Arsenic in Ground-Water Resources of the United States

Arsenic is a naturally occurring element in rocks, soils, and the waters in contact with them. Recognized as a toxic element for centuries, arsenic today also is a human health concern because it can contribute to skin, bladder, and other cancers (National Research Council, 1999). Recently, the National Research Council (1999) recommended lowering the current maximum contaminant level (MCL) allowed for arsenic in drinking water of 50 µg/L (micrograms per liter), citing risks for developing bladder and other cancers. The U.S. Environmental Protection Agency (USEPA) will propose a new, and likely lower, arsenic MCL during 2000 (U.S. Environmental Protection Agency, 2000). This fact sheet provides information on where and to what extent natural concentrations of arsenic in ground water exceed possible new standards.

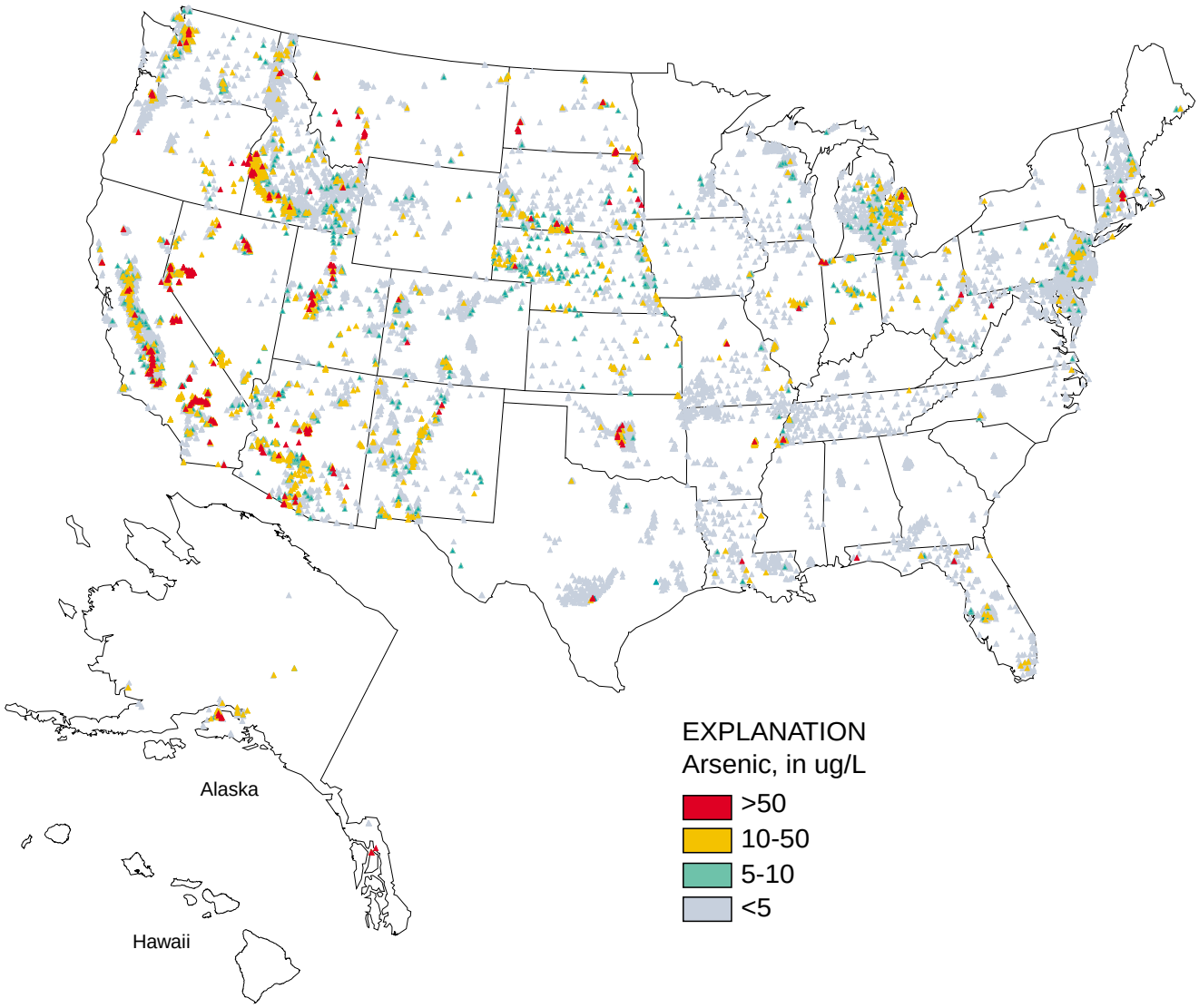

Figure 1. *Arsenic concentrations in ground water of the United States.*

U.S. Department of the Interior
U.S. Geological Survey

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The U.S. Geological Survey (USGS) has collected and analyzed arsenic in potable (drinkable) water from 18,850 wells in 595 counties across the United States during the past two decades. These wells are used for irrigation, industrial purposes, and research, as well as for public and private water supply. Arsenic concentrations in samples from these wells are similar to those found in nearby public supplies (see Focazio and others, 1999). The large number of samples, broad geographic coverage, and consistency of methods produce a more accurate and detailed picture of arsenic concentrations than provided by any previous studies.

