

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

**National Monitoring Conference
Denver, CO
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Funding Provided by Bureau of Land Management
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

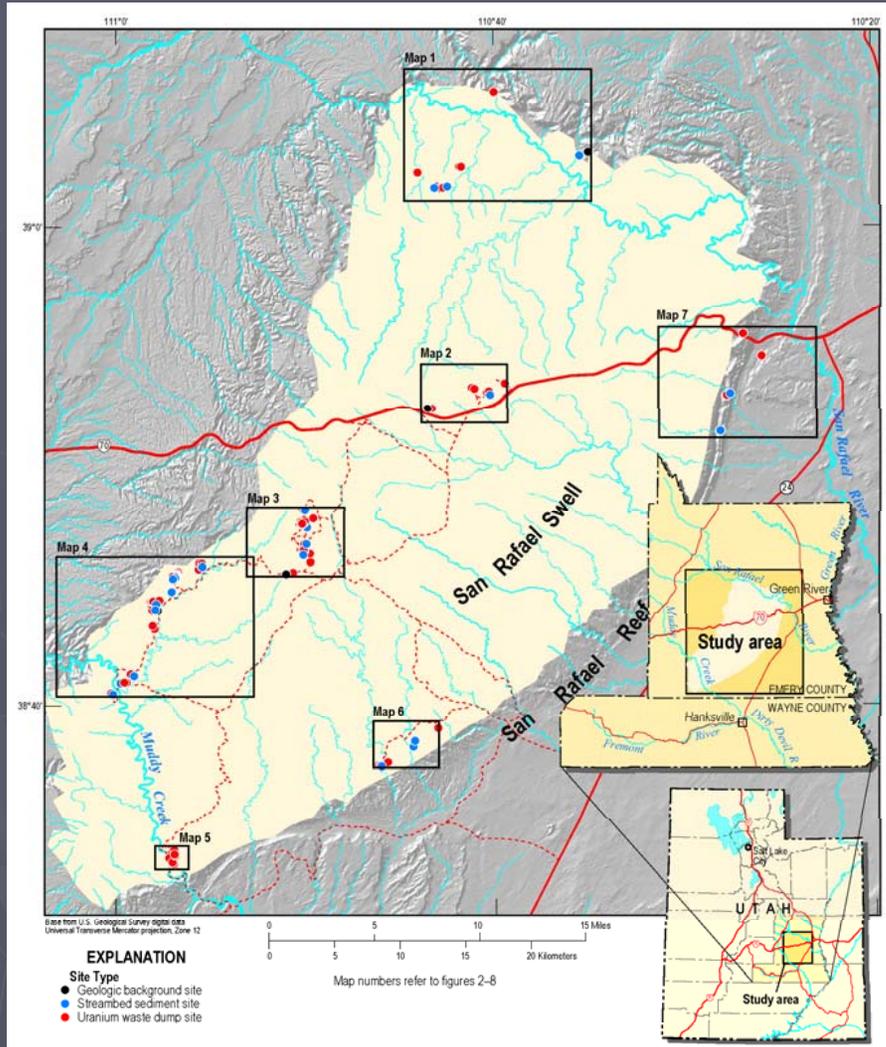
Radioactive sands are radioactive for thousands of years

Environmental degradation

Cost effective sampling techniques



Study Area



San Rafael Reef



San Rafael Swell



Solid Phase Sampling

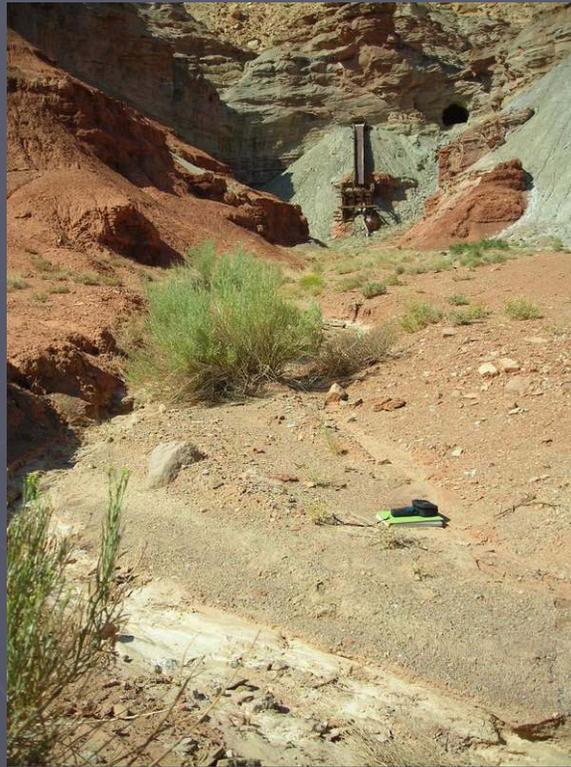
- Modified Protocols from Hageman, P.L., and Briggs, P.H., 2000
- Non-specialized sampling equipment
- Cost effective



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



Results

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.

