Implementation of Innovative In Situ Biotreatment Technology at NWIRP McGregor, 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

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Bench-Scale Groundwater Study: In Situ

In Situ Bench-scale Study Results: Perchlorate Concentrations
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

[Map showing trench locations]

Possible Source Area
A-Line Trench
B-Line Trench
C-Line Trench
Unnamed Tributary
Area M
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
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**
Soil Bench-Scale Study
Phase II Results

![Graph showing perchlorate concentration over time for Treatment Cell 1 and Treatment Cell 2, with zero order and first order models.]

Pilot-Scale Soil Study: Anaerobic Landfarming

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

Bioremediation of Perchlorate
Contamination in Soil and Groundwater
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