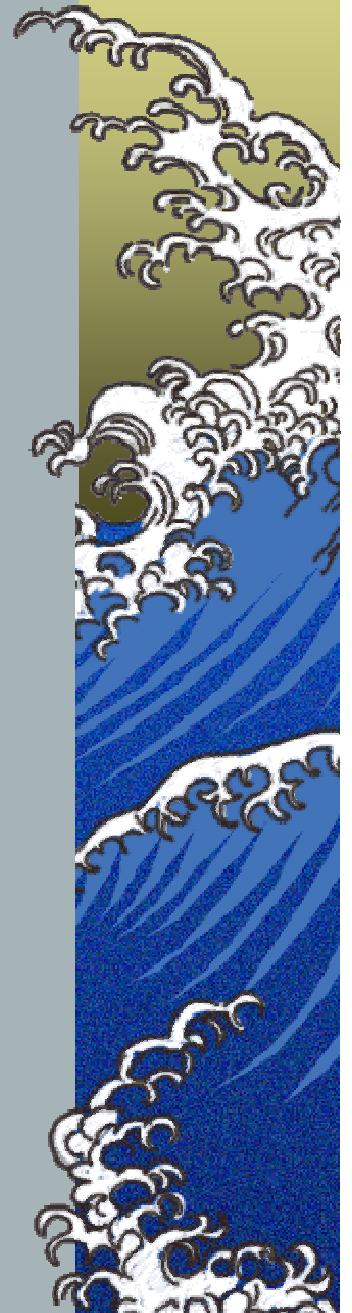
**Leak in new,
just out of box,
dry break**

UST gravel pack



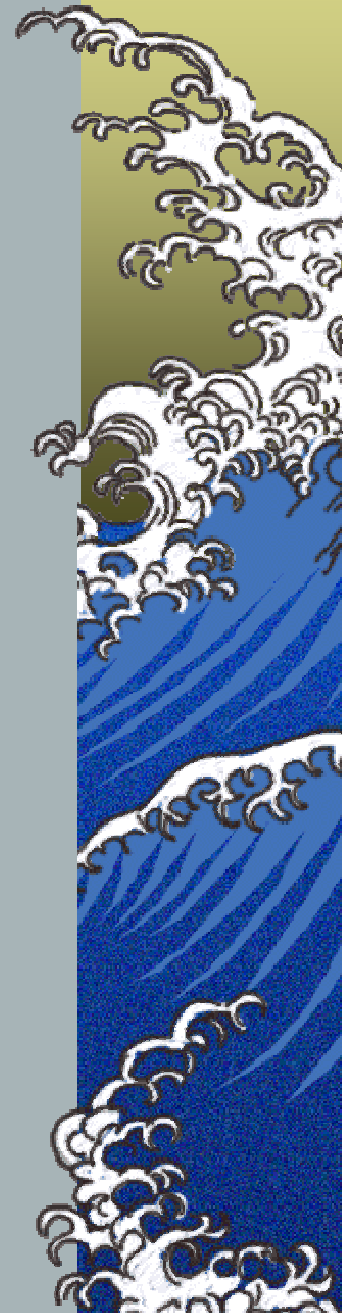
Oil Company Joint Research

- ✦ *DES/UNH/Oil Company w/ API/EPA assistance*
- ✦ *Intensive Inspection/Repair Program, 21 Stations (77 leaks, 4/station)*
- ✦ *Leak Rate Measurement Study (dry break, ATG, Fill Adapter cap w/ three leak rates)*
- ✦ *Stage II Site Pilot (seven sites)*



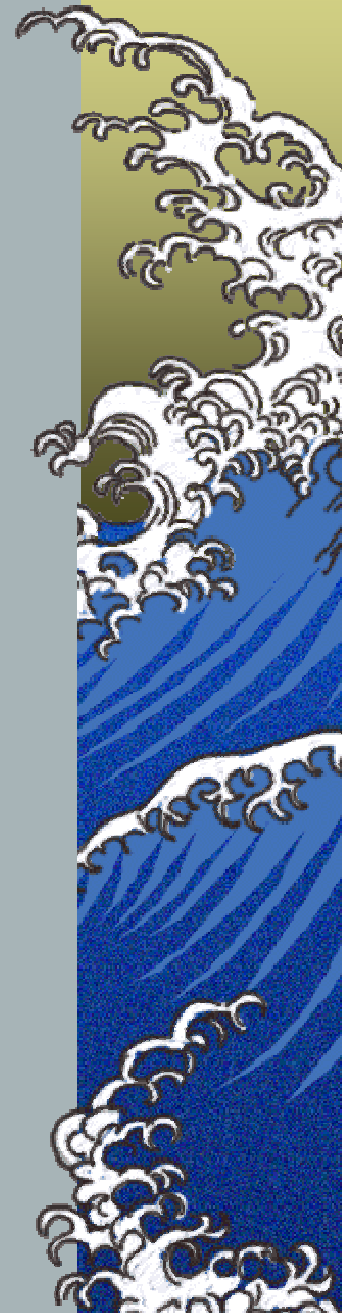
Pilot Sites

- ✦ *Control*
- ✦ *Repair Sites*
 - ✦ *Pressure Decay Testing*
 - ✦ *Enhanced Inspection*
 - ✦ *Veeder Root ISD system and repairs*
- ✦ *Pressure Reduction Sites*
 - ✦ *VST Vent Processor*
 - ✦ *Healy ORVR Compatible Nozzle and Bladder Tank*
- ✦ *Leak Collection Site*
 - ✦ *SVE system*



Instrumentation

- ★ *All Sites for 1 year*
 - ▲ *Continuous Pressure Monitoring*
 - ▲ *Soil & Tank Temperature*
 - ▲ *Groundwater VOCs & Water Level*
 - ▲ *Station Throughput & Deliveries*
 - ▲ *Soil Gas (tank pad & nearest MW)*
 - ▲ *Equipment Operational Data*
 - ▲ *SVE Influent Concentrations*
 - ▲ *Down time, maintenance requirements...*
- ★ *Merrimack Site*
 - ▲ *ISD Data Package*

