Connecting the World

Water Reuse for Managing Impacted Water At Sierrita

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Sierrita Operations
Groundwater Sulfate Plume

Background

- 1970 – Sierrita Tailings Impoundment begins operation
- 1973 – Pima County identifies elevated sulfate in wells east of tailings
- 1978-81 – Sierrita installs first series of interceptor wells
- 1995 – Elevated sulfate identified in potable water supply wells
- 2003 – Sulfate in two supply wells exceed 500 mg/L
- 2003 – Provided Community Water Company with an interim alternate water supply
- 2006 – Signed a Mitigation Order on Consent with ADEQ to address sulfate in drinking water
- 2007 – Paid for the design and construction of two new water supply wells and associated water treatment – $13 million
Mitigation Order Requirements

- Ensure drinking water supplies do not exceed 250 mg/L sulfate at point of use

- Schedule and tasks
  - Submit Work Plan to ADEQ (Aug 2006)
  - Form Community Advisory Group (Jul 2006)
  - Establish local information repositories (Jun 2006)
  - Evaluate Interceptor Well performance (Apr 2007)
  - Characterize aquifer and plume (Oct 2008)
  - Submit a feasibility study (Dec 2008)
  - Submit a Mitigation Plan to ADEQ (May 2009)
Mitigation Action Identification and Screening

Develop Mitigation Action Objective
(ensure existing drinking water supplies have a sulfate concentration < 250 mg/L)

Develop Mitigation Response Actions (e.g., source control, groundwater control, water management, treatment)

Identify and Screen Control Technologies Applicable to Each Action

Identify and Evaluate Representative Process Options for each Technology

Assemble Technologies into Mitigation Alternatives
Areas of Application of Mitigation Approaches

Legend
- Proposed Focused Feasibility Study Well
- Interceptor Well
- Monitoring Well
- Drinking Water Supply Well
- Agricultural Supply Well
- Approximate Location of Sulfate Plume >250mg/L
- Source Control
- Plume Management
- Drinking Water Supply Mitigation

(Based on information as of October 2007)
Water Balance

SCHEMATIC DIAGRAM OF 2006 WATER BALANCE FOR SIERRITA TAILINGS IMPOUNDMENT

- Tailings Water Delivered (26,323 AF)
- Water Reclaimed (6,429 AF)
- Precipitation (4,485 AF)
- Evaporation (11,983 AF)
- Seepage (7,467 AF)
- Surface Water Discharges (350 AF)
- Water Retained (5,279 AF)
- Interceptor Well Pumping (7,940 AF)

NOTE: AF = acre-feet
Mitigation Action Objective – Ensure drinking water supplies do not exceed 250 mg/L sulfate at point of use

- Alternative 1
  - Monitored natural attenuation

- Alternative 2
  - Plume stabilization
  - Large scale water treatment plant at end of mine life

- Alternative 3
  - Plume stabilization and reduction
  - Large scale water treatment plant at end of mine life

- Alternative 4
  - New tailings impoundment and plume stabilization

- Alternative 5
  - New tailings impoundment, plume stabilization and reduction
### Alternative 5

**New Tailings Impoundment, Plume Stabilization and Reduction**

- **Source Control**
  - Base case actions
    - Lined ponds (Duval Canal and Amargosa Ponds)
    - Optimize reclaim pond pumping
    - Soil cap and stormwater controls at final reclamation of STI
  - Pumping at the IW and FFS wells for source control
  - Develop new tailings impoundment to replace the Sierrita Tailings Impoundment

- **Plume Management**
  - Pumping at FFS, PS and MC wells to prevent plume migration and to reduce the plume extent
  - Groundwater monitoring

- **Water Use**
  - Extracted groundwater used in operations during mine life
  - Post-mining extracted groundwater would be minimal and can be evaporated in pit or possibly treated for other uses.
**Alternative 5**

*Pumping Facilities*

- Extraction well
- Arizona State Land Boundary

**Legend**
- Extraction Well
- Arizona State Land Boundary

IW - Interceptor well
FFS - Focused Feasibility Study well
PS - Plume Stabilization well
MC - Mass capture well
Sierrita's Current Well Pumping Rates

Interceptor Pumping

Canoa Pumping

Combined Pumping

Year

gpm

2006 2007 2008 2009 2010
Pumping Rate Comparison

Current Water Usage
Interceptor Wellfield/Sulfate Plume Projected Pumping Rates
Water from Canoa Wellfield
Long-Term Mitigation Pumping

Cumulative Volume Pumped (Mgal)

- Current Tailings Impoundment
- New Tailings Impoundment

Year

2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110
Proposed Location of New Tailings Impoundment

Legend
- Sierrita Tailings Impoundment
- Esperanza Tailings Impoundment
- Proposed New Tailings Impoundment
Modeled Seepage Rates for Sierrita Tailings Impoundment

Graph showing modeled seepage rates from 2010 to 2060, with two scenarios:
- 2016 Scenario
- 2042 Scenario

Seepage rates decrease over time, with the 2042 Scenario showing a sharper decline compared to the 2016 Scenario.
Alternative 5
Simulated 250 mg/L Sulfate Contour Over Time
Closing

- Use of technology to develop water balance
- Sustainability
  - Sulfate laden water replaces fresh water for mine
  - Reduces post mine life groundwater pumping and management
  - New modern tailings impoundment
  - Community benefit
- Sierrita Operations Website