ABOUT SEQUOIA

- True turn key insitu remediation specialists
- Pilot testing and feasibility studies
- System design and manufacturing
- Installation and earthworks
- Operations and maintenance
- Research and development



PRESENTATION OUTLINE

- Why Use Insitu Chemical Injection Techniques?
- Delivery Methods
 - Direct Push or Geoprobe
 - Sequoia Screw Pile Isolation System
 - Standard Wells Sequoia Isolation Injection System
- Mixing/Injection System
- Distribution Header and Monitoring System



WHY USE INSITU CHEMICAL INJECTION TECHNIQUES?

Cost Effective

- Bioremediation enhancements like oxygenation can be extremely economic
- Injectant can be applied under buildings, roadways, and piping thereby eliminating infrastructure replacement costs



WHY USE INSITU CHEMICAL INJECTION TECHNIQUES? – Con't

- Less Disruptive
 - In and out Screw pile or direct push leaves little evidence behind
 - Onsite activity lasts for days not months or years
 - Work around buildings or other infrastructure with little or no interference



WHY USE INSITU CHEMICAL INJECTION TECHNIQUES? — Con't

Flexible

- Combination of techniques can treat comingled plumes
- Addresses both hot spot and low level contamination issues
- Variety of Contaminants
- Surgical remediation
 - Deep plumes with small vertical extent
 - Bedrock with fracture flow
 - High permeable zones within low permeable matrix



WHY USE INSITU CHEMICAL INJECTION TECHNIQUES? – Con't

- Rapid Treatment
 - Chemical oxidation can work quickly
- Destruction vs transfer
 - Remediation completed at site instead of transfering problem to another location



WHY IMPROVE THE PROCESS?

- Chemical short circuiting
 - Around the injection pipe
 - In other areas of the site eg: old wells
- Chemical mixing
 - Operator Health and Safety Issues
 - Ensure complete mixing
- To understand where injectant is going
- > Safety Improvements

DELIVERY METHODS

Direct Push or Geoprobe

- Best for bottom up not top down
- Short Circuiting can occur
- Limited in cobbley soils

> Seguoia Screw Pile - Innovation

- Designed and manufactured by Sequoia
- Isolation System no short circuiting
- Best option for top down injections

Into existing wells - Innovation

- Drop tube assemblyIsolation packer assembly









Screw Pile Injection System

- Quick and simple to install
- Pressurized packer system for annular sealing – reduction of liquids to surface
- No cuttings are produced
- ➤ Angle drilling or limited access friendly (<8')



Angle Installation





Vertical Installation





Packer Assembly



Injection Screw Pile



Existing Wells

- Isolation system with drop tube to decrease well sedimentation
- Internal gripping mechanism to eliminate wellhead popping off during injection

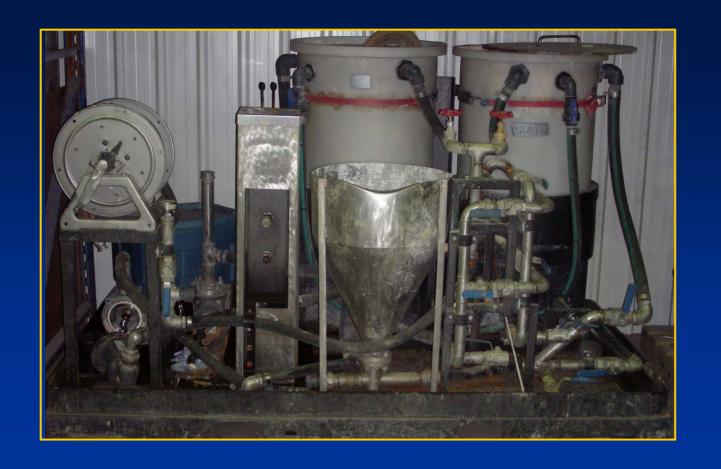




DRY CHEMICAL MIXING SYSTEM

- Hydraulically powered, variable speed quiet operations
- Venturi (vacuum) mixing airborne dust control
- Flexibility (1) mixing and (1) injection pump
- Inject up to 70 L/min up to 150 psi
- Two tanks for chemical mixing (multiple chemicals)







Distribution Logging System

- Designed to provide real time data wirelessly to operator – flow rate, total flow, wellhead pressure
- > High pressure and low pressure alarms
- Data logging capable
- Operator can adjust injection rate to suit each injection wellhead acceptance







SUMMARY

- Sequoia has taken an innovative approach to increase success during chemical injection projects
- Learn from previous mistakes, make changes, and improve the process
- Listen to our field operators to improve health and safety of our equipment