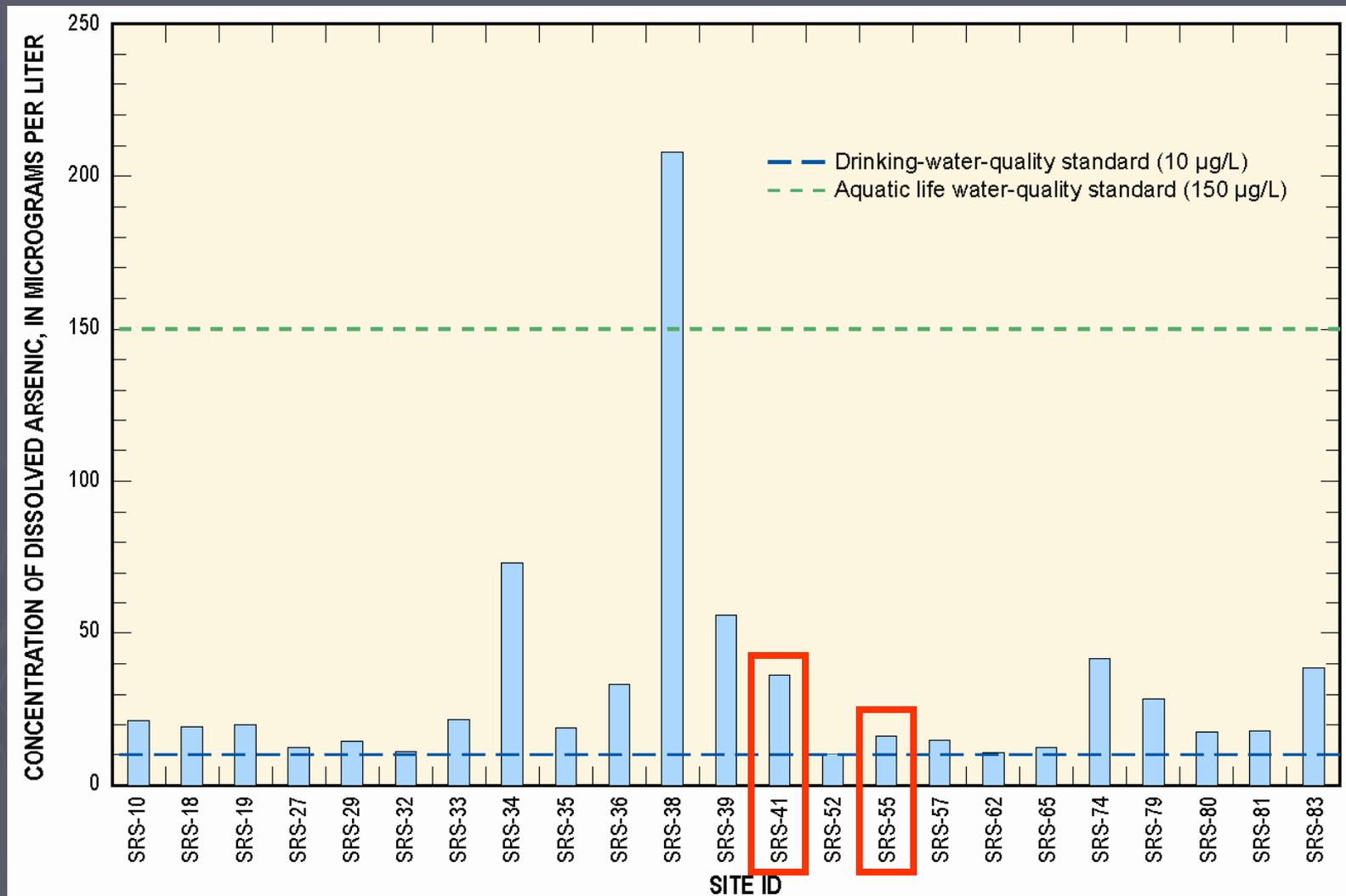
Background sample SRS-86 exceeded aquatic life water quality standard for selenium

