

Secondary Water Quality Impacts

Southeastern *In Situ* Soil and Groundwater
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Project Objectives

- Create guidance document
 - Identify high priority SWQIs
 - Survey of regulators and industry professionals
 - Document chemical/microbiological processes controlling occurrence, transport and attenuation
 - Provide guidance on monitoring approaches

Secondary Water Quality Impacts (SWQI)

- *Federal definition:* Secondary Drinking Water Standard – concentration that does not present a risk to human health and manages aesthetics considerations.
- *Project definition:* Change in groundwater quality resulting from an *in situ* remediation technology that has a significant adverse impact on the beneficial use of the groundwater resource.

In Situ Technologies

- *In Situ* Aerobic Bioremediation (ISArB)
- *In Situ* Anaerobic Bioremediation (ISAnB)
- *In Situ* Chemical Oxidation (ISCO)
- *In Situ* Chemical Reduction (ISCR)



Orin Remediation Technologies, Madison, WI and
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Direct Secondary Water Quality Impacts

➤ Direct Impacts

- Occur when materials intended to stimulate biological activity or react chemically with the contaminants introduce compounds, cations or anions.
- Immediately contravene existing groundwater standards.

Indirect Secondary Water Quality Impacts

➤ Indirect Impacts

- Occur after the injectable material has time to react in the aquifer resulting in changes to conditions or parameters that were not originally of concern.
- May or may not be adverse.

Examples of SWQI

	Direct	Indirect
ISAnB	TOC, BOD, COD, color, TDS, Na, SO ₄ , Mg	pH, ORP, VFAs, taste, odor, color, TDS, As, Cr ³⁺ , Fe ²⁺ , Mn, Gases (H ₂ S, CH ₄), organics
ISArB	Ca, Mg, Nutrients	pH, NO ₃
ISCO	Na, Ca, K, S ₂ O ₈ , Fe ²⁺ , pH, Mn	pH, Color, Mn, Cl, SO ₄ , Fe ³⁺
ISCR	Fe ⁰ , nZVI	Fe ²⁺ , see ISCO, ISAnB

Survey Results

- 72 Surveys and Questionnaires Received
- Responses from regulators, Air Force, USACE, industry professionals
 - 29 States & 3 USEPA regions
 - 18 DoD facilities represented
 - 22 industry reps, vendors, consultants represented



Q 1: Technology Considerations

- **Question 1:** Have you considered potential SWQI when implementing and/or managing an *in situ* technology?

	Regulators	Industry Professionals
Yes	87%	63%
No	13%	37%

Question 2:

- Which specific parameters have had to be monitored as a condition for regulatory approval?

Q 2: Additional Monitoring

	Regulators	Industry Professionals
<i>In Situ</i> Bioremediation	pH & ORP, TOC (70%) Fe & Mn (65%) SO ₄ , CH ₄ (65%) As, NO ₃ (55%)	CH ₄ , TOC (71%) Fe & Mn (50%) pH & ORP (50%) As, NO ₃ (43%)
<i>In Situ</i> Chemical Technologies	Fe (68%) pH (68%) ORP (63%) Mn (53%)	pH & ORP (69%) Fe & Mn (46%) Taste, odor, color (38%) TDS (38%)

Q 2: Conclusions

- pH, ORP, Fe, Mn: Are considered important SWQI from an operational and regulatory standpoint
- SO₄, CH₄: Important to regulators but not industry professionals
- As, NO₃: Regulators concerned with health related issues
- Taste, odor, color, TDS: Industry professionals concerned with aesthetic issues

Question 3:

- Have you ever denied or been denied approval of a permit, or requested or have been requested to modify a permit application, with regards to a specific parameter to gain regulatory approval?

Q 3: Permit Modification

	Regulators	Industry Professionals
<i>In Situ</i> Bioremediation	Fe & Mn (25%) pH & ORP, TDS (20%) As (20%) NO ₃ (15%)	H ₂ S (7%)
<i>In Situ</i> Chemical Technologies	Fe & Mn (32%) TDS (21%) pH & ORP (16%) SO ₄ , Cr (16%)	Mn (8%)

Question 4:

- Have you been involved in a project where a SWQI of any specific parameter created a documented impact to human health or the environment?

Q 4: Significant Impact

	Regulators	Industry Professionals
<i>In Situ</i> Bioremediation	Fe & Mn (25%) As (20%) NO ₃ , TOC, SO ₄ , TDS (10%)	CH ₄ (14%) Taste, odor, color (7%) ORP, Fe, VFA, H ₂ S (7%)
<i>In Situ</i> Chemical Technologies	Fe & Mn (16%) pH & ORP (11%) TDS, SO ₄ (11%)	Mn (8%) Taste, odor, color (8%)

Other Regulatory Issues

- Does your State have a mandated compliance or buffer zone between treatment zone and receptors?
 - Mostly NO (60%); Rule-of-thumb (26%); Guidance (14%)
- Have additional monitoring costs incurred for SWQI been:
 - Incidental or substantial?
 - Incidental (72%)
 - Required during first year or long-term?
 - Long-term (57%)

Management Approach

- Mitigation and monitoring approaches
 - Distinguish between operational monitoring, performance monitoring and health-related monitoring.

- Recovery and buffer zones
 - Time and distance to restore aquifer to natural conditions
 - Type of SWQI and groundwater hydrogeology
 - Receptors



SWQI Guidance

- Document to be published in Summer 2010
- Webinars scheduled for Fall 2010
- Surveys
- Case Studies
- Regulatory Guidance

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