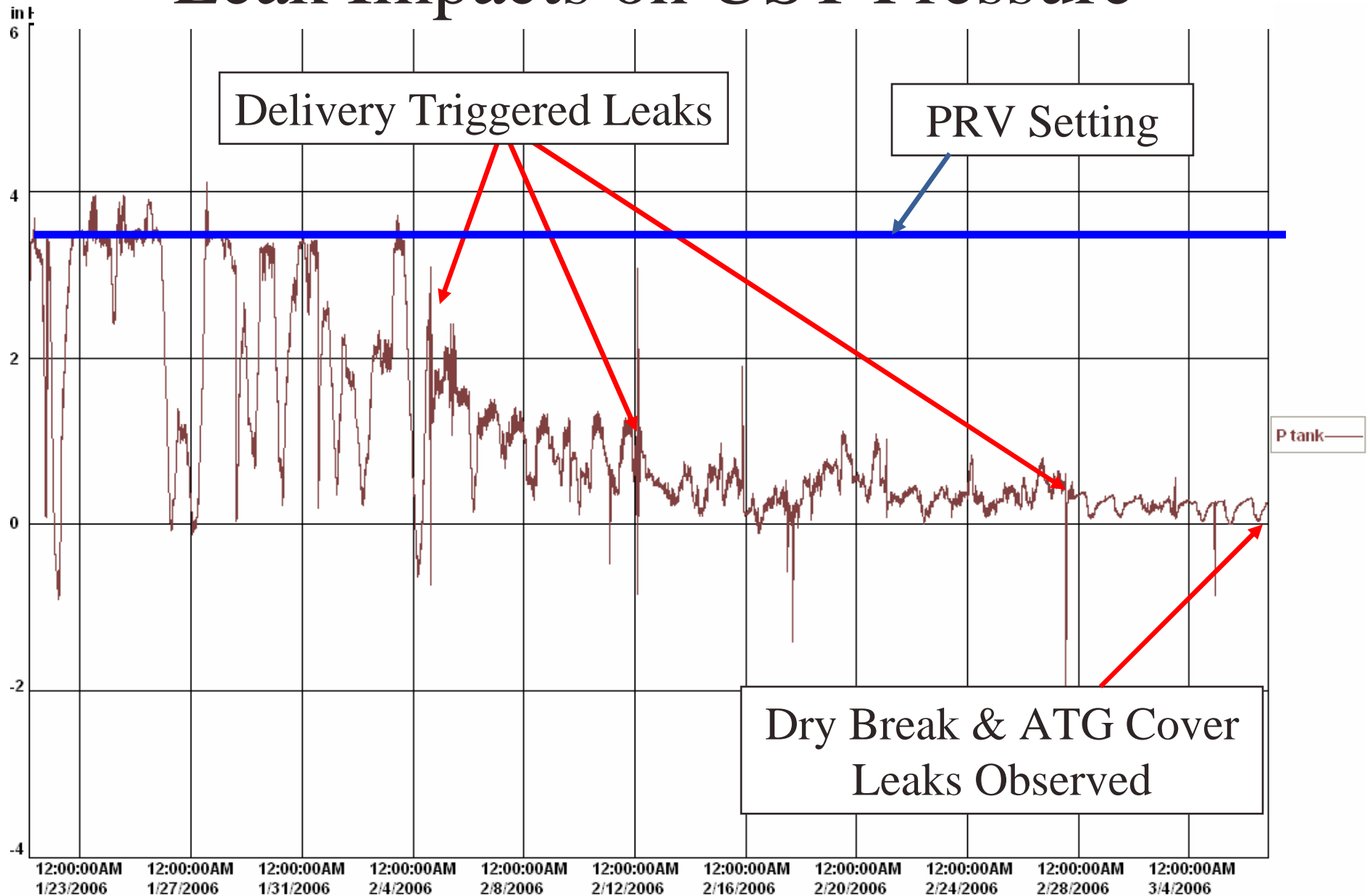


LEAK REPAIR:
Tanks can be
patched up but
leaks reoccur

Art Work was
provided by LUSTline



Leak Impacts on UST Pressure



Repair Approach Findings

✦ *Leak Frequency*

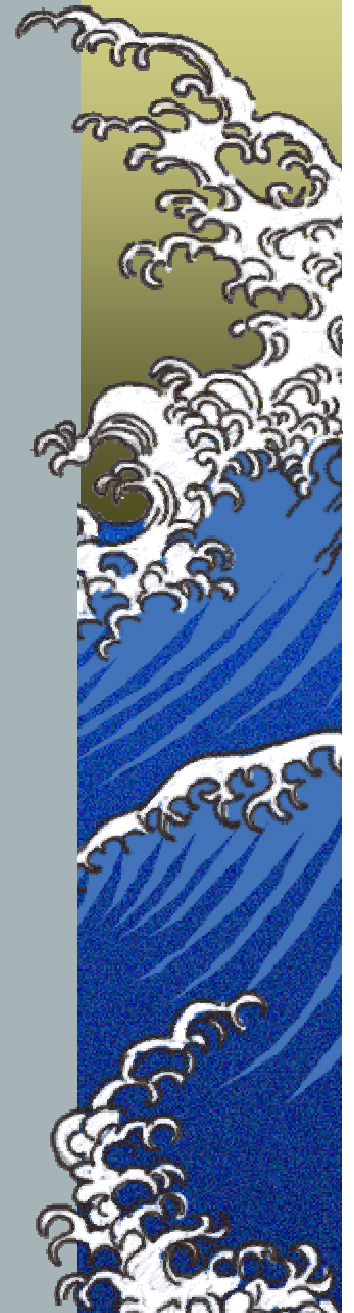
- ✦ *22 Large Leaks in 7 mo.*
- ✦ *Repairs Lasted an Average of 58 Days*

✦ *Types of Repairs*

- ✦ *4 Dry Breaks, 15 Fill Caps, 1 Drain Valve, 5 ATGs, 3 Drop Tube Gaskets, 7 Fill Adapter Gaskets*

