

Session G5: Healthy Drinking Water for Healthy People

Room C123
3:30 – 5:00 pm

0015
G5-1

The Reliability of Drinking Water Quarterly Compliance Monitoring Data as Reflected by EPA's 2nd 6-Year Review of National Primary Drinking Water Regulations

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Beginning in 2005, the National Rural Water Association commissioned an evaluation of the variability of quarterly compliance monitoring data used for determining drinking water system compliance with the National Primary Drinking Water Regulations of the federal Safe Drinking Water Act. This evaluation culminated in four separate white papers and this presentation discusses primarily the last two of these which are based on approximately 1000 sets of 4 quarterly sample determinations involving 10 different regulated drinking water contaminants. These data were taken from the US Environmental Protection Agency 2nd 6-Year Review of National Primary Drinking Water Regulations and demonstrate often excessive variability in the means of four quarterly samples, with an average 95% confidence interval around the means of determinations at or near the appropriate MCL of 193%. The details and implications of these findings are reviewed. The final work evaluated the possibility of improving the precision of quarterly measurement means by increasing sampling frequency and the results were, at best, mixed. These data are presented and possible future steps discussed.

0310
G5-2

Assessment of Arsenic Concentrations in Domestic Well Water in Maine

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Arsenic data from a Maine Health and Environmental Testing Laboratory (ME-HETL) database of water analyses from domestic wells was analyzed as part of the USGS National Water Quality Assessment Program to assist the State of Maine in developing a better understanding of the statewide spatial occurrence of elevated arsenic levels and to identify areas of the State that should have increased education to promote well-water testing. Private water wells are not regulated under the federal Safe Drinking Water Act and well owners typically are responsible for testing the quality of their drinking water. Results of arsenic analyses of domestic well water