Where do high concentrations of arsenic in ground water occur in the United States?

Arsenic concentrations in ground water generally are highest in the West. Parts of the Midwest and Northeast also have arsenic concentrations that exceed 10 µg/L, the World Health Organization's (WHO) provisional guideline for arsenic in drinking water (World Health Organization, 1999). Arsenic concentrations appear to be lower in the Southeast, based on a smaller amount of data. Arsenic concentrations also could be high at locations not shown on figure 1 because data are not available everywhere. Even at sampled locations, concentrations might differ between shallow and deep waters. Nonetheless, these data illustrate how arsenic concentrations vary across broad regions of the country.

How frequently are arsenic concentrations in ground water likely to exceed possible new maximum contaminant levels?

To look at the Nation as a whole, arsenic data were grouped by county and linked to the number of public-supply systems withdrawing ground water in each county (Focazio and others, 1999). Estimates of the percentage of small public water-supply systems which exceed six targeted arsenic concentrations in their ground-water resource are shown in figure 2. Systems were called "small" if they served between 1,000 and 10,000 persons. Focazio and others (1999) provide similar information for both smaller and larger sized systems. The highest concentration evaluated is at the current MCL of 50 µg/L, along with several lower concentrations, one of which may become the new MCL.

As the concentration for a possible new MCL decreases, the likelihood of exceeding that standard increases. Just over 13 percent of small systems used water with arsenic concentrations greater than 5 µg/L, compared to fewer than 1 percent exceeding the current 50 µg/L MCL. Public systems exceeding a new, lower MCL will be required to either treat their water or find alternative sources of supply. This choice undoubtedly will increase costs for consumers while decreasing their exposure to arsenic. Although homeowners with private wells are not regulated, a lower drinking-water standard would mean that more homeowners will be consuming water with concentrations that exceed a standard.

USGS information provides a broad picture of arsenic concentrations in ground water throughout the United States. In 24 percent of the U.S. counties where data were available, at least 10 percent of samples had arsenic concentrations exceeding 10 µg/L, the WHO provisional guideline for arsenic. Water users in these counties (colored darkest brown in fig. 3) are the most likely to have ground water exceeding new standards for arsenic.

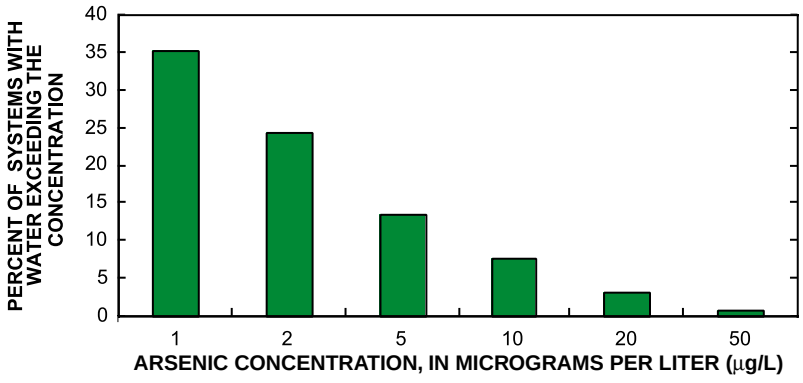

Figure 2. *Percentage of small public water-supply systems estimated to exceed targeted arsenic concentrations in their ground-water resource (µg/L, micrograms per liter).*

