Application Development and Regulatory Review Process for Low pH ISR in Wyoming

BENJAMIN J. SCHIFFER, P.G.
WWC Engineering (WWC) is an independent, employee-owned, multi-disciplinary, professional firm specializing in Civil/Site, Environmental, Land Development, Mining, Municipal, NEPA, Oil & Gas, Planning, Roads/Bridges, Surveying, Water/Wastewater and Water Resources services. WWC has approximately 100 employees and has been serving the Rocky Mountain region since 1980. Our client focus is to provide innovation, quality and value to every project.
Overview of Presentation

➢ Regulatory Actions
➢ Lessons Affirmed
➢ Lessons Learned

Compared to alkaline lixivants, low pH lixiviants have the potential to recover a higher percentage of uranium (including uranium that is resistant to other methods), require less lixiviant injection, require a shorter duration of ISR operations, result in lower radium levels, and result in a higher degree of natural attenuation during restoration (IAEA 1993, 2001).
WHAT WE DID

Regulatory Action and Associated Support--
➢ Prepared Major Revision to Permit to Mine No. 802
  ▪ Appendix D-5, Mine Plan and Reclamation Plan page changes
  ▪ Low pH Technical Report and Environmental Report
  ▪ Responses to Comments (3 rounds).
➢ Prepared Amendment to License WYSUA-1601
  ▪ Approved License Application, Sections 3 thru 7 in both ‘clean’ and ‘track change’ versions to accommodate low pH operations
  ▪ Low pH TR and ER
➢ Prepared Modification to AQD Permit CT-12198
➢ Provided assistance for Stakeholder outreach efforts
➢ Prepared Field Leach Trial application
LESSONS AFFIRMED—’What we did well’

‘Set the stage for success…’


➢ Collaborative (Strata, consultants and regulators) application development phase
  ▪ LQD Guideline 24
  ▪ Multiple internal and regulatory meetings with purpose and preparation
  ▪ Follow-up on outcomes and deliverables
  ▪ Combined Applications Key for Consistency

➢ Managed parallel paths (regulatory and technical)

➢ Implementation Plan
  ▪ Only 2 pages comprised of “…risk-informed, performance-based licensing with an adaptive, milestone-driven implementation plan.”

“The purposes of this white paper are to condense abundant publicly available information into a single document, provide specific technical evaluations of the environmental and human health aspects of low pH ISR, and, most importantly, provide a catalyst for engagement, input, and discussions with the regulatory community, area residents, general members of the public, and other stakeholders.”
LESSONS AFFIRMED—’What we did well’ (Cont.)

<table>
<thead>
<tr>
<th>Technical Issue</th>
<th>Potential Resolution</th>
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</thead>
<tbody>
<tr>
<td>Water management infrastructure compatibility</td>
<td>Pond liner resistant to low pH; additional pre-treatment prior to deep injection</td>
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<tr>
<td>Well, piping, and process infrastructure compatibility</td>
<td>Minor changes necessary, although most of the currently installed piping and infrastructure is compatible with low pH reagents</td>
</tr>
<tr>
<td>Instrumentation and control network compatibility</td>
<td>Minor changes necessary, although most of the currently installed piping and infrastructure is compatible with low pH reagents</td>
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<tr>
<td>Occupational and public health implications</td>
<td>Additional control measures and standard operating procedures necessary</td>
</tr>
<tr>
<td>Acid transportation and storage</td>
<td>Described in approved permit and license; potential environmental and public health and safety impacts of increased acid transportation to be evaluated</td>
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- Technical Issues Matrix
- QA and Internal Processes
- Anticipate Hearing(s)
- Manage expectations
- Expect and receive high level comments and respond accordingly
- Importance of Process
- Commitment to Restoration Methods and RTVs
Lessons Learned—‘What we could do better’

- Evaluate optionality opportunities
  - Test then revise or
  - Revise/amend

- Expect the unexpected
  - NRC/URP transition strategy...

- Implementation Plan
  - Proof of Concept Request
  - Performance-based Criteria
  - Quantifiable metrics
  - Field Trial
  - Implemented Multiple DEQ reviews and approvals as appropriate during 4 stages of implementation
  - Final Version—14 pages...
Conclusions

➢ Told by many that we would never receive authorization for low pH...
➢ Proud of what we achieved
➢ But Must always work to do better!
➢ Thank you for your time and any Questions?