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

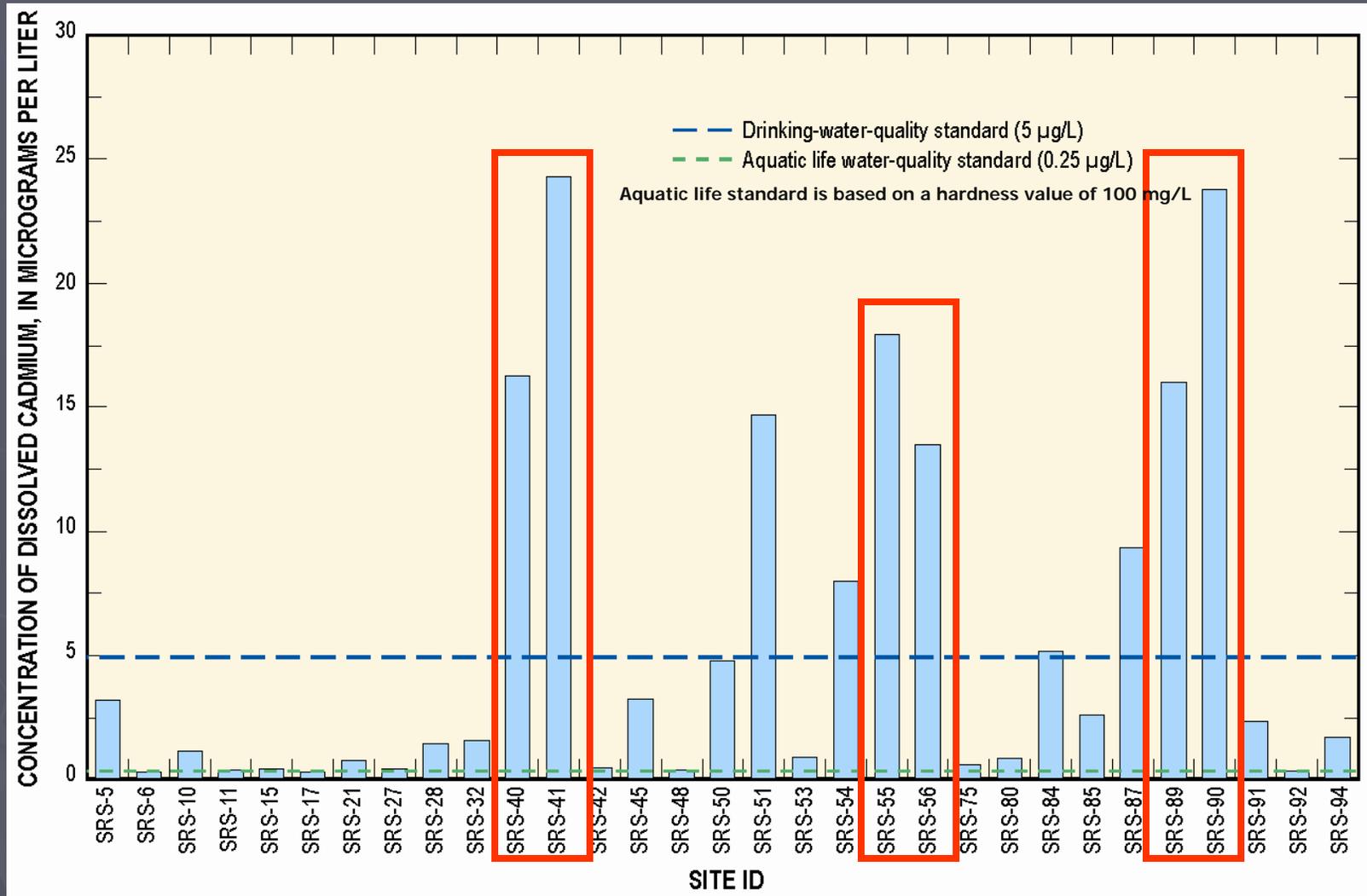
Arsenic, Cadmium, Copper, Uranium and Zinc were the most common constituents exceeding water quality standards.



