

Implementation of Innovative In Situ Biotreatment Technology at NWIRP McGregor, Texas

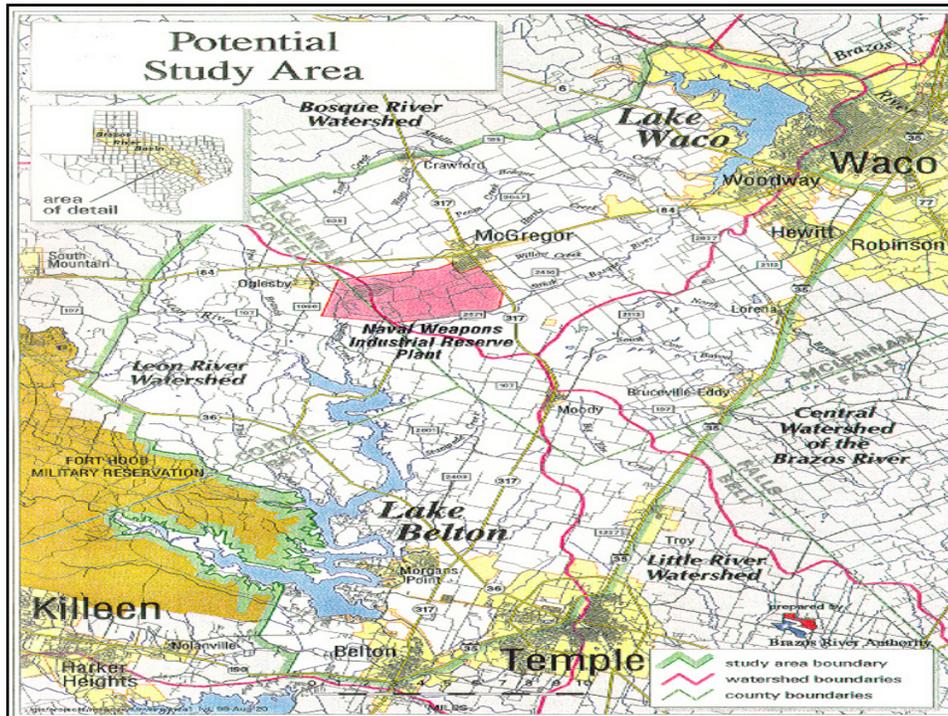
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5th Annual Joint Services Pollution Prevention and
Hazardous Waste Management Conference and Exhibition
San Antonio, Texas
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Presentation Overview

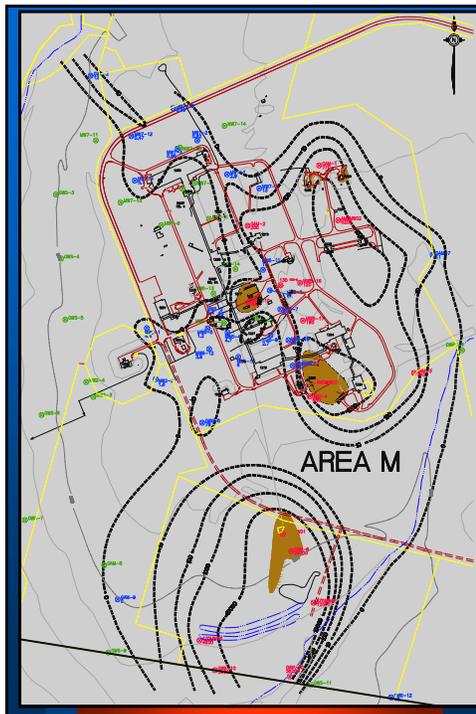
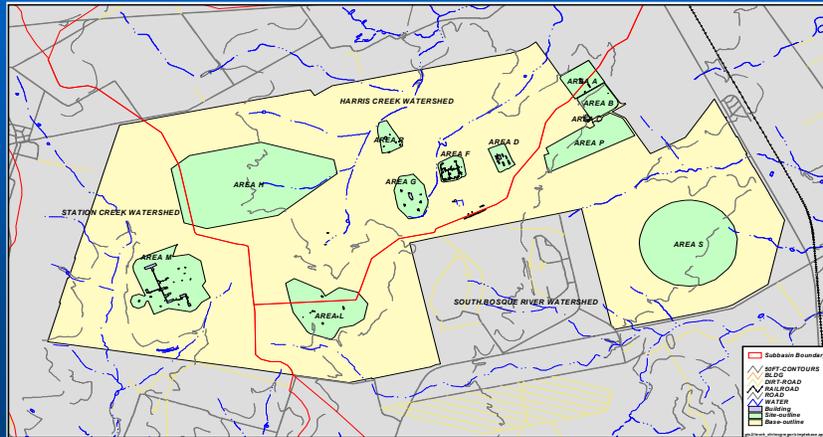
- Site Description and History
- Areas of Environmental Concern
- Interim Stabilization Measures:
Bench- and Pilot-Scale Evaluation
 - Groundwater
 - Soil
- Conclusions



