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 In Situ 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 co-mingled 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 transferring 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 cobbled soils

- **Sequoia 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 assembly
  - Isolation 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.