

STANDARDS

1914 - U.S. Treasury Department sets a bacteriological (*B. coli*) standard for drinking water.

- No chemical standards were set because agreement could not be reached on health effects.
- The bacteriological standard applied only to public drinking water supplies carried by common carriers engaged in interstate commerce.

1962 - USPHS retains arsenic tolerance limit at 50 µg/L; sets recommended maximum limit at 10 µg/L.

- Recommended limit reflects increasing concern over human health effects (cardiovascular system).
- Link to cancer not yet established.
- Standard had no effect on most municipal water utilities; not regulated under USPHS.
- Noting that the standards were intended to apply "only to water used on common carriers," the American Water Works Association resolved that the "Standards of the USPHS be accepted as minimum standards for all public water supplies."

1946 - USPHS revises Drinking Water Standards; retains arsenic, adds chromium and selenium.

1970 - U.S. Environmental Protection Agency (EPA) established; William Ruckelshaus, administrator.

1975 - EPA initiates review of 50 µg/L arsenic MCL.

1942 - USPHS sets first arsenic standard (tolerance limit) at 50 µg/L.

- Little arsenic data is available.

1925 - U.S. Public Health Service (USPHS) sets first drinking water standards for chemicals

- Tolerance limits were set for lead (100 µg/L), copper (200 µg/L) and zinc (5,000 µg/L).

1974 - EPA promulgates minimum drinking water standards, including 50 µg/L arsenic maximum contaminant level (MCL).

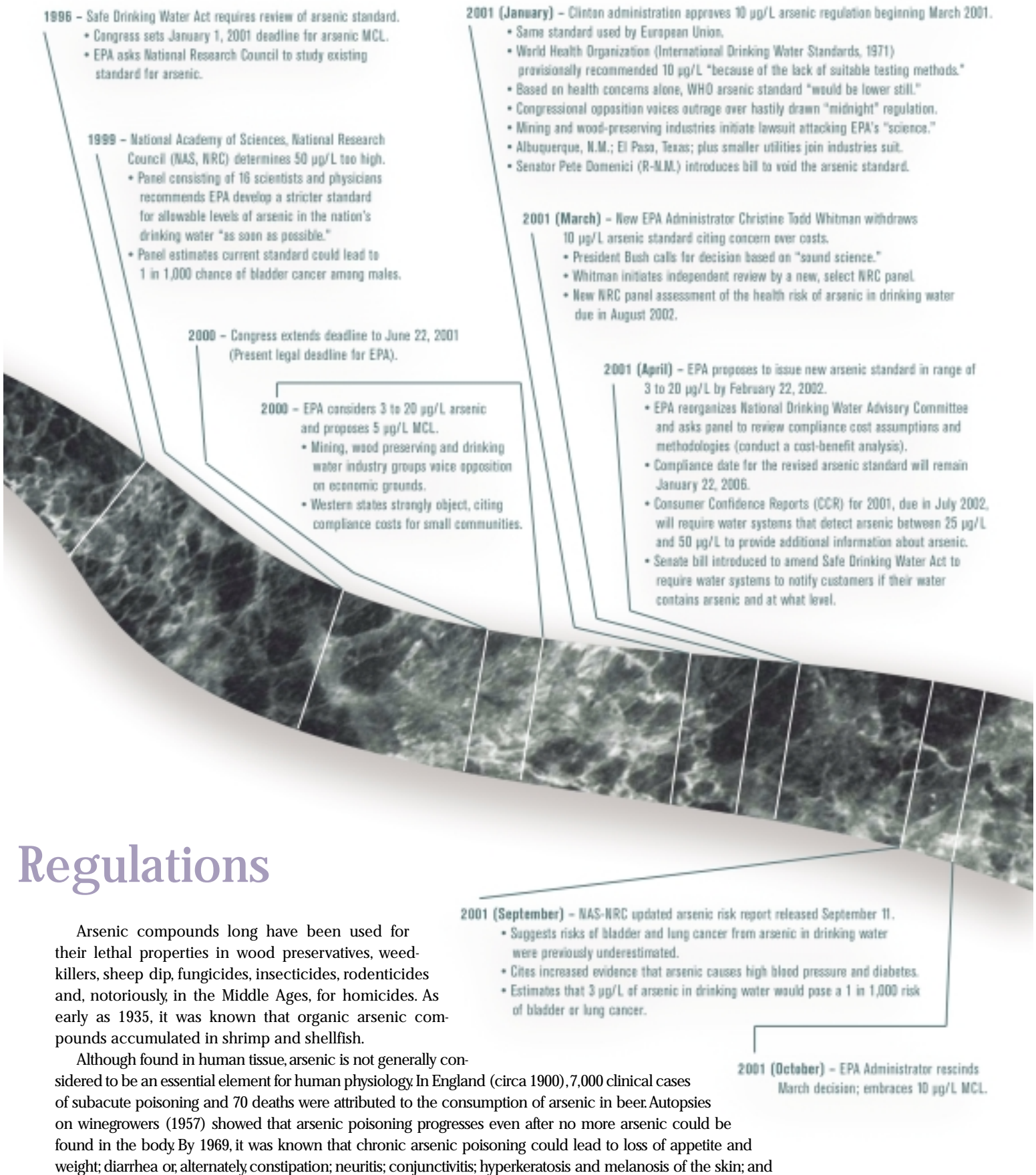
- For the first time, drinking water standards apply to all public water suppliers.
- AWWA strongly opposes establishment of all mandatory drinking water standards.