✦ *Pressure Decay Test Issue*

- ✦ *Soil Gas VOCs Elevated after Test, N₂ cylinder volume @ STP 1,050 gallons*



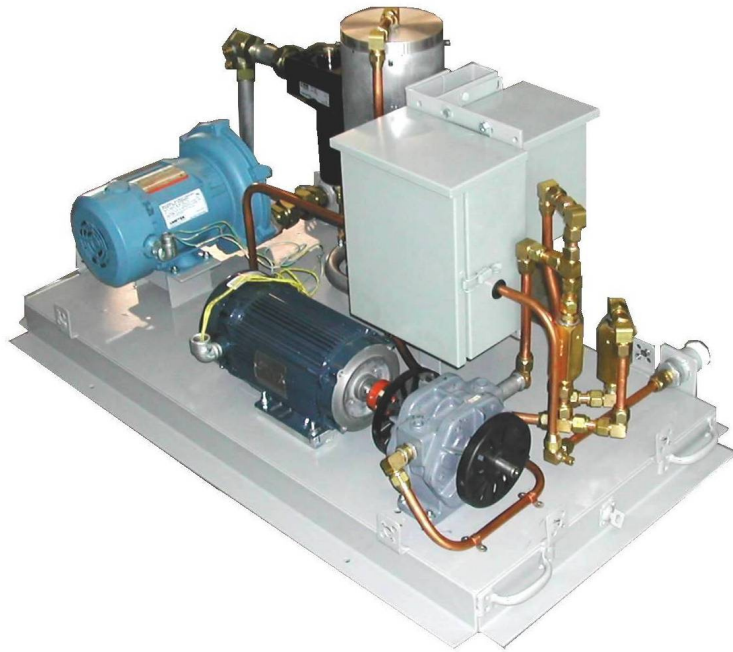
PRESSURE:
Tanks behave
badly when
under pressure

Art Work was
provided by LUSTline



Pressurization Mitigation Technologies

VST/ARID Vapor Processing Systems



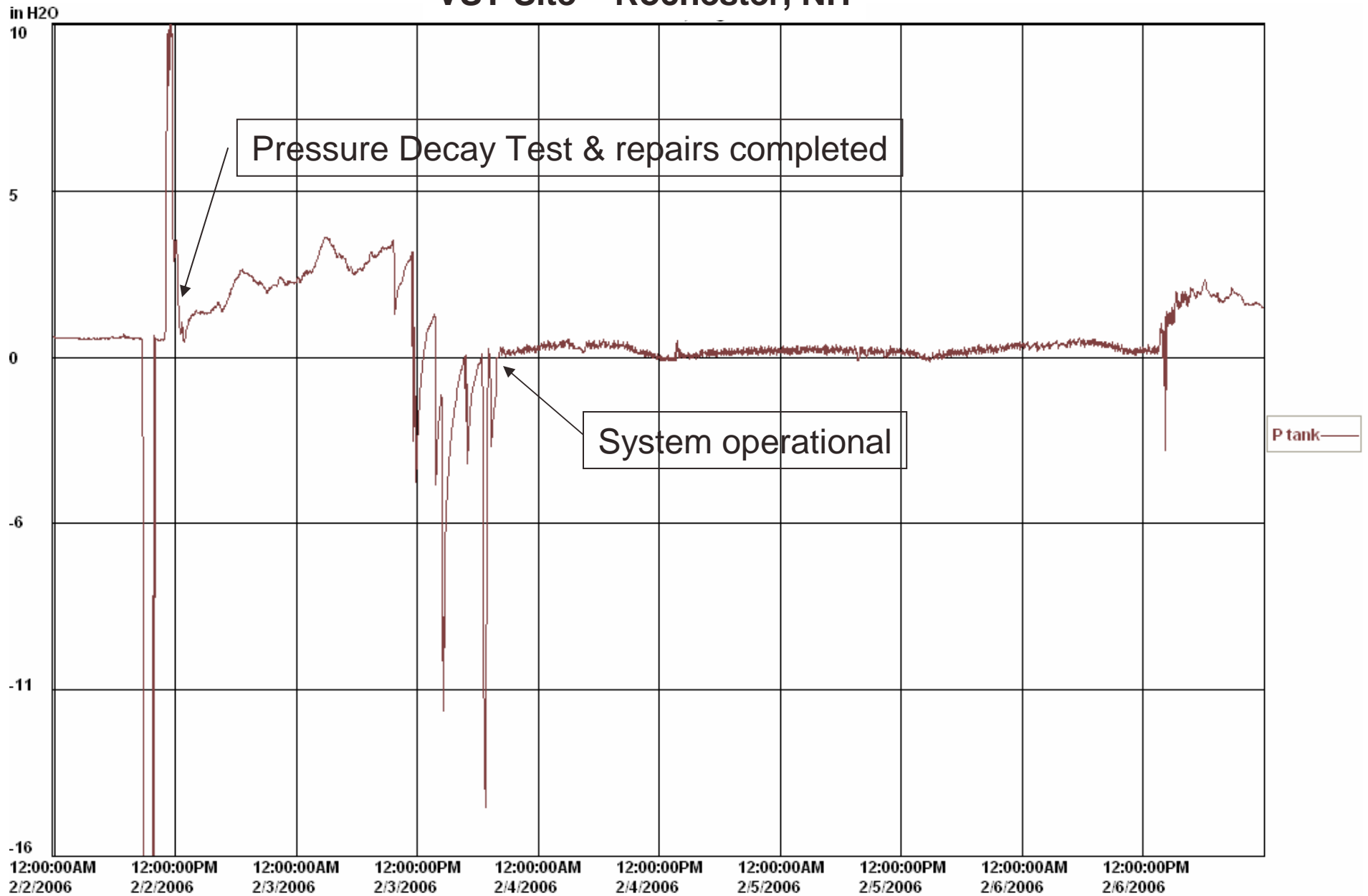
- **Pressure Management**
- **Lower Product Evaporative Losses**

