Nitrate Treatment

It’s Never Easy

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What Am I In For?

• Nitrate treatment overview
• Project overview
• Technical approach
• Case studies of participating utilities
• Lessons learned
Nitrate Treatment

Non-Treatment Options

Well Abandonment  Wellhead Protection and Land Use Management  Alternative Sources and Source Modification  Blending
Nitrate Treatment

Non-Treatment Options
- Well Abandonment
- Wellhead Protection and Land Use Management
- Alternative Sources and Source Modification
- Blending

Treatment Options
- Nitrate Removal
  - Ion Exchange
    - Conventional, Specialized Resin, Counter Current, Multiple Vessel Configuration, WBA IX
  - Reverse Osmosis
    - Process & Membrane Improvement and Modification
  - Electrodialysis
    - EDR SED
- Hybrid Systems
- Nitrate Reduction
  - Biological Denitrification
    - Fixed Bed Fluidized Bed MBR/MBfR
  - Chemical Denitrification
    - ZVI SMI Other Media
Proposition 50 Project - Objectives

• $5M in grant funds to install and operate strong base anion exchange (SBA-IX) systems over a three-year period

• Minimize O&M costs by sharing:
  • Operations
  • Brine disposal
  • Salt delivery

• Reduce waste brine disposal costs:
  • Collection
  • Administration
  • Purchasing agreements with disposal providers
Project Approach

• Install at least three strong base anion exchange (SBA-IX) treatment systems in disadvantaged communities
  • Treatment systems provided by Ionex SG
  • Ionex SG would provide oversight of necessary site improvements in a design-build type approach

• Systems operated for three years to validate the consolidated management approach and inform future solutions
IonexSG filed for bankruptcy in late 2018
  • Resulted in need to specify equipment and engineer site improvements
• Specification package intended to develop ‘boiler plate’ language and be easily modified to benefit other utilities
• Site visits and operational data review identified both concerns and opportunity for operational cost savings
• A deeper dive into the water quality details of the participating utilities revealed…it’s not just nitrate
System Improvements
Rio Bravo Greeley School

• Population - 887, connections - 16
• Supplied by a single well
  • Well 01 - 300 gpm capacity
• Bottled water has been provided since August 2015 which correspond with the time the nitrate MCL was exceeded
• Nitrate concentrations have remained between 11-13 mg/L as NO₃
• No other known water quality challenges until the first 1,2,3-TCP (TCP) compliance sample results were reported
System Improvements
Rio Bravo

Current System Configuration

- Chlorination
- RBG School Well 01
- Storage Reservoir
- Booster Pump
- Hydro-pneumatic Tank
- To Distribution System
System Improvements
Rio Bravo
Vast majority of water production is for non-potable purposes
  • Treating only potable supply greatly reduces O&M
  • Cross connection control investigation showed significant pipeline improvements necessary

Challenging design questions result of the potential of nitrate ‘sloughing’ from GAC
  • Full- vs. partial flow treatment
  • Order of GAC in process
System Improvements
Rio Bravo with SBA-IX

Proposed System Configuration
System Improvements
Rio Bravo

• Unique challenges
  • Project funding did not include:
    • GAC treatment or media replacement
    • Pipeline improvements
    • Well pump replacement
    • Second hydropneumatic tank
  • Corrosion analysis showed SBA-IX could have detrimental impacts
  • RO discharge to septic
    • Permitting
    • Discharge volume
  • Shifting to RO appears to be the right solution- but limits ability to test consolidated management approach
System Improvements
LSID-Tonyville

• Contaminants: Nitrate, perchlorate, and arsenic

• Primary Improvements
  • SBA-IX for nitrate, arsenic, and perchlorate removal

• Additional Site Improvements
  • Limited site work
System Improvements
LSID – Tonyville
System Improvements
LSID – Tonyville

Current System Configuration

Friant Kern Canal
Surface Water Treatment
Storage Reservoir
Hydro-pneumatic Tank
Booster Pump
To Distribution System
Chlorination
System Improvements
LSID – Tonyville

Proposed System Configuration Option 2

- NLH Well
- Pre-Filter
- SBA-IX Nitrate Perchlorate and Arsenic Removal
- Chlorination
- Storage Reservoir
- Brine Tank
- Brine Pump
- Pressure Tank
- Booster Pump
- Spent Brine Tank
- Waste Brine
- To Distribution System
Proposed System Configuration Option 1

- NLH Well
- Pre-Filter
- SBA-IX Perchlorate
- SBA-IX NO₂
- Storage Reservoir
- Chlorination
- Brine Pump
- Brine Tank
- Pressure Tank
- Booster Pump
- To Distribution System
- Spent Brine Tank
- Waste Brine
System Improvements
LSID-Tonyville

• Unique challenges
  • Existing surface water is of relatively high quality but groundwater treatment is still required
    • Largely due to periodic dry up of the Friant Kern Canal
  • Cost to treat is significantly more than that of surface water
  • Perchlorate and potentially arsenic in brine can limit disposal and comingling possibilities
System Improvements
Woodville

• Contaminants: Nitrate > MCL and 1,2,3-TCP > MCL in recent years, currently low-level

• Primary Improvements
  • SBA-IX for nitrate removal

• Additional Site Improvements
  • Electrical upgrades
  • Storage
System Improvements
Woodville
System Improvements
Woodville

Current System Configuration

Well 03
Chlorination
Hydro-pneumatic Tank
To Distribution System
System Improvements
Woodville

Proposed System Configuration
System Improvements
Woodville

• Unique challenges
  • Site visit revealed Well 3 functions as a peaking well and cycles on/off several times per hour when needed
  • Primary well (Well 1) is currently below nitrate MCL but concentrations appear to be trending upwards
  • Storage could limit the need for SBA-IX treatment but a solution is needed in the event the primary well fails
  • Provisions required for future TCP treatment installation
Reminders and Lessons Learned

- Smaller ≠ simpler
- The needs of each individual system are unique and therefore so is the right solution
- If details are not carefully considered the proposed solution may create long term water quality or operational challenges
- A balance is needed between treatment system sophistication and operational requirements
- Even with grant funding and short-term operational support. Long-term operations are not affordable
- There is a real need for continued improvement and innovation with nitrate treatment approaches
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