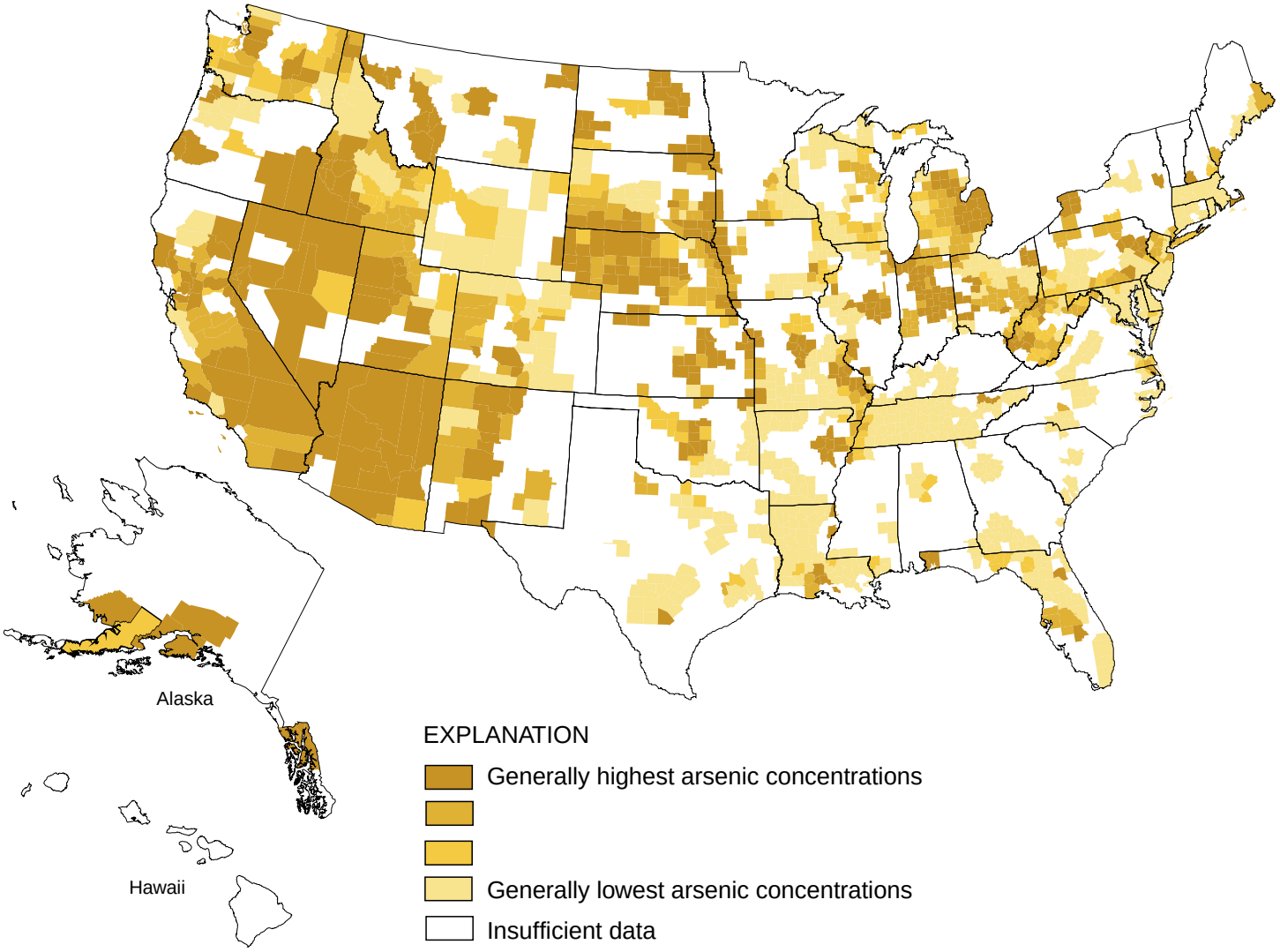

Figure 3. *Counties with arsenic concentrations exceeding possible new MCLs in 10 percent or more of ground-water samples.*

Counties with arsenic concentrations exceeding 10 μg/L in 10 percent or more of samples.

Counties with arsenic concentrations exceeding 5 μg/L in 10 percent or more of samples.

Counties with arsenic concentrations exceeding 3 μg/L in 10 percent or more of samples.

Counties with fewer than 10 percent of samples exceeding 3 μg/L, representing areas of lowest concentration.

Counties with insufficient data in the USGS data base to make estimates.

References

Focazio, M.J., Welch, A.H., Watkins, S.A., Helsel, D.R., and Horn, M.A., 1999, A retrospective analysis on the occurrence of arsenic in ground-water resources of the United States and limitations in drinking-water-supply characterizations: U.S. Geological Survey Water-Resources Investigations Report 99–4279, 21 p.

National Research Council, 1999, Arsenic in drinking water: Washington, D.C., National Academy Press, 273 p.

U.S. Environmental Protection Agency, Drinking water priority rulemaking—Arsenic: accessed on 4/5/00 at URL http://www.epa.gov/OGWDW/ars/arsenic.html

Welch, A.H., Westjohn, D.B., Helsel, D.R., and Wanty, R.B., in press, Arsenic in ground water of the United States—Occurrence and geochemistry. (To be published in the journal Ground Water, v. 38, no. 4, in July/August 2000.)

World Health Organization, 1999, Arsenic in drinking water: Fact Sheet 210, accessed on 4/5/00 at URL http://www.who.int/inf-fs/en/fact210.html

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