Healy ORVR Compatible Nozzles

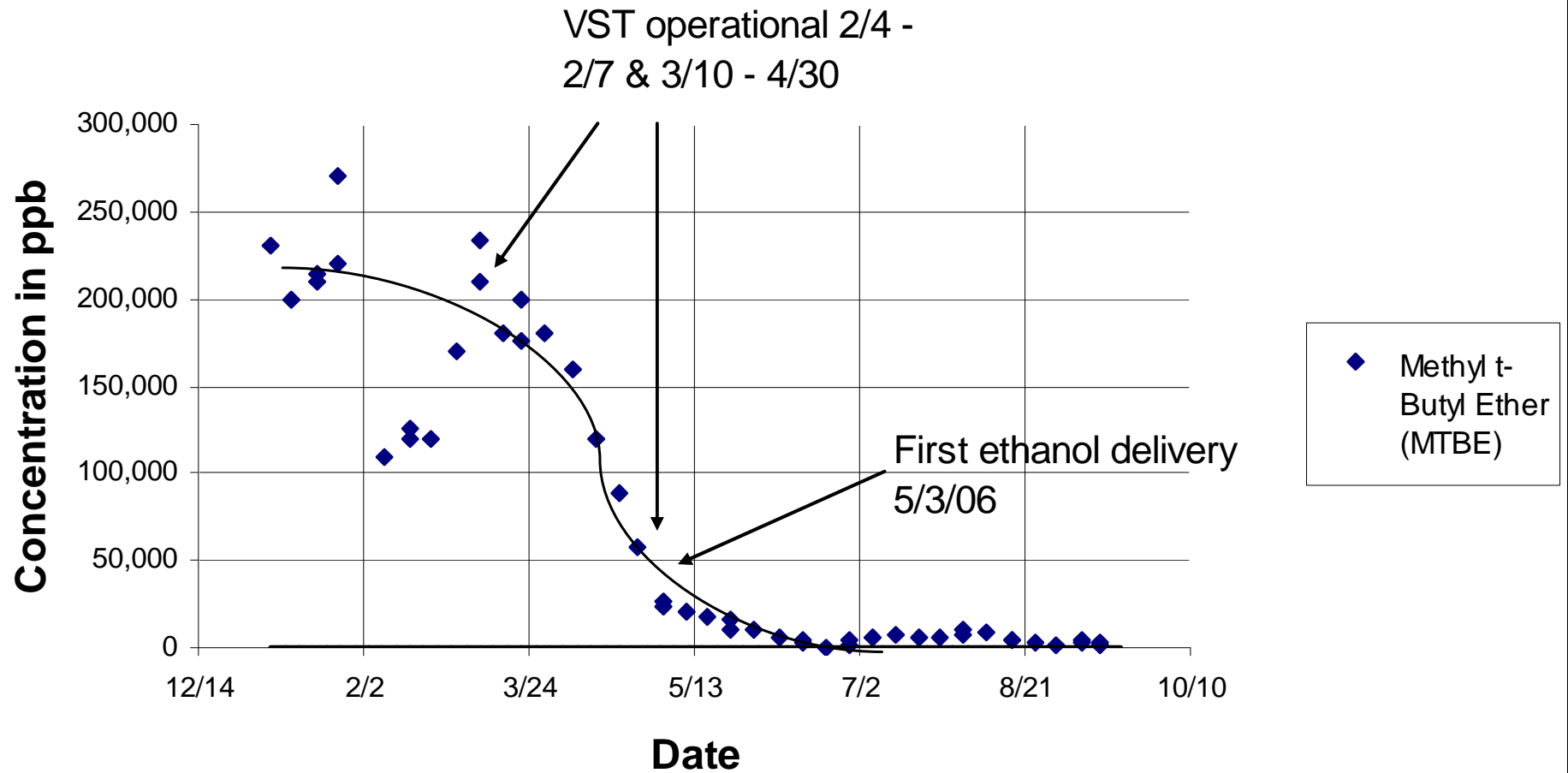


- **Reduced A/L**
- **Lower UST Pressures**
- **Lower Product Evaporative Losses**