1989 - EPA fails to meet deadline to set revised arsenic MCL.

Arsenic in Drinking Water

Part 1: The Development of Drinking Water

Arsenic is widespread in almost all types of soil, particularly in association with iron and sulfur compounds. Accordingly, much has been made of the natural origins of dissolved arsenic in United States ground waters. However, the broad-spectrum toxicity of arsenic compounds has made them favorites for many agricultural and industrial uses. Therefore, arsenic deposits are mined and tailings created that may leach arsenic into U.S. surface waters.



Regulations

Arsenic compounds long have been used for their lethal properties in wood preservatives, weed-killers, sheep dip, fungicides, insecticides, rodenticides and, notoriously in the Middle Ages, for homicides. As early as 1935, it was known that organic arsenic compounds accumulated in shrimp and shellfish.

Although found in human tissue, arsenic is not generally considered to be an essential element for human physiology. In England (circa 1900), 7,000 clinical cases of subacute poisoning and 70 deaths were attributed to the consumption of arsenic in beer. Autopsies on winegrowers (1957) showed that arsenic poisoning progresses even after no more arsenic could be found in the body. By 1969, it was known that chronic arsenic poisoning could lead to loss of appetite and weight; diarrhea or, alternately, constipation; neuritis; conjunctivitis; hyperkeratosis and melanosis of the skin; and

Political and Public Reactions to EPA Decision to Delay and Withdraw the Arsenic Rule

- *March 22, 2001*—Addressing the Western Governor's Association, **EPA Administrator Christine Todd Whitman** announced she would withdraw the arsenic rule pending further review and public comment; the arsenic rule's compliance date would remain January 2006.
- *March 23, 2001*—**Federal Register** announces EPA will extend the arsenic rule's effective date to May 22, the first step in withdrawing the rule.
- **Senator Joseph Lieberman** (D-Conn.) seeks an investigation of EPA's decision by the Government Affairs Committee.
- **Senator Christopher Dodd** (D-Conn.) and Representative Bernie Sanders (I-Vt.) introduce bills to reinstate the 10 µg/L standard and make it subject to revision only by Congress.
- **Senator Harry Reid** (D-Nev.) introduces a bill to authorize \$750 million in grants to assist small systems in removing arsenic and other contaminants.
- *April 23, 2001*—**Federal Register** announces EPA plans to extend the effective date of the January 22 final arsenic rule to February 22, 2002; invites public comment on extension.
- **EPA** receives 14,000 comments, mostly unfavorable.
- **AWWA** calls extension "prudent;" asks EPA to grant full five-year compliance schedule to avoid undue hardship on utilities.
- *May 22, 2001*—**Federal Register** announces EPA decision to finalize delay to January 22, 2002; seek appraisal of the benefits of the 10 µg/L arsenic standard by the Science Advisory Board's Environmental Economics Advisory Committee.



