Arsenic

Arsenic Background

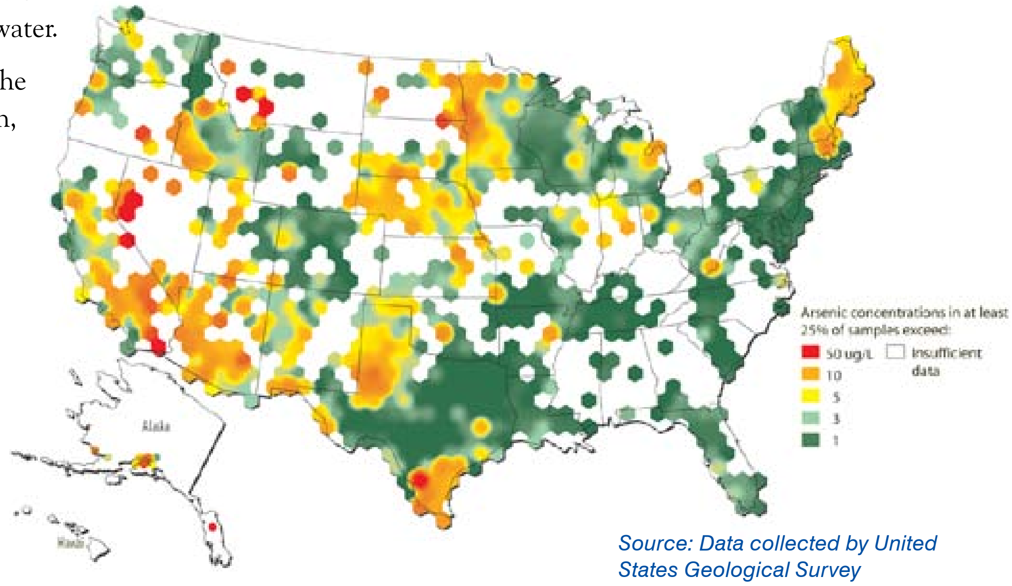
Arsenic Occurrence in the United States

Arsenic is typically found in groundwater systems of the Southwest. Originating from natural minerals in the ground, arsenic "hot spots" occur based on geologic type and groundwater chemistry. Most of the treatment technologies (e.g., coagulation, media sorption) are modified forms of the same reactions in nature which have caused the release of arsenic into the water.

An overview of the arsenic regulation, occurrence, and technologies evaluated by Carollo.

Engineering Services

Carollo provides a full range of engineering services from innovative research to final design and construction management. As the EPA deadline of January 2006 approaches, more and more utilities have been seeking Carollo to provide both comprehensive and site specific recommendations in order to meet the new Arsenic Rule.



Source: Data collected by United States Geological Survey

Regulatory Highlights

1975	US EPA sets National Interim Primary Drinking Water Regulation (MCL) at 50 μg/L.
1986	Amendments to the SDWA converted the 1975 interim arsenic standard to NPDWR.
1992	Due to the potential significance of internal cancer studies published in 1992, EPA decides to evaluate and incorporate this new risk information into the revision of the arsenic regulation.
August 6, 1996	SDWA Amendments are added into Section 1412(b)(12)(A) and is issued the proposed regulation by January 1, 2000, and this final regulation by January 1, 2001.
January 22, 2001	EPA adopts a final rule of 10 μg/L for arsenic, replacing the old standard of 50 μg/L.
March 20, 2001	EPA administration withdraws the pending arsenic standard to seek independent review of the science and the cost of the rule.
April 19, 2001	EPA announces a delay in the new MCL. A range of 3 - 20 μg/L is proposed for independent reviews by three expert panels including NAS, EPA's SAB, and NDWAC.
February 22, 2002	The arsenic rule in drinking water becomes effective with the new 10 μg/L standard.
January 23, 2006	The date by which systems must comply with the new 10 μg/L standard. Some states (e.g., California) may set the MCL less than 10 μg/L.

MCL : Maximum Contaminant Level
SDWA: Safe Drinking Water Act
NPDWR: National Primary Drinking Water Regulation
SAB: Science Advisory Board
NDWAC: National Drinking Water Advisory Council
NAS: National Academy of Sciences

"Dedicated to creative, responsive, quality solutions for those we serve."

Research Work

The Carollo Water Research Group works with the American Water Research Foundation AwwaRF) to develop and evaluate new technologies. Recently, Carollo evaluated a new low cost, arsenic field kit that would provide utilities with immediate turn around for analytical results. Experience in the research arena, positions Carollo to provide the most appropriate and complete final design.

Design Work

When addressing arsenic mitigation, Carollo considers more than just how to remove arsenic. Many times arsenic mitigation focuses primarily on the process without considering other important design aspects such as:

- Alternatives Source → Blending or Purchase
- Custom Design → Flexibility to Accept Various Media
- Waste Disposal → Off-Site or On-Site Disposal
- Emerging Technologies → AwwaRF Discoveries

Carollo's Arsenic Experience

Site/Client	Treatment Technology	Year
AwwaRF	Arsenic Field Kit Evaluation	2003
City of Chandler, AZ	Iron Media	2003
City of Corcoran, CA	Iron Media	2003
City of Lakewood, CA	Iron Media	2003
City of Magna, UT	Coagulation/Filtration	2003
City of St. George, UT	Coagulation/Filtration	2003
Picacho Peak Development, AZ	Coagulation/Filtration, Iron Media	2003
Town of Gilbert, AZ	Coagulation/Filtration, Iron Media	2003
Los Angeles Department of Water and Power, CA	Coagulation/Filtration	2002
City of Magna, UT	Electrodialysis Reversal, Iron Media	2000
Sierra Pacific Power Company, CA	Oxidation/Filtration, Reverse Osmosis, and Ion Exchange	1995
Westpac Utilities, Inc., Reno, NV	Reverse Osmosis, Ion Exchange, Activated Alumina, Oxidation/Filtration, Coagulation/Filtration	1992
City of Hanford, CA	Ion Exchange, Activated Alumina, Reverse Osmosis	1989

Arsenic Removal Technologies

Technology	Advantages	Disadvantages
Coagulation/ Filtration	• Effective, proven technology • Moderate operator training	• Process sensitive to pH • Disposal of As contaminated sludge may be a concern
Lime Softening	• Can treat high levels of As	• Process sensitive to pH • May require additional treatment • Sludge generation
Oxidation/ Filtration	• Also removes Fe and Mn • Moderate operator training	• Process sensitive to pH • Addition of iron and oxidant may be required
Activated Alumina (AA)	• High selectivity toward As^{5+} • Effective in treating water with high TDS	• Process very sensitive to pH • High concentration of SeO_4^{2-}, F^-, Cl^-, and SO_4^{2-} may compete for adsorption site
Granular Ferric Hydroxide (GFH)	• High selectivity toward As^{5+} • No regeneration chemicals on-site	• Short track record • Proprietary media
Ion Exchange (IEX)	• Removal of multiple contaminates (e.g., NO_3^-, ClO_4^-, and Cr^{6+})	• Pretreatment may be needed • Brine waste handling/disposal
Membrane Filtration RO/NF and EDR	• High removal efficiency • Removal of other contaminants in water matrix	• Reject water disposal • Poor production efficiency