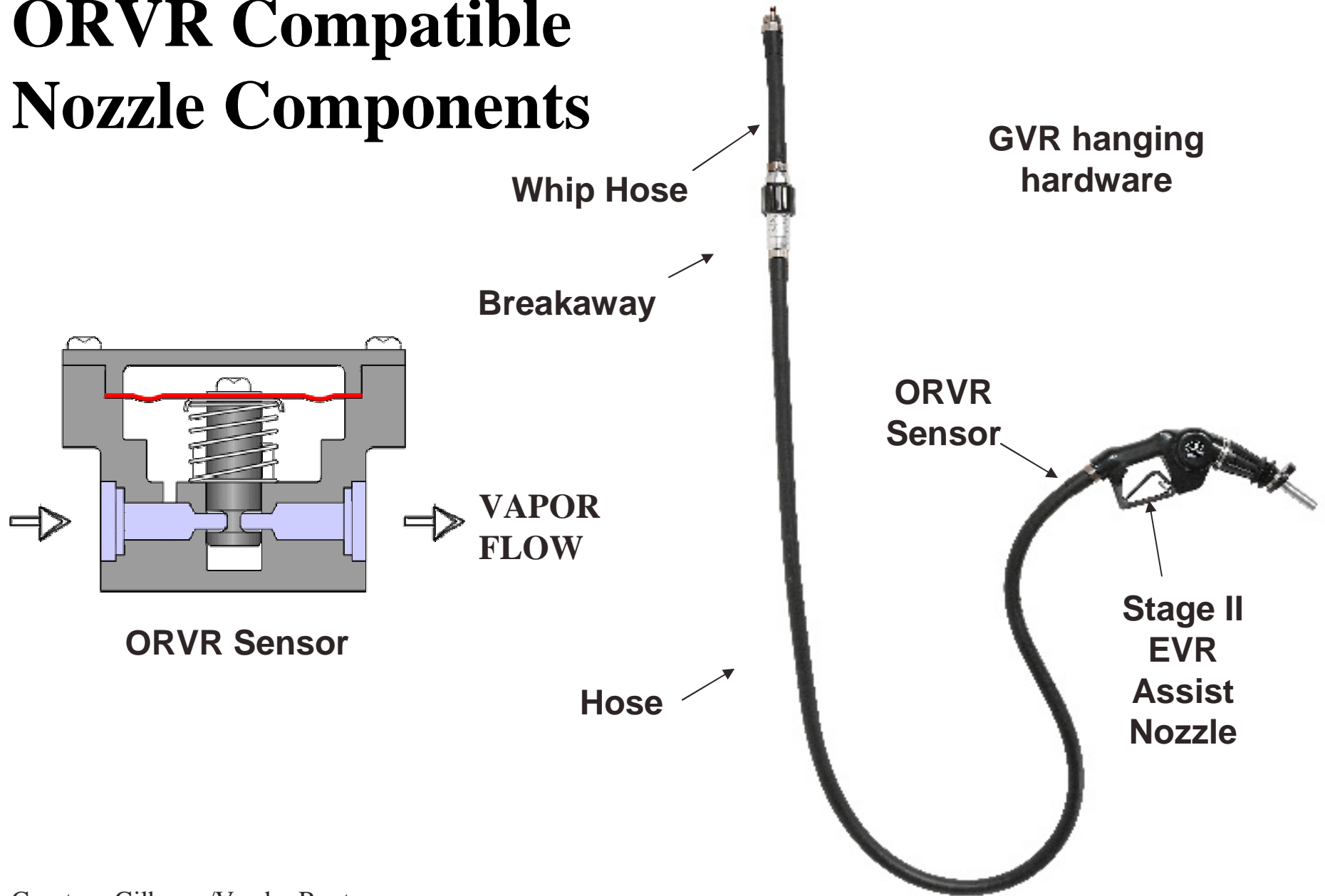
VST Site – Rochester, NH



Groundwater MtBE Trends (VST Installation)

