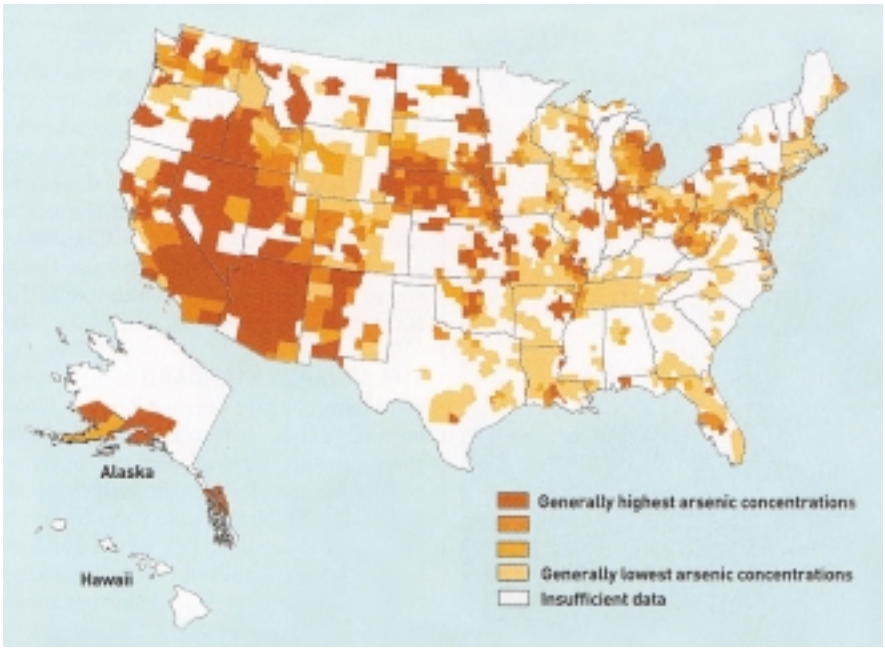


Image courtesy of United States Geological Survey.

Arsenic in Drinking Water

Part 3: Occurrence of Arsenic in U.S. Waters

By John T. O'Connor, EngD, P.E.

Editor's Note: Part 1 of this series provided a timeline for the development of a drinking water standard for arsenic. It also summarized the political and public reactions to the U.S. EPA decision to delay and withdraw the arsenic rule.

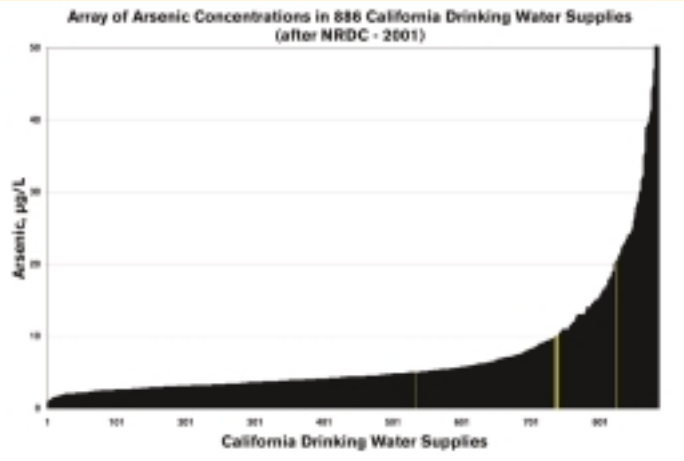
Part 2 dealt with human exposure and advances in knowledge concerning human health effects of exposure to arsenic.

Only recently has a substantial amount of data become available on the concentrations of arsenic in United States drinking water supplies. Most of these data have been accumulated by the state regulatory agencies responsible for monitoring drinking waters. Since the arsenic standard has been 50 µg/L, some state agencies have recorded arsenic concentrations only in excess of that concentration. Others have been limited by the sensitivity of the analytical techniques and equipment used for the arsenic analysis. As a result, much of the available arsenic data are "below the limits of detection."

The U.S. Environmental Protection Agency (EPA) has compiled the available arsenic data from the 25 states that have conducted monitoring programs. In turn, the Natural Resources Defense Council (NRDC) has utilized the EPA data to calculate "best estimates" of the concentrations of arsenic in finished drinking waters for communities in each of the 25 states. In many instances, only a single analysis had been conducted.

Recognizing that these results are still tentative and very limited, the graphs prepared for this review are an initial attempt to visualize the impact of various arsenic standards on the proportion of community water supplies that would be affected in a few of the states for which arsenic data has been reported. The graphs present the array of estimated arsenic concentrations, from lowest to highest, in the water systems or, in some cases, in well waters surveyed.