Site History

- **Operated for More Than 50 Years Under Various Owners and Tenants**
 - United States Army, Navy, and Air Force
- **Industrial Activities:**
 - Weapons and Weapons Systems
 - Bombs, Missiles, and Explosives
 - **Solid-fuel Rocket Propulsion Systems**
 - Ammonium Perchlorate

Site History



Area M

- 750-acre Watershed
- Perchlorate Concentrations (ppb)
 - Surface Water : 5,600
 - Groundwater: 4 to 91,000
 - Springs: 22,000
- Drainage Pathway
 - Unnamed Tributary
 - Station Creek
 - Leon River/Lake Belton

Interim Stabilization Measures

- **Why ISMs?**
 - Migration of Perchlorate-Contaminated Groundwater and Surface Water from Site
 - Action Letter from the TNRCC (2/99) Requiring Migration Abatement
- **Treatment Technology Evaluation**
- **Bench-Scale Studies**
- **Pilot-Scale Studies**

Bench-Scale Groundwater Study: In Situ

- **Objective: Evaluate In Situ Treatment of Perchlorate-Contaminated Groundwater**
- **Permeable Reactive Barrier (PRB)**
- **PRB Media Evaluation**
 - Length of Acclimation Period
 - Reduction Effectiveness
 - Length of Effectiveness
 - Hydraulic Characteristics
 - Feasibility

Bench-Scale Groundwater Study: In Situ

■ Experimental Approach

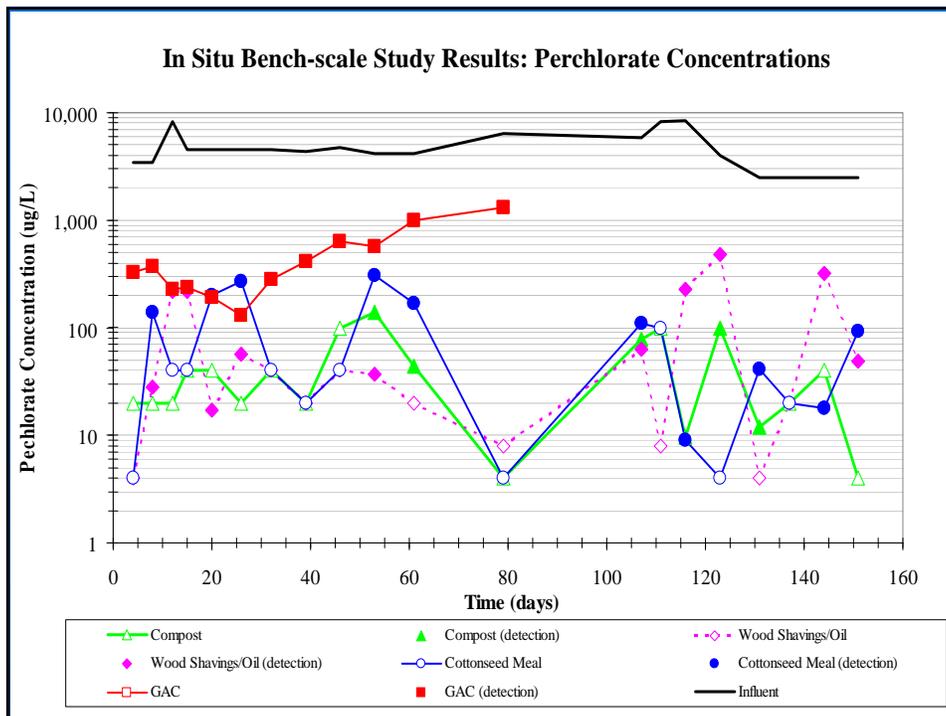
- Plastic Bioreactors
- PRB Media: 5 to 10% by Mass
 - Compost
 - Canola Oil-Coated Wood Shavings
 - Cottonseed Meal
 - Granular Activated Carbon
- Influent Concentration: 5 to 8 mg/L
- Flow Rates Similar to Site Groundwater