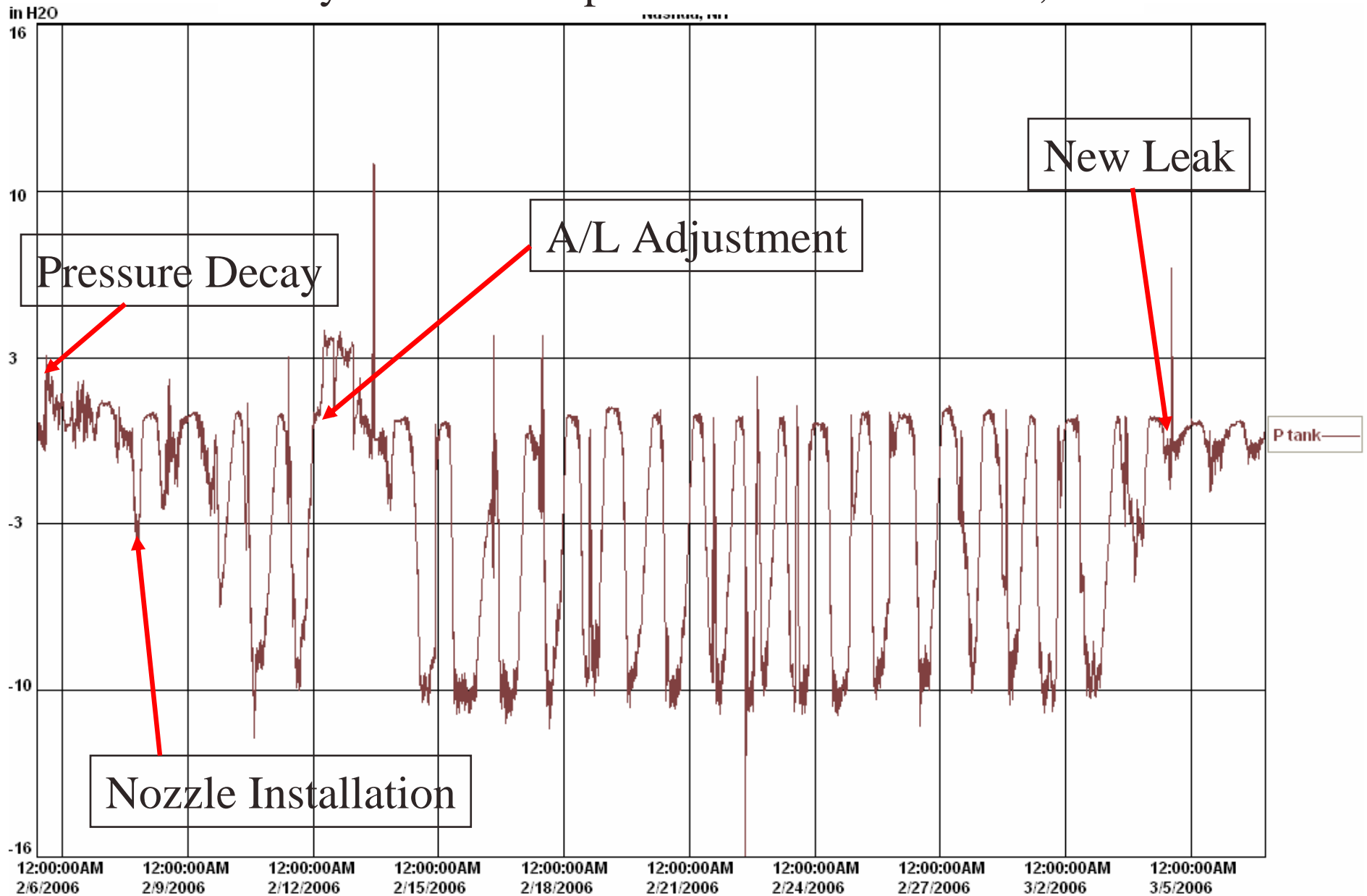


ORVR Compatible Nozzle Components



Courtesy Gilbarco/Veeder Root

Healy ORVR Compatible Nozzle – Nashua, NH



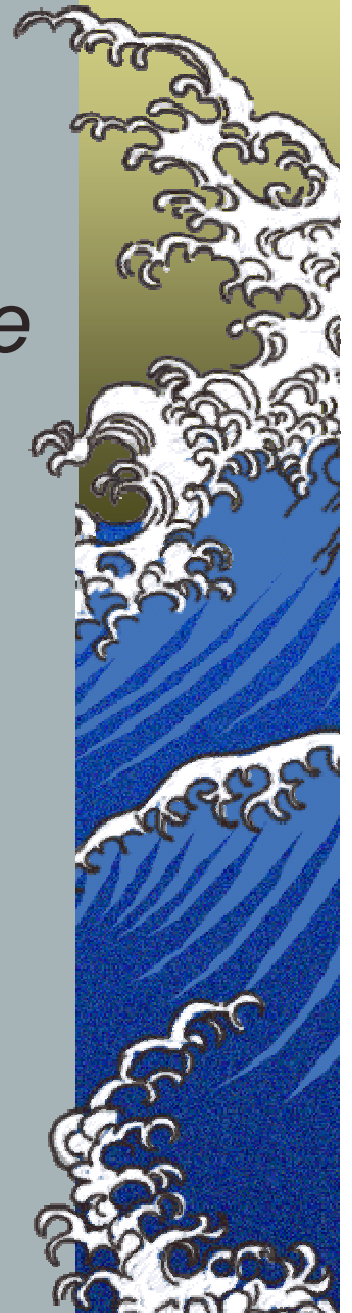
Nashua Site Data

<i>Date/Event</i>	<i>T. Pad Headspace VOCs (ppm)</i>	<i>MW Headspace VOCs (ppm)</i>	<i>Groundwater VOCs MtBE/TBA (ppb)</i>
<i>1/12/06 to 1/26/06*</i>	<i>714 average</i>	<i>369 average</i>	<i>30,750/ 13,500</i>
<i>1/30/06 Pressure Decay 2/8/06 Healy Nozzle Installed</i>			
<i>2/15/06</i>	<i>2</i>	<i>5</i>	<i>29,000/ <20,000</i>
<i>2/22/06</i>	<i>6</i>	<i>3</i>	<i>6,200/ 6,000</i>
<i>3/1/06</i>	<i>1</i>	<i>0</i>	<i>2,800/ 2,700</i>
<i>3/8/06</i>	<i>2</i>	<i>6</i>	<i>1,600/ 1500</i>
<i>4/12/06</i>	<i>5</i>	<i>0</i>	<i>260/ 1,000</i>
<i>5/25/06</i>	<i>7</i>	<i>0</i>	<i>702/ 814 (w/o ORVR compatibility)</i>

Notes: * Four background sample rounds

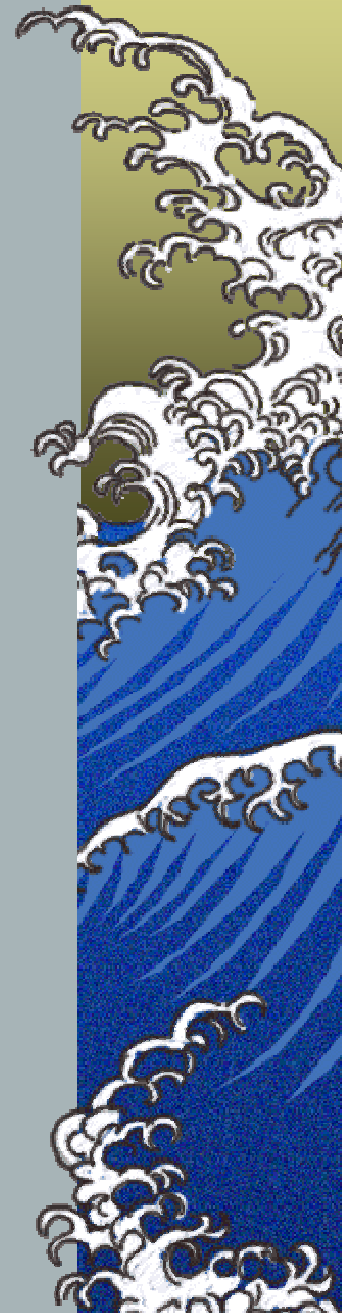
Overall Findings

- ✦ *Pressure Reduction Effective (Reduce A/L or pressure management system)*
- ✦ *Inspection/Repair*
 - ✦ *Inspections/testing failed to fix key leaks*
 - ✦ *Leaks too frequent to address w/o upgrading hardware*
 - ✦ *Deliveries apparently triggered leaks*