These arrays allow visualization of the impact of state-mandated arsenic limits of 3 µg/L, 5 µg/L and 10 µg/L on the proportion of water supplies potentially affected. For example, assuming the data are representative and the NRDC best esti-



Elevated (60 µg/L) levels of arsenic are present in Crowley Lake, Calif., the reservoir in the Los Angeles Aqueduct that provides 75 percent of the water supply for the 3.2 million residents of Los Angeles. The arsenic derives from geothermal inputs from Hot Creek, an indirect tributary. As a result of this influx, the arsenic in the influent to the Sylmar, Calif., water filtration plant averages 20 µg/L. To meet an ocean discharge standard of 12 µg/L, the arsenic is being removed by the addition of ferric chloride to co-precipitate iron hydroxide and arsenic. (Kneebone, PE. and Hering, J.G., "Behavior of Arsenic and other Redox-Sensitive Elements in Crowley Lake, Calif.; A Reservoir in the Los Angeles Aqueduct System," *Environmental Science and Technology, 2000, 34, 4307–4312).*

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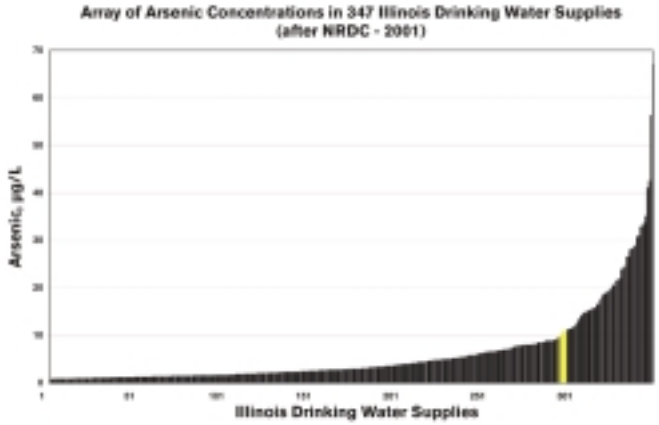
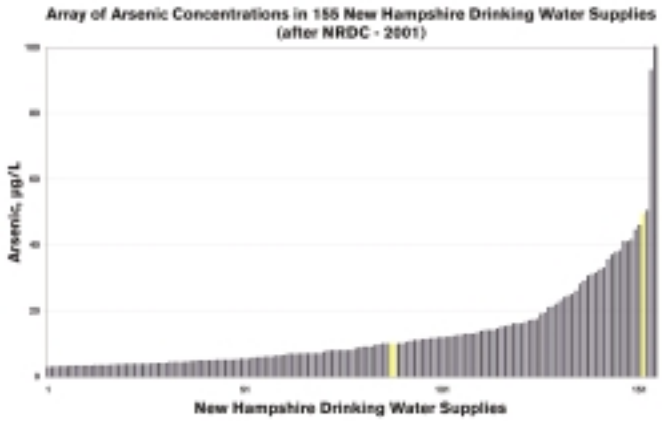
mates are an effective guide, about 40 percent of the 155 New Hampshire water supplies surveyed would be affected by a 10 µg/L maximum contaminant level (MCL).

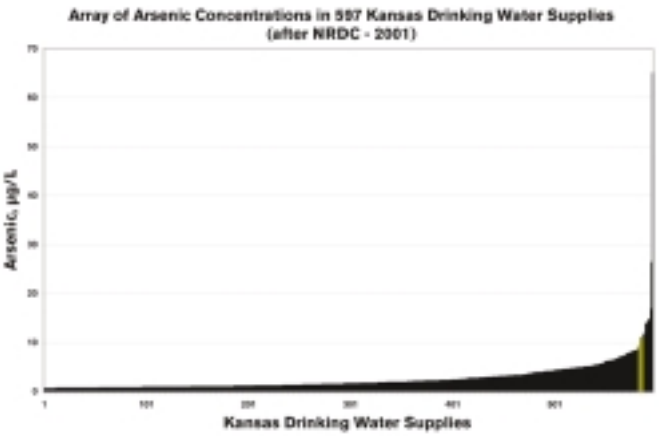
Alternately, the NRDC data indicate that fewer than 8 percent of Missouri supplies, many of which are untreated groundwaters derived from limestone strata, might be affected at the 10 µg/L level. A more recent review of arsenic data for Missouri, conducted by the Missouri Department of Natural Resources, indicates that few, if any, water supplies in the state will require treatment to meet a 10 µg/L MCL.

