H2O Engineering Inc.

PRODUCTS
- Ozone Remediation
- Ozone for Water Treatment: Self-Contained Systems and Large Scale Systems
- Membrane Filtration: Reverse Osmosis (RO), Nano Filtration (NF) and Ultra Filtration (UF)
- Electrodeionization (EDI/EDR)
- Liquid Chemical Injection
- Gas Sampling System
- Remote Monitoring
- Kaeser Compressors and Blowers
- Tonkafo Pumps

SERVICES
- Design & Technical Support
- In-Field Support & Training
- Comprehensive Service Contracts
- Equipment Rentals & Lease Options
- System Automation & Controls
- Process Optimization & System Customization
- UL 508A Panel Fabrication

Based out of San Luis Obispo, California
H2O Engineering Inc partners with environmental engineering consultants and project contractors having served customers Nation and Worldwide.

www.h2oengineering.com
Ph: 1-866-987-0303
Today’s Presentation

- Ozone Facts

- Alabama Case Studies
  - Case Study: Complex BTEX site
  - Case Study: Ozone polishing site
Ozone

- Tri-atomic oxygen – powerful oxidant (2.08 eV)
- Fundamentally different
  - 24/7 injection
  - Extended time – 1 to 5 years
Ozone

- Low cost – $50 to $150 a cubic yard
- ChemOx – fast reaction rates
- Minimal waste – O$_2$ and CO$_2$
- Enhances bioremediation
- Advanced oxidation process (ozone & peroxide)
- Long term solution
H2O: Sparge Well Installation

- Ozone Delivery Tubing
- Well Head Connection
- Riser Pipe
- Bentonite Cement
- Bentonite Chips
- IOP
- #2/16 Monterey Sand
Ozone: Radius of Influence

- Silts: 10' - 14'
- Silty Clay: 8’ - 12’
- Clay: 5’ - 10’
- Silty Sand: 14’ - 17’
- Sand: 15’ - 20’

Sparge Well
Why H2O Engineering?
H2O Process

Site Info → H2O Mass Balance → Design Strategy → Proposal
H2O INTELO-ZONE® Control Logic, Series C

- Safety
- System configuration
- Regression strategy
- Operator interface
- Telemetry-Smart phone/tablet
H2O: Remote Monitoring
Case Study #1
Complex BTEX site in Alabama
Active Service Station – Tuscumbia, AL

Challenges

- Shallow GW table
- Clay to silty clay. Bedrock at 10 to 12 feet BGS.
- High BTEX concentrations
- System start-up in Jan 2008
Sparge Well Design
## Contaminant Levels: Pre- and Post-Ozone Treatment

**Pre Ozone Treatment: As of January 22, 2008**

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Groundwater (ppm)</th>
<th>SSCALS</th>
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</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>50.6</td>
<td>0.654</td>
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<tr>
<td>Toluene</td>
<td>33.5</td>
<td>131</td>
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<tr>
<td>Ethylbenzene</td>
<td>5.7</td>
<td>91.5</td>
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<tr>
<td>Xylene</td>
<td>35.3</td>
<td>175</td>
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<tr>
<td>MTBE</td>
<td>2.35</td>
<td>2.62</td>
</tr>
</tbody>
</table>

**Benzene and BTEX concentrations vs. Time for MW1**

- Benzene concentrations: 50.6, 14.5, 10.6, 8.53, 6.93, 1.37, 0.036, 0.044, 0.037, 0.003, 0.000, 0.38, 0.419 ppm
- BTEX concentrations: 127.1, 66.3, 30.9, 16.53, 6.98, 1.596, 2.573, 0.94, 0.216, 0.041, 1.52, 1.135 ppm
Case Study #2
Ozone Polishing Site
Former UST Station – Birmingham, AL

- Shallow to moderate GW table
- Silty clay to sandy clay. Bedrock at 10 to 20 feet BGS.
- Moderate BTEX concentrations in multiple wells
- Site in the UST program for some time
- System start-up in May 2013 / Shut-down in May 2014
Sparge Well Design
Contaminant Levels:
Pre- and Post-Ozone Treatment

Pre Ozone Treatment: As of May 21st 2013

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Groundwater (ppm)</th>
<th>SSCALS</th>
</tr>
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<tbody>
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<td>0.86</td>
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<tr>
<td>Toluene</td>
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<td>BTEX</td>
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<td></td>
</tr>
<tr>
<td>MTBE</td>
<td>1.7</td>
<td>2.62</td>
</tr>
</tbody>
</table>
Conclusions

• Safety - INTELO®-Zone control logic
• $50 to $150 per cubic yard
• Fast reaction rates
• 24/7 injection
• Long term solution
Your partner for pure water and a clean world.

Thank you.

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