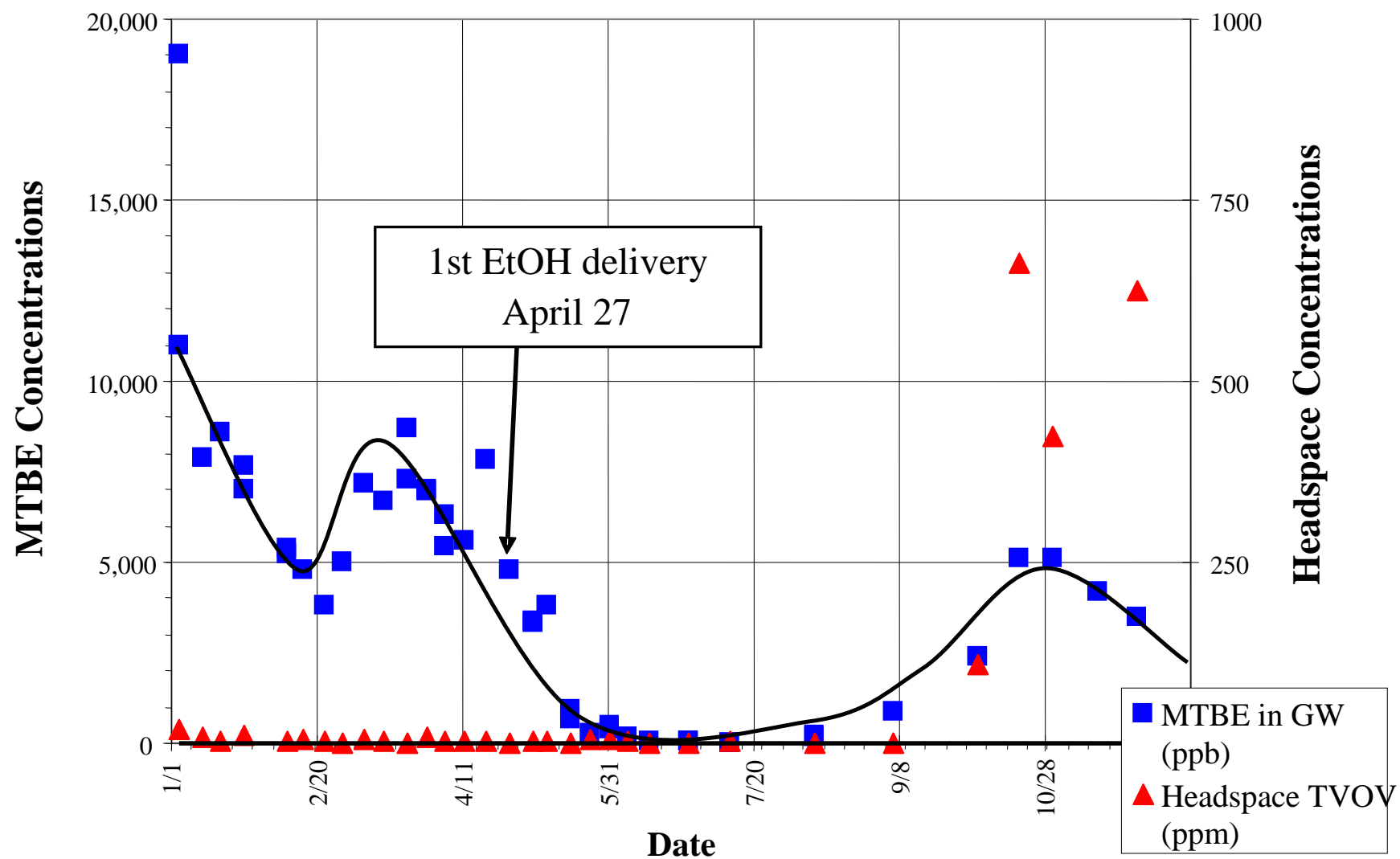


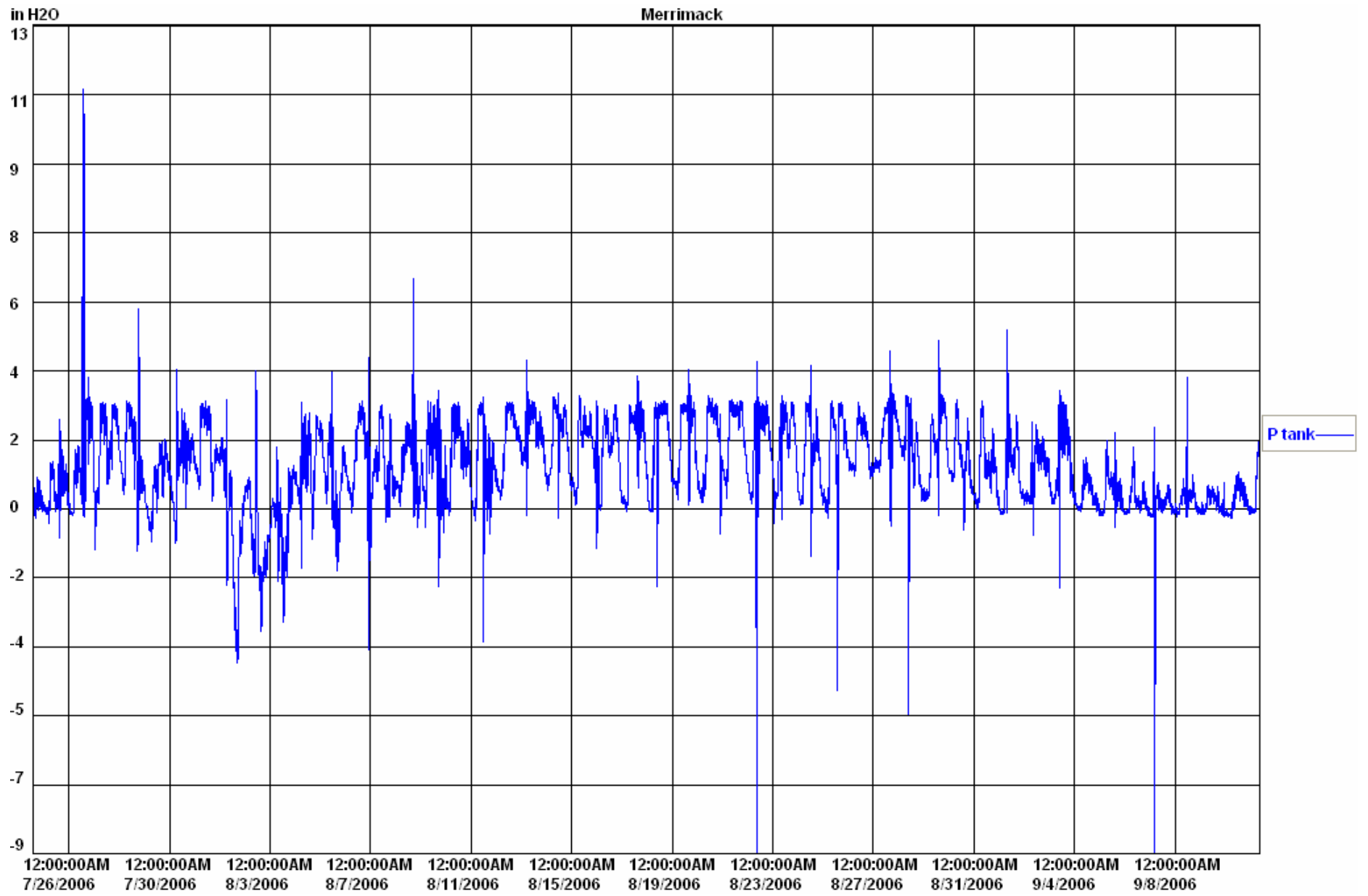
Overall Findings (cont'd)

- ★ *Statewide Site Closure Rate*
 - ▲ *Increasing at Sites w/ Active Gas Tanks
(8 in 2004, 11 in 2005 and 26 in 2006)*
- ★ *“Small” Ongoing Releases*
 - ▲ *Significant Vapor Release Problem w/ MtBE*
 - ▲ *Problem Limited to Larger Releases w/o MtBE*
 - ▲ *5 of 7 Sites in Pilot Addressed by MtBE Transition,
1 site w/ benzene and 1 w/ BTEX problem
remaining*
 - ▲ *Benzene, Other Ethers, Low Concentration MtBE
Groundwater Problems*

