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Horizontal Directional Drilling Services

Horizontal Remediation Wells

Horizontal Remediation Technologies • Installation • Design • Engineered Well Screens • Services

In-situ Testing, Operating and Troubleshooting Of Horizontal Remediation Wells

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Before the Project: Remedial Feasibility Testing

- Site testing is performed utilizing vertical monitoring wells for remedial feasibility:
- Soil Vapor Extraction, (SVE)
- Air Sparging (AS)
- Total Phase Extraction (TPE)
- Biosparging

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Vertical Well Testing is Performed to Determine :

- Radius of Influence (SVE and AS)
- Cone of Depression (TPE)
- Increase in Dissolved Oxygen (Biosparging)

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Results of Vertical Well Tests

- Remedial feasibility tests determine vertical well spacing required to remediate the site.
- Indicate blower/pump/ treatment required for operation

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Downfalls to Vertical Well Feasibility Tests

- Tests indicate necessity of high density network of vertical wells for effective remediation
- Intensive network requires costly trenching, piping, electrical, blower pump, and treatment infrastructure
- Site constraints provide an obstacle to effective remediation network throughout contaminant plume

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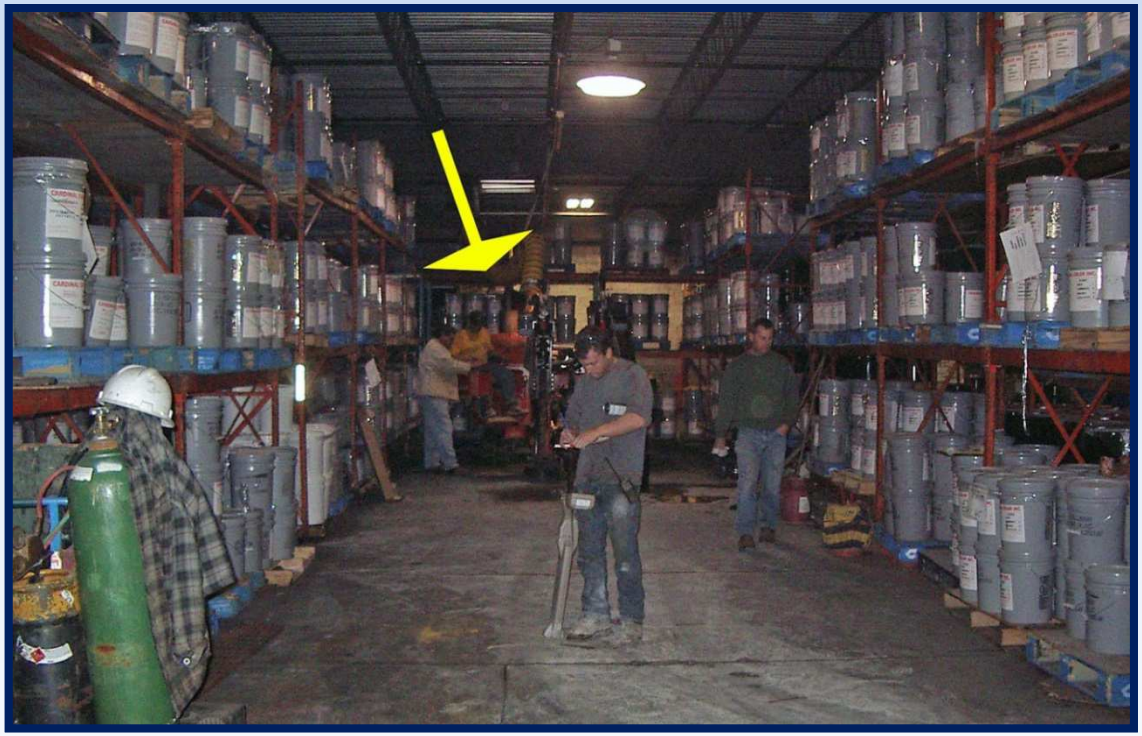
Why Use Horizontal Remediation Wells (HRWs)

- Site Constraints
- Traditional vertical equipment could not fit in tight spacing



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Why Use Horizontal Remediation Wells (HRWs) cont.

- No Business Disruptions
- Larger ROI
- Rapid Site Closure
- More Efficient

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Comparison of Costs: HRW vs Vertical Well Network

- Effectiveness of Treatment Area
- Accelerated Remediation Timeframes
- Installation Feasibility with Site Constraints
- Reduction in infrastructure costs

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Decision to Utilize HRWs as most cost effective option

- Based upon above listed considerations
- Consultation with the Professionals for:
  - Optimal well placement
  - Well screen design
  - Constructability

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Coordination with the Professionals

- Target zones of impact (well depth and length)
- Expected geologic profile
- Well screen design
- Review anticipated spacing of HRWs based on previous testing
- Review site constraints (utilities, buildings, property and rights-of-way issues).
- Consideration of Ground Conditions

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So now your HRWs are successfully installed: What's next?

- Proper well development
  - Remove/breakdown drilling fluids
  - Formation restoration

- In-Situ, As Built Testing
  - Determines actual pressure and flow rate capabilities of each well (SVE and AS)
  - Determine increased DO dispersion of Biosparge wells
  - Trough of influence for TPE wells
  - Other influence of chemox/thermox technologies

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Review of in-situ/as-built testing data

- Results of testing data utilized to design and specify optimal remediation equipment sizes
- Eliminates speculative equipment specification based on vertical well data
- Provides design data for cost effective waste stream treatment options if applicable
- Indicates possibility of manipulating flow/pressure/vacuum as desired by the environmental professional

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Troubleshooting existing HRWs

- HRWs can be developed during their functional lifespan.
- Development removes:
  - Biologic fouling
  - Mineral fouling
  - Formational abnormalities due to over pressurization or over pumping
  - Siltation

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Necessity of well development

- Indicated by changes in site data over time
  - Vacuum
  - Pressure
  - D.O.
  - Fluid flow rate

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Necessity of HRW development cont.

- Typically formation dependent
  - Some formations are more susceptible to fouling
    - Biologic (presence of fertilizers or bacteria in groundwater)
    - Mineralization (high Iron/Manganese) oxidation
    - Siltation due to presence of fines in the treatment zone

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Methods of HRW Development

- Gentle pressurized flushing throughout the screened section of the well utilizing proprietary, environmentally safe chemicals and nozzle array
- Total extraction of fluids throughout the screened section in a thorough, stepwise manner.
  - Determined by inspection of fluids generated during the process
  - Should be performed by experienced personnel

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Follow-up Testing

- Recommended to determine increase in effectiveness of development techniques
- Effectiveness of development process determines future well development schedule to maintain optimum HRW operation

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Founded in 1992, Directional Technologies, Inc. has installed over 1,000 horizontal remediation wells throughout the world.

Corporate Headquarters in Wallingford, CT
Branches offices in Philadelphia, PA; Ashby, MA; Atlanta, GA; Destin, FL

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