- *June 28, 2001*—**The Natural Resources Defense Council** (NRDC) announces it will file lawsuit against the EPA and its administrator for ignoring the June 22 congressional deadline for having a new plan to reduce arsenic levels.
- **Sen. Barbara Boxer** (D-Calif.) announces she and several colleagues on the Senate Environment and Public Works Committee would file papers in support of the NRDC's lawsuit; Senators Hillary Rodham Clinton and Charles Schumer of New York, Jon Corzine of New Jersey, Paul Wellstone of Minnesota and Harry Reid of Nevada join in support NRDC's lawsuit.
- *July 27, 2001*—**Nineteen Republicans** join Democrats in 218–189 House vote to restore 10 µg/L arsenic limit by prohibiting EPA from using funds to lower standard. Administrator Whitman warns that amendment "will not put a standard in place any sooner than planned under EPA's science-based approach."

skin cancer. More recent medical findings on adverse human health effects has made arsenic appear even more formidable.

As shown in the time line, the U.S. Public Health Service (USPHS) first issued a Drinking Water Standard for arsenic in 1942. The maximum tolerance limit was set at 50 parts per billion (ppb) or micrograms per liter ($\mu\text{g/L}$). The water utilities of the United States were not markedly affected by these USPHS standards since they applied solely to the limited number providing water for interstate commerce.

By 1962, USPHS had revised its Drinking Water Standards and again called for a Maximum Permissible Concentration (MPC) of 50 $\mu\text{g/L}$ for arsenic. The MPC implied grounds for rejection of the supply. This time, the USPHS also issued a Recommended Maximum Limit (RML) of 10 $\mu\text{g/L}$ for arsenic. This limit implied those water sources with more than 10 $\mu\text{g/L}$ arsenic should not be used when more suitable supplies could be made available. Though of no practical consequence, the establishment of this RML was considered noteworthy because it was appreciably (five times) lower than the MPC. The impact of the 1962 USPHS arsenic standard on water utilities nationwide was essentially nil. It was not until after the formation of EPA in 1970 that drinking water standards that were applicable to water suppliers nationwide were promulgated. Even then, little effort was made to monitor water sources or remove arsenic from drinking water.

EPA began a laconic review of the arsenic standard in 1975. While several interim deadlines were missed, the issue became more urgent with a 1999 National Research Council health effects panel recommendation calling for a stricter arsenic standard "as soon as possible." An EPA proposal (2000) to set the drinking water maximum contaminant level (MCL) for arsenic at 5 $\mu\text{g/L}$ met with strong opposition from mining, wood-preserving and water industry groups. A compromise was reached with a revised EPA proposal for a 10 $\mu\text{g/L}$ MCL for arsenic.

The chaotic aftermath of the 2000 presidential election brought unparalleled attention to the otherwise routine confusion involved in the establishment of a

drinking water standard. Three days prior to going into effect, the 10 $\mu\text{g/L}$ arsenic standard, approved in the waning days of the Clinton administration, was withdrawn by the newly-appointed EPA Administrator. A new National Research Council team was formed to reassess the health effects of arsenic in drinking water. In addition, EPA reorganized its National Drinking Water Advisory Committee and asked it to urgently review the arsenic MCL compliance cost assumptions and methodologies.

For all the political rhetoric, public anxiety and additional review, little real latitude appeared to exist for the establishment of an increased, final MCL for arsenic. In appointing the new study panels amidst calls for the application of "sound science," EPA proposed to issue a new arsenic standard in the range of 3 to 20 $\mu\text{g/L}$ by February 22, 2002.

The National Academy of Sciences, National Research Council (NAS-NRC) report was released on September 11, 2001. It concluded that the existing health

effects data on arsenic essentially were sound. In addition, their review of three new epidemiological studies indicated that the health risks posed by arsenic in drinking water were greater than previously believed. As a result, in October, well before its self-imposed deadline, EPA rescinded its March implementation ban and endorsed the 10 $\mu\text{g/L}$ arsenic MCL.

Part 2 of this series will deal with human exposure and advances in knowledge concerning human health effects of exposure to arsenic.

About the Author:

John T. O'Connor, EngD, P.E., is CEO of H2O'C Engineering, Columbia, Missouri. Phone 877-22-WATER; email: john@h2oc.com

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