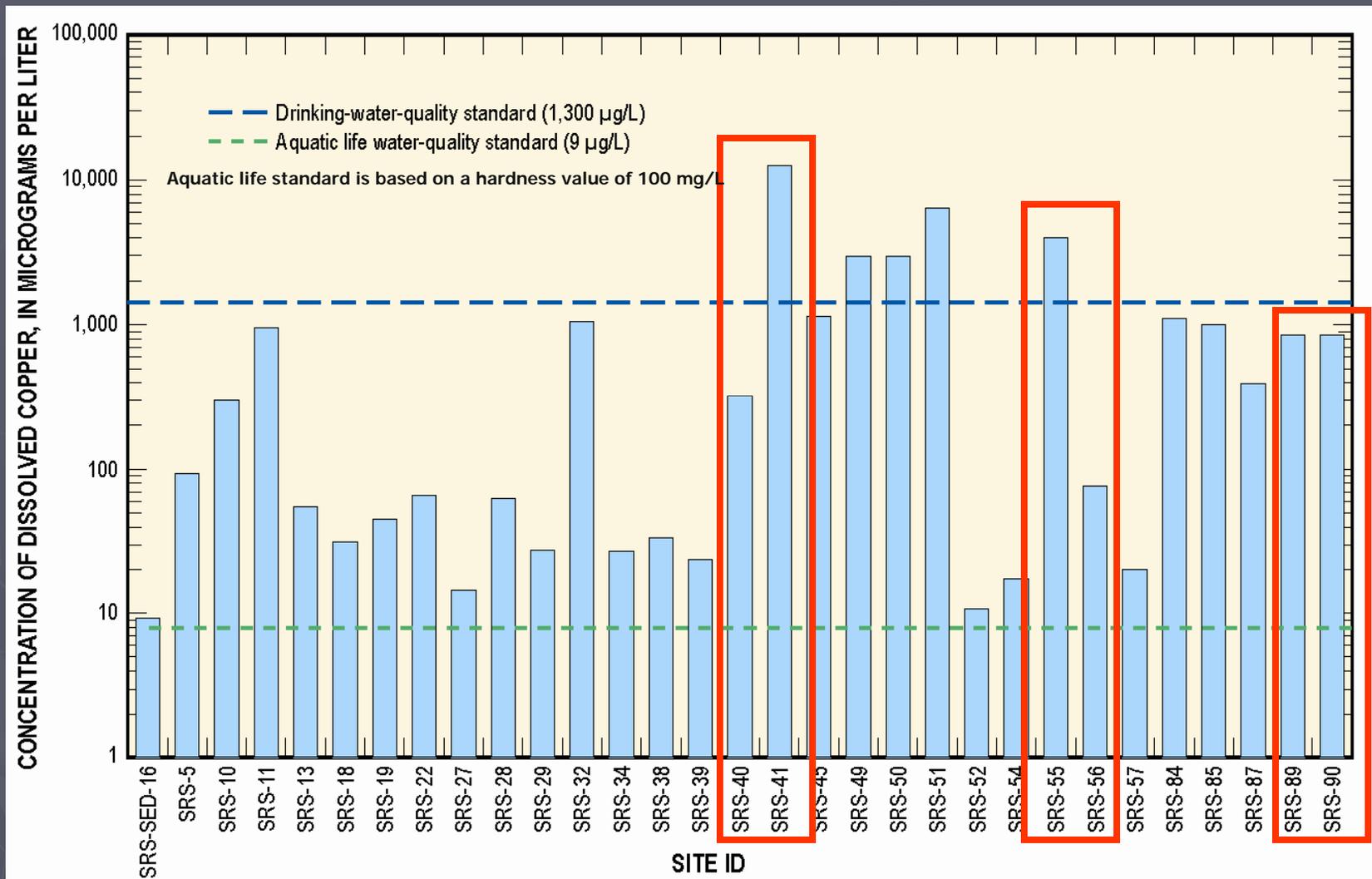
Elevated Levels of Arsenic



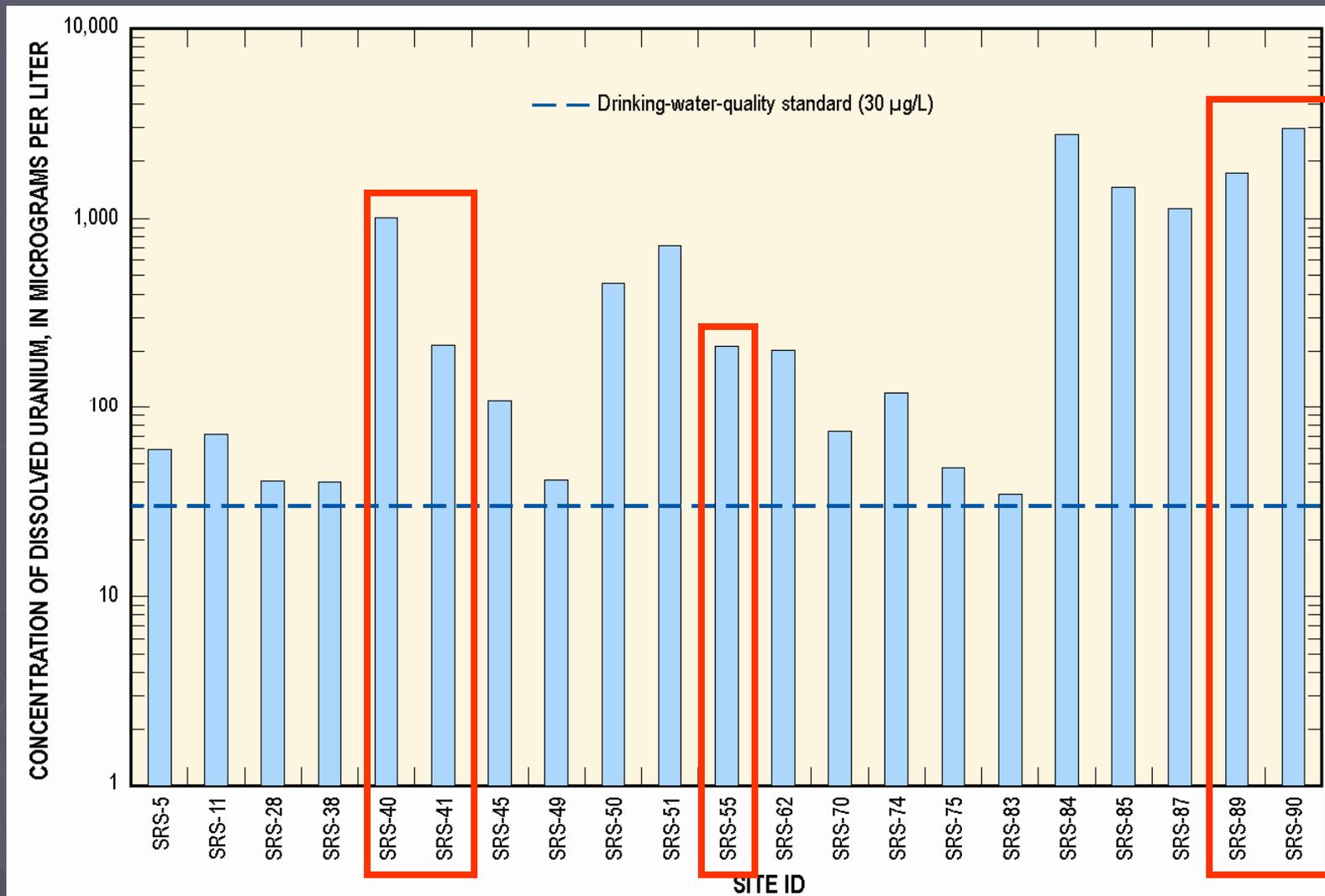
Elevated Levels of Cadmium



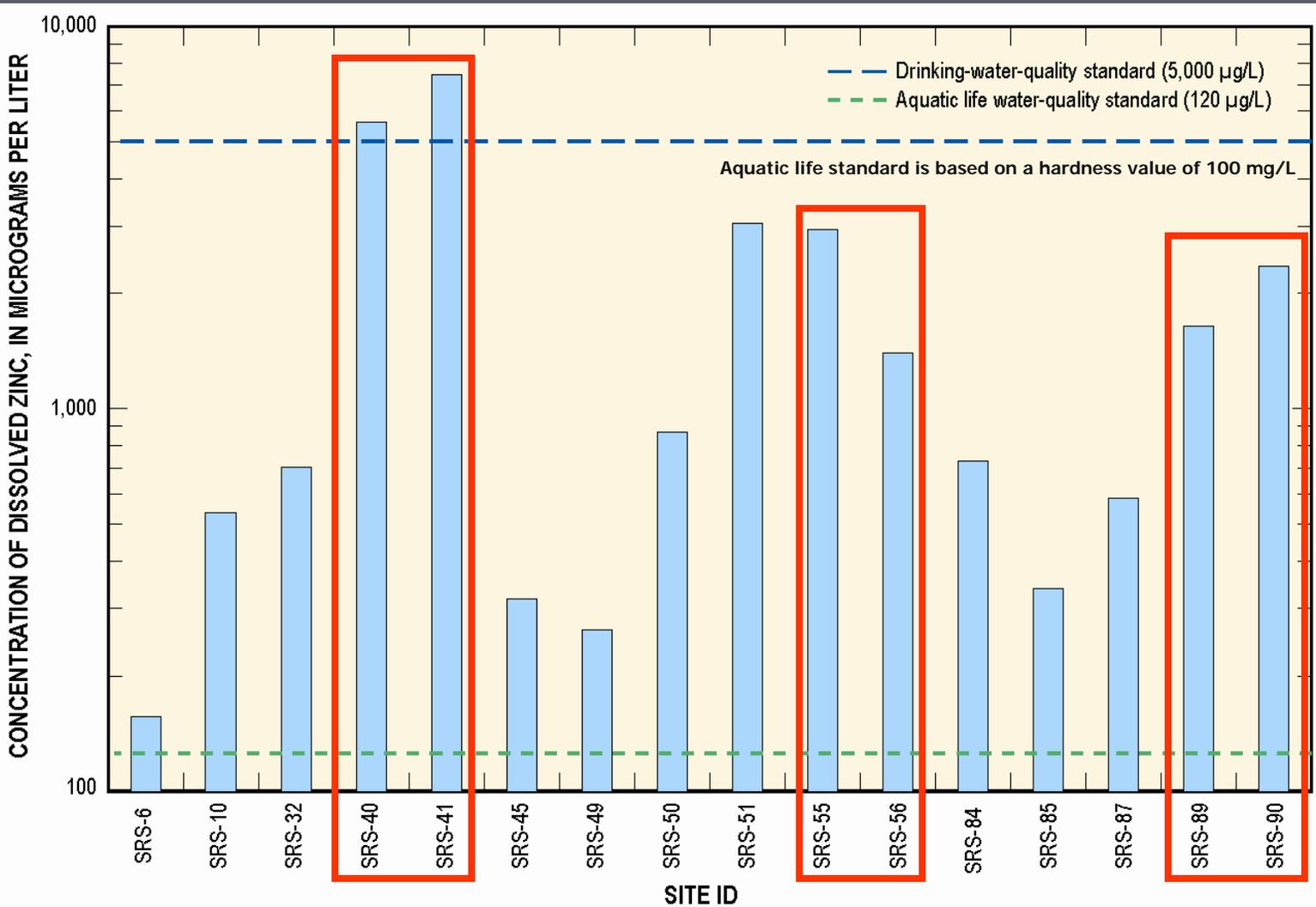