Bench-Scale Groundwater Study: In Situ

Medium	Phosphate	TKN	TOC	Ammonia	Total P
-	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
compost	430	23,000	250,000	640	7500
wood/oil	31	180	690,000	3.40	28 U
cottonseed meal	42	70,000	500,000	200	10000
GAC	15	2,800	970,000	0.69	42
cottonseed	-	32,000	440,000	20	4,900



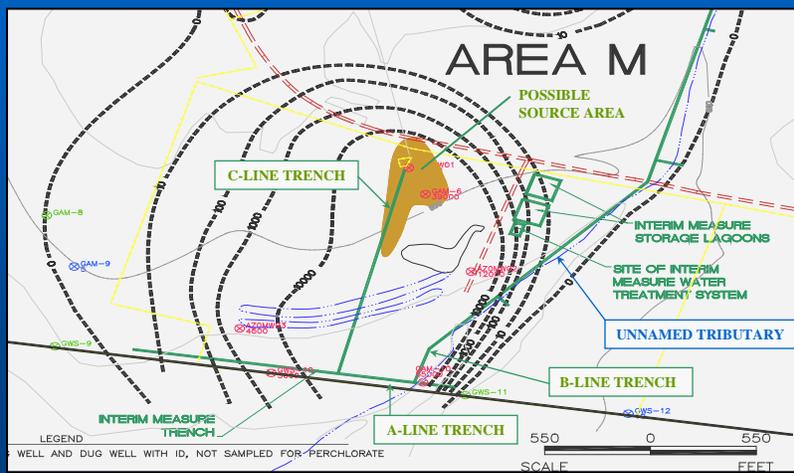
Bench-Scale Groundwater Study: In Situ



ISM Pilot-Scale Implementation

- Groundwater Cutoff and Collection Trenches
- Ex situ Biotreatment System
- In situ Groundwater Biotreatment
- Soil Biotreatment
 - Anaerobic Landfarming

Cutoff/Collection Trench Construction



Cutoff/Collection Trench Construction

■ A-line Property Line Cutoff Trench

- Extends through Weathered Limestone Water-bearing Zone
- 30 Inches Wide
- Up to 25 Feet Deep
- Perforated Collection Pipe
- Drainage Aggregate



Cutoff/Collection Trench Construction



Collection System Modification

Clay	Clay	Clay
Excavated Trench Material	Excavated Trench Material	Excavated Trench Material
Geotextile	Geotextile	Geotextile
Drainage Aggregate (#57 Gravel)	Drainage Aggregate (#57 Gravel)	Compost (15% by volume) and Drainage Aggregate (#57 Gravel)
GAC (2 lbs/foot)	Cotton Seed Meal (2 lbs/foot)	
Cotton Seed (20 lbs/foot)	Cotton Seed (20 lbs/foot)	
Native Materials	Native Materials	Native Materials