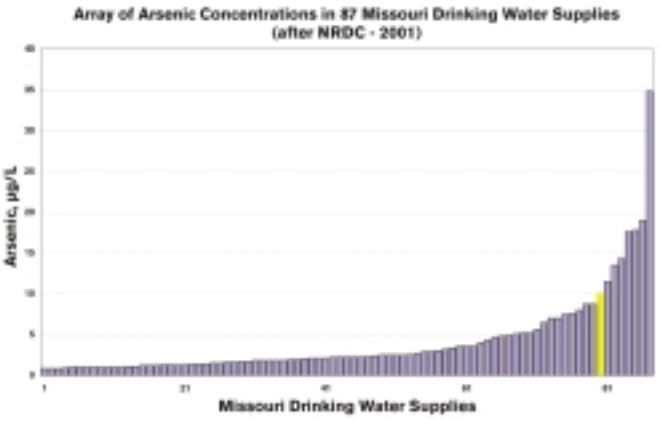
It is important to note that the nationwide cost of arsenic removal primarily will be a function of the number of water utilities that will be required to take remedial action rather than the incremental cost of removing arsenic to meet a lower limit such as 10 µg/L or even 3 µg/L. Currently, EPA estimates that 13 million people in the United States drink water with more than 10 µg/L arsenic.

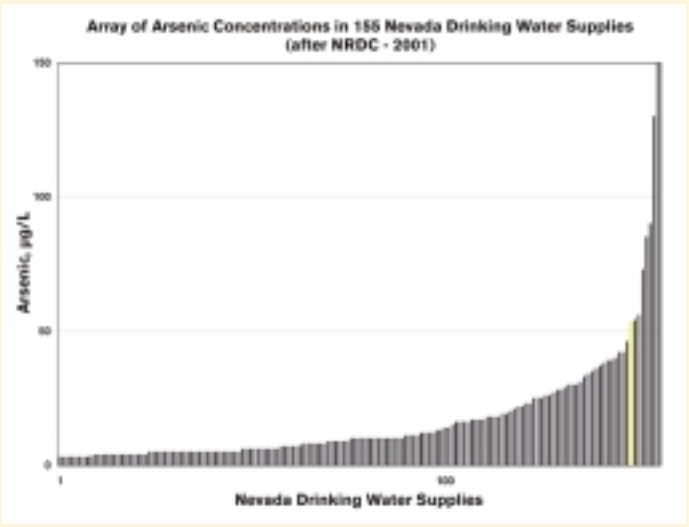
A comprehensive United States Geological Survey (USGS) review (Water-Resources Investigations Report 99–4279) of a range of existing water quality data indicates that most of the water utilities that are affected by a lowered arsenic standard are in the western, midwestern and northeastern states. USGS estimates that 1 percent of 54,000 U.S. public water supplies currently exceed 50 µg/L;



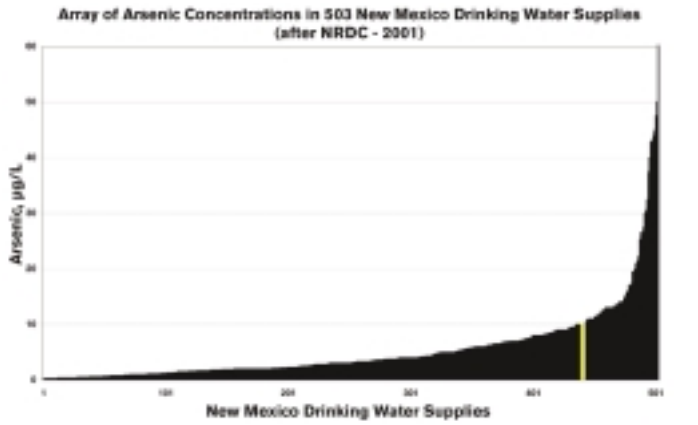








EPA has previously called for Fallon, Nev., (population: 8,300) to reduce arsenic in its drinking water from 100 µg/L to the then current standard of 50 µg/L. The state epidemiologist is investigating whether six cases of leukemia in children, diagnosed from March to July 2000, are related to arsenic ingestion, since no other county in Nevada has ever reported more than one case in a year.



3 percent exceed 20 µg/L; 8 percent exceed 10 µg/L; and 14 percent exceed 5 µg/L arsenic.

It is almost certain that more comprehensive arsenic data will become widely available as communities and regulatory agencies attempt to resolve MCL compliance issues. Only then will spatial and temporal variations in arsenic concentrations, including seasonal effects and the effects of antecedent rainfall, become evident. In many instances, source selection or blending will permit utilities to avoid implementing treatment for the removal of arsenic.

Part 4 of this series summarizes the methods available for the removal of arsenic from drinking water sources.

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