Elevated Levels of Copper



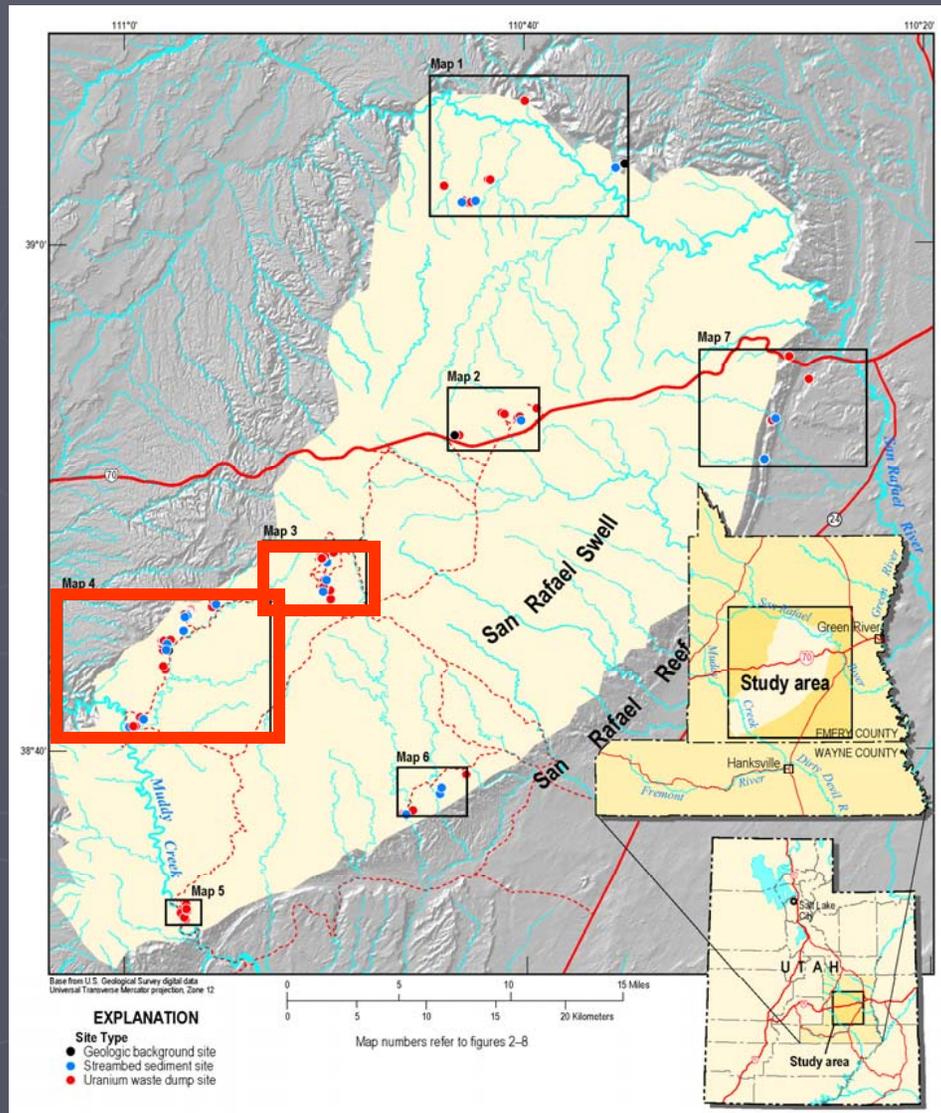
Elevated Levels of Uranium



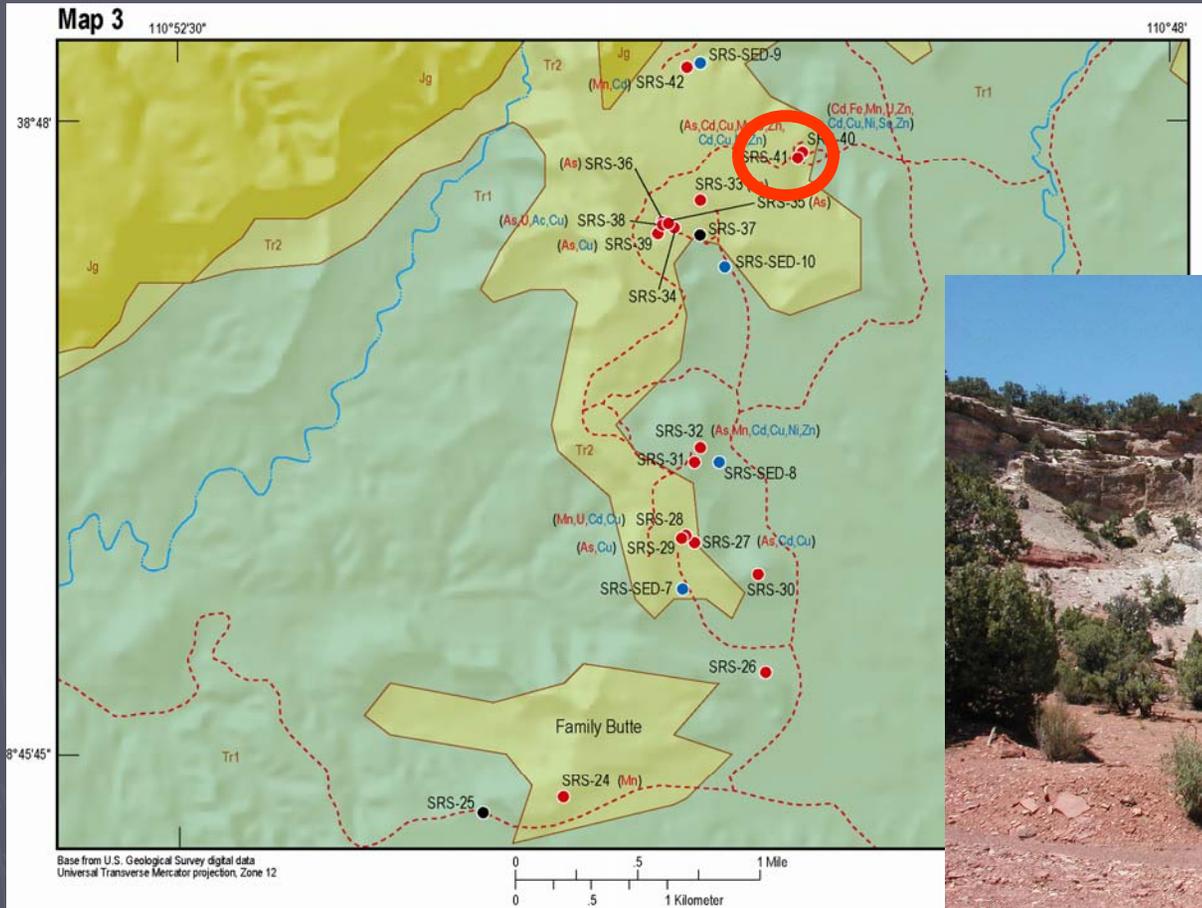
Elevated Levels of Zinc



Areas of Concern



Family Butte



Geologic Units

- Jg Jurassic, Glen Canyon Group-Navajo Sandstone, Kayenta Formation, Wingate Sandstone
- Tr2 Triassic, Chinle Shale, Shinarump Member
- Tr1 Triassic, Moenkopi Formation

Sample site

SRS-29 Site ID, refer to [table 4](#) for site information (for SRS-32 and 34 see [table 3](#) for site information)

