Assessment of Nonpoint Source Chemical Loading Potential to Watersheds Containing Uranium Waste Dumps Associated with Uranium Exploration and Mining, San Rafael Swell, Utah

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Abandon Mine Lands Program
Topics of Discussion

• AML Program in Utah

• San Rafael Swell Study area

• Solid phase sampling

• Leachate extractions and results

• Future/ongoing AML assessment work
Problem

17,000 to 20,000 abandon mines throughout Utah
Located on or adjacent to public lands managed by BLM
Remote locations
Watersheds are ephemeral drainages
Monsoonal rain events
Radioactive sands are radioactive for thousands of years
Environmental degradation
Cost effective sampling techniques
Study Area

San Rafael Reef

San Rafael Swell
Solid Phase Sampling

- Modified Protocols from Hageman, P.L., and Briggs, P.H., 2000
- Non-specialized sampling equipment
- Cost effective
Solid Phase Sampling

Waste Dumps
85 sites

Streambed
24 sites

Background
8 sites
Leachate Extractions

• Modified Leachate Protocols from Hageman, P.L., and Briggs, P.H., 2000

• Sampling and Cleaning Protocols from National Field manual for the Collection of Water-Quality Data

• QA/QC samples (6 Blanks, 7 Replicates)

• Leachates analyzed for 18 trace elements

  Ag  Mn  
  As  Mo  
  Ba  Ni  
  Be  Pb  
  Cd  Sb  
  Cr  Se  
  Cu  U  
  Fe  V  
  Hg  Zn  

USGS
Results compared with EPA drinking water quality standards and aquatic life water quality standards

56 percent of waste dump leachates (48/85) exceeded one or more water quality standard

Sites SRS-40, SRS-41, SRS-55, SRS-56 SRS-89 and SRS-90 were the most common sites that exceeded water quality standards.

Streambed sample SRS-SED-16 exceeded aquatic life water quality standards for copper.

Background sample SRS-86 exceeded aquatic life water quality standard for selenium

Lucky Strike Mine, Tomisch Butte, and Family Butte areas showed largest concentrations of trace elements

Arsenic, Cadmium, Copper, Uranium and Zinc were the most common constituents exceeding water quality standards.
Elevated Levels of Arsenic
Elevated Levels of Cadmium

Aquatic life standard is based on a hardness value of 100 mg/L

USGS
Elevated Levels of Copper

Aquatic life standard is based on a hardness value of 100 mg/L.
Elevated Levels of Uranium

CONCENTRATION OF DISSOLVED URANIUM, IN MICROGRAMS PER LITER

SITE ID

Drinking-water-quality standard (30 µg/L)
Elevated Levels of Zinc

Aquatic life standard is based on a hardness value of 100 mg/L.
Areas of Concern
Family Butte

Sites SRS-40 and SRS-41
Lucky Strike Mine

EXPLANATION

Geologic Units
- Jurassic, Glen Canyon Group, Navajo Sandstone, Kayenta Formation, Wingate Sandstone
- Triassic, Chinle Shale, Shinarump Member
- Triassic, Moenkopi Formation

Sample Site
SRS-55: Site ID; refer to Table 4 for site information (for SRS-33 and 34 see Table 3 for site information)

- Blue: Constituents listing for those that exceed water quality standards; see Table 5. Red text indicates drinking water standards; blue text indicates aquatic life standards
- Geologic background site
- Streambed sediment site
- Uranium waste dump site

SRS-55
Tomisch Butte

EXPLANATION

Geologic Units
- Jurassic, Glen Canyon Group-Kaiap Sldstone, Kayenta Formation, Wingate Sandstone
- Triassic, Chinle Shale, Shinarump Member
- Triassic, Moenkopi Formation

Sample site
- SRS-89: Site ID, refer to table 4 for site information (for SRS-32 and 34 see table 3 for site information)
- Constituents listed for those that exceed water-quality standards, see table 5. Red text indicates drinking water standards, blue text indicates aquatic life standards
- Geologic background site
- Streambed sediment site
- Uranium waste dump site

SRS-89

SRS-90
• AML studies in Fry, White and Red Canyons during the summer 2007
  (USGS SIR awaiting regional approval)

• AML studies in Brown’s Hole during the summer 2008
  (USGS SIR in technical review)

• Solid sample digestion for trace elements analysis

• Soil Screening Levels for Radium, Thorium and Uranium

• Streamstats
Summary

• Cost effective program to determine potential trouble areas

• Elevated levels of selected trace elements in waste dumps exceeding water quality standards for Arsenic, Cadmium, Copper, Uranium and Zinc

• No distinguishable affect on downstream drainages

• Ongoing and future studies looking more into human hazards associated with recreational activities on waste dumps
Additional Information

Water Quality Results

http://nwis.waterdata.usgs.gov/usa/nwis/qwdata

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Questions