Shaft Sampling & Profiling at the Section 27 Mine

Presented By: Amy Andrews

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS
Outline

• Site Location
• History
• INTERA’s Profiling and Sampling Plan
• Profiling and Sampling Procedure
• Results
• Conclusions
Section 27 Site Location

Grants Uranium Mineral Belt

~30 miles North of Grants, NM
Section 27 Site History

- Uranium ore in Westwater Sandstone groundwater
- Operational in 1970’s
Hydrogeology

- Ore-bearing aquifer –
  - Westwater Canyon Member of the Morrison Formation
- Multiple aquifers
  - Westwater Canyon, Dakota Sandstone, Tres Hermanos in the Mancos Shale

Morrison Formation
Regional Site History

- Uranium ore in Westwater Sandstone groundwater
- Dewatering 1950’s - ~1986
  - Regional cone of depression
  - Groundwater recovery
- NMWQCC Standards exceeded
  - U, Ra, SO4, TDS
- Geochemical stabilization with time
Dewatering and Area Groundwater

- Interconnected workings
  - 10 miles long, 3 miles wide
- Mine dewatering prior to implementation of surface water and groundwater regulations
  - 150 billion gallons from numerous mines
  - Surface discharge to several major arroyos
  - Saturated the alluvium and recharged deeper aquifers in some areas
2003-2007 Cone of Depression

- Cone of depression – contains affected groundwater
Site Characterization Strategy

- Groundwater monitoring program designed
- Support common goal to understand regional groundwater quality
  - Current groundwater quality
  - Vertical groundwater variability
Shaft Profiling Equipment

• In-Situ Troll 9500
  – Probes include temperature, pH, conductivity, oxidation reduction potential (ORP), rugged dissolved oxygen (RDO), and depth of water (via barometric pressure)
  – Parameters are logged every 10 seconds and can be seen on the Rugged Reader as they are collected
 Shaft Profiling

- Profile 2 Vent Shafts
- Parameters plotted
- Sample depth determined
Shaft Sampling

- Discrete depth grab sampler
Field Investigations

- Depth-to-water measurements
- Vertical profiling of vent holes
  - Continuous profiling
  - Profiling results influenced sample depth in each vent shaft
- Groundwater quality sampling
Shaft Profiling Results

- **Parameters**
  - Temperature, pH, Conductivity, Dissolved Oxygen, Oxidation Reduction Potential

**Temperature – May 2007**

**Conductivity – May 2007**
Shaft Profiling Results

2007 Profile Results

- **2007 VH-1-15'**
  - Uranium = 0.502 mg/L
  - Radium 226 = 20.9 pCi/L
  - Gross Alpha = 247 pCi/L

- **2007 VH-1-30'**
  - Uranium = 0.594 mg/L
  - Radium 226 = 22.4 pCi/L
  - Gross Alpha = 247 pCi/L

- **2007 VH-1-85'**
  - Uranium = 24.5 mg/L
  - Radium 226 = 42.9 pCi/L
  - Gross Alpha = 9570 pCi/L

2013 Profile Results

- **2013 VH-1-25'**
  - Uranium = 10.8 mg/L
  - Radium 226 = 17 pCi/L
  - Gross Alpha = 8770 pCi/L

- **2013 VH-1-40'**
  - Uranium = 10.7 mg/L
  - Radium 226 = 20 pCi/L
  - Gross Alpha = 9530 pCi/L

- **2013 VH-1-95'**
  - Uranium = 10.1 mg/L
  - Radium 226 = 19 pCi/L
  - Gross Alpha = 6400 pCi/L
Shaft Profiling Results

2007 Profile Results

- **2007 VH-1-15’**
  - Uranium = 0.592 mg/L
  - Radium 226 = 20.9 pCi/L
  - Gross Alpha = 247 pCi/L

- **2007 VH-1-30’**
  - Uranium = 0.594 mg/L
  - Radium 226 = 22.4 pCi/L
  - Gross Alpha = 247 pCi/L

- **2007 VH-1-85’**
  - Uranium = 24.5 mg/L
  - Radium 226 = 42.0 pCi/L
  - Gross Alpha = 9570 pCi/L

2013 Profile Results

- **2013 VH-1-25’**
  - Uranium = 10.6 mg/L
  - Radium 226 = 17 pCi/L
  - Gross Alpha = 87.70 pCi/L

- **2013 VH-1-40’**
  - Uranium = 10.7 mg/L
  - Radium 226 = 20 pCi/L
  - Gross Alpha = 9530 pCi/L

- **2013 VH-1-95’**
  - Uranium = 10.1 mg/L
  - Radium 226 = 18 pCi/L
  - Gross Alpha = 6400 pCi/L
Sampling Results

Section 27
VH-1

WQCC Standard = 30 pCi/L

Date
Jan-07 Apr-08 Jul-09 Oct-10 Jan-12 Apr-13 Jul-14

Radium 226+228 (pCi/L)
0 5 10 15 20 25 30 35 40 45

- Shallow
- Medium
- Deep
Sampling Results

Section 27
Time Series - Uranium
VH-1

Date
Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14

Uranium (mg/L)
0 5 10 15 20 25 30

- Shallow
- Medium
- Deep

WQCC Standard = 0.03 mg/L
Results

• Groundwater levels rising
  – average of 12.35 ft from 2007-2013
• Groundwater stratification no longer observed
• Groundwater quality results above the NM Water Quality Control Commission (NMWQCC):
  – Uranium
  – Radium 226 and 228
  – Iron
  – Manganese
  – Sulfate
  – Total dissolved solids (TDS)
  – Molybdenum
Regulatory Status

• 5-year renewal of sampling program for Section 27
• Provide information for understanding regional water quality conditions
• Final report and recommendations in January 2015
• Traditional approaches to groundwater remediation inappropriate
Conclusions

• Groundwater levels are rising due to cessation of mine dewatering

• Groundwater quality is spatially variable

• Uranium and radium concentrations have remained relatively stable or decreased over the 5-year monitoring period
Questions