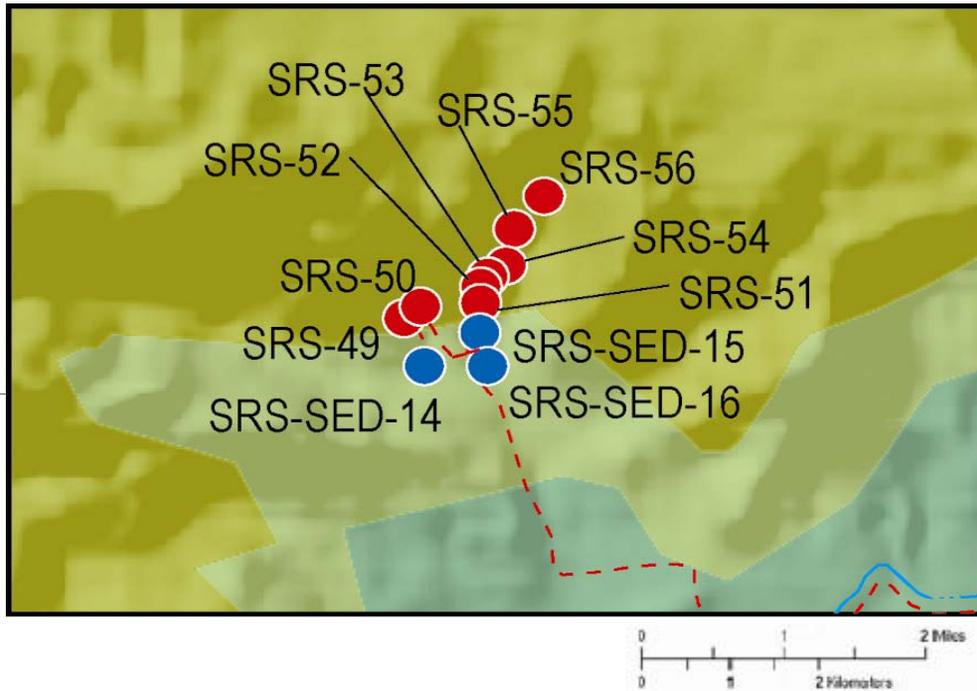
(As,Cu) Constituents listing for those that exceed water-quality standards, see [table 5](#). Red text indicates drinking-water standards, blue text indicates aquatic life standards

- Geologic background site
- Streambed sediment site
- Uranium waste dump site

Sites SRS-40 and SRS-41



Lucky Strike Mine



SRS-55

EXPLANATION

Geologic Units

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

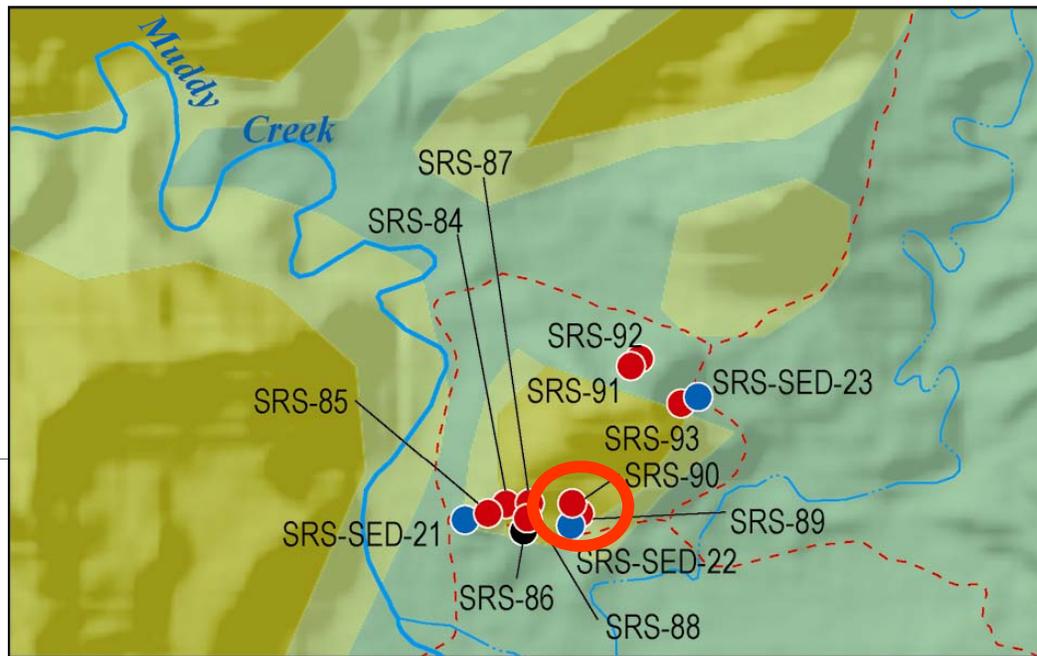
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(As,Cu) Constituents listing for those that exceed water-quality standards, see [table 5](#). Red text indicates drinking-water standards, blue text indicates aquatic life standards

- Geologic background site
- Streambed sediment site
- Uranium waste dump site

Tomisch Butte



EXPLANATION

Geologic Units

- J4 Jurassic, Glen Canyon Group-Navajo Sandstone, Kayenta Formation, Wingate Sandstone
- Tr2 Triassic, Chinle Shale, Shinarump Member
- Tr1 Triassic, Moenkopi Formation

Sample site

SRS-29 Site ID, refer to [table 4](#) for site information (for SRS-32 and 34 see [table 3](#) for site information)

(As, Cu) 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-89



SRS-90

Future and Ongoing Assessment

- 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



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Additional Information

Water Quality Results

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



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Questions