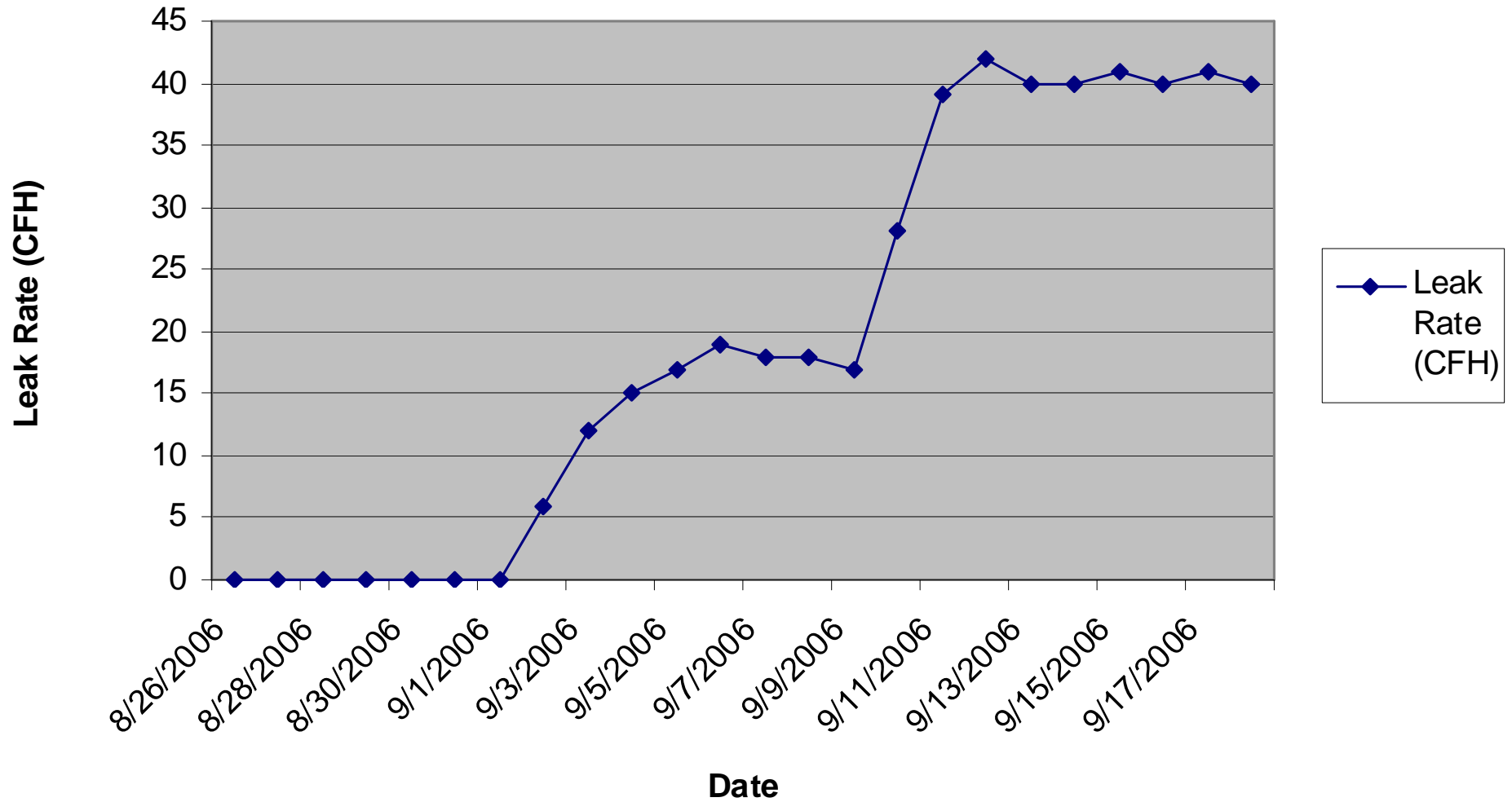


Merrimack Site, MW-5 near tanks





Merrimack, NH ISD Test Site Vapor Leakage Detection Results



Note: Graphic Provided by Veeder Root

Vapor Release Study - Merrimack

<i>Date</i>	<i>MW-5 HS VOCs</i>	<i>MW-5 MtBE (ppb)</i>	<i>MW-5 Benzene (ppb)</i>	<i>Comments</i>
<i>3/30/2006</i>	<i>9</i>	<i>7,000</i>	<i><100</i>	
<i>4/27/2006</i>	<i>1</i>	<i>4,800</i>	<i><50</i>	<i>Date of EtOH transition</i>
<i>7/12/2006</i>	<i>3</i>	<i>21</i>	<i>0.9</i>	
<i>10/5/2006</i>	<i>110</i>	<i>2,400</i>	<i><50</i>	<i>Larger leak(s)</i>
<i>11/15/06</i>	<i>N/M</i>	<i>4,200</i>	<i>110</i>	
<i>1/10/2007</i>	<i>387</i>	<i>1,300</i>	<i>140</i>	

ETBE Concentrations

<i>Date</i>	<i>MW-3 @ UST</i>	<i>Pump n Treat</i>	<i>Drinking Water Supply</i>	<i>Comments</i>
<i>7/25 - 8/30/05</i>	<i><2ppb</i>	<i><2ppb</i>	<i><2ppb</i>	
<i>8/23/2005</i>				<i>Katrina</i>
<i>1/18 – 1/26/06</i>	<i>55ppb</i>	<i>25.3ppb</i>	<i><.5ppb</i>	<i>European imports w/ EtBE</i>
<i>4/20 – 4/28/06</i>	<i>28ppb</i>	<i>8.0ppb</i>	<i><2.5ppb</i>	
<i>10/5/06 – 11/22/06</i>	<i><.5ppb</i>	<i><4ppb</i>	<i>0.88ppb</i>	<i>1 year travel time</i>

Note: Date range used because of different sampling schedule for NPDES permit.

Contact Information:

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