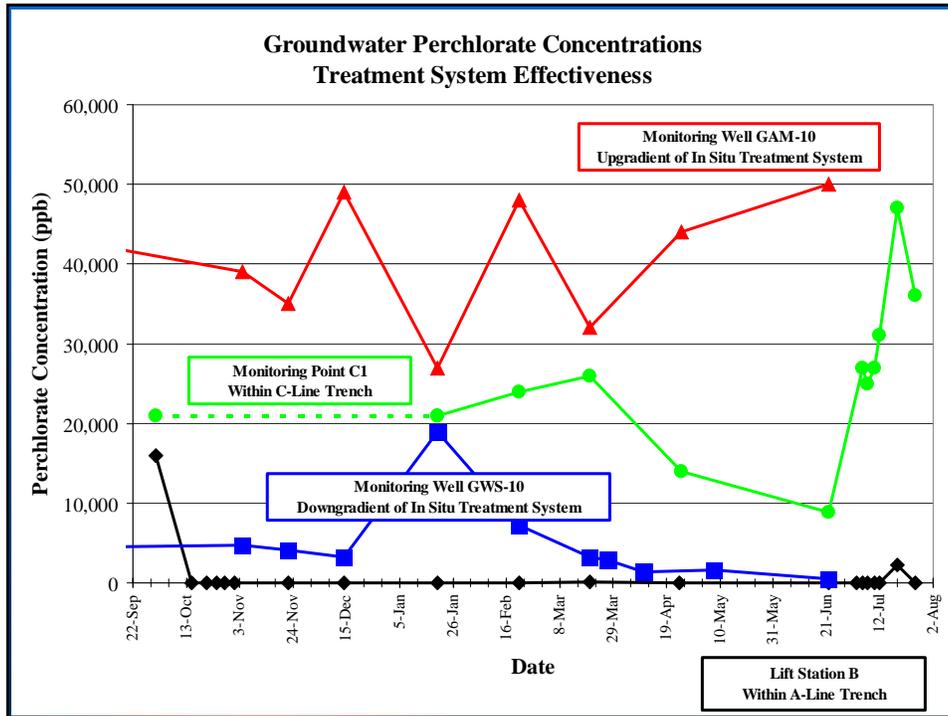
A-line Trench

B-line Trench

C-line Trench

Collection System Modification





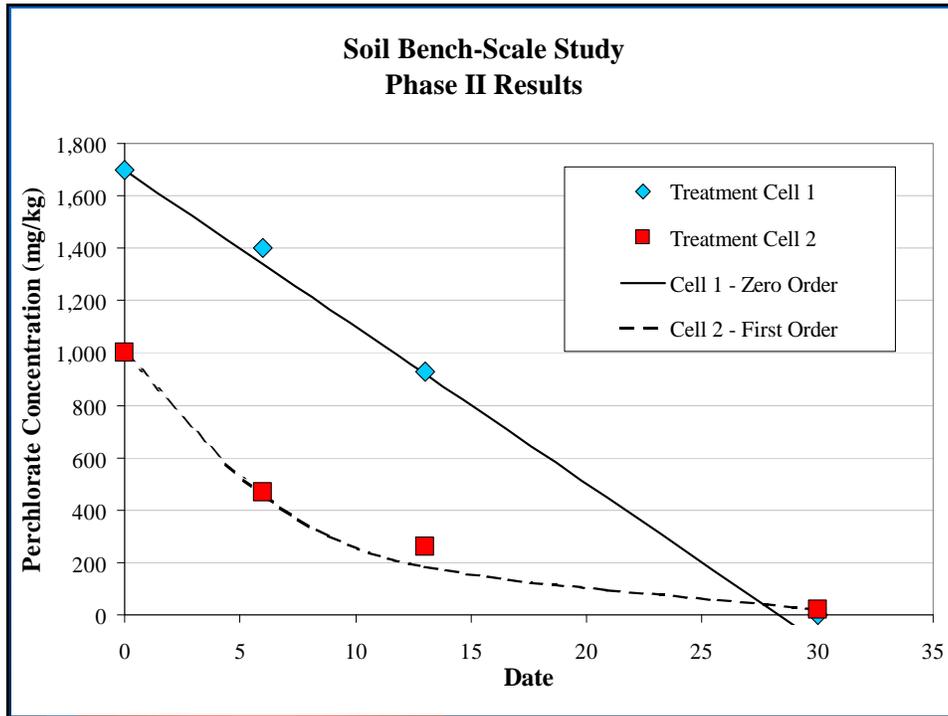
Bench-Scale Soil Study: Anaerobic Landfarming

■ Experimental Approach

- Nutrients: Nitrogen and Phosphorus
- Carbon Sources: Fructose and Citric Acid
- Microbes: Acclimated and Indigenous

■ Findings/Results

- Concentrations Reduced From **580 mg/kg** to **Detection Limits (0.6 to 1.6 Mg/kg)** in **28 Days**



Pilot-Scale Soil Study: Anaerobic Landfarming

- **Amendments**
 - Citric Acid
 - Nitrogen and Phosphorus
 - Soda Ash
- **Flood Cell**
- **Monitor**

The photograph shows a red excavator with a long arm working on a site covered with black plastic mulch. There is a large pile of brown soil or debris in the background, and a white tank is visible on the right. The ground is wet, suggesting a flood cell setup.

Conclusions

- **VOC Biodegradation**
- **In Situ Treatment System Effectiveness**
 - Projected to Last 8 to 15 Years
- **Perchlorate Mass Leaving Site Reduced**
 - From 60 to 0.5 Pounds Per Month
- **In Situ Soil Bioremediation Effective**
- **Future Applications: Other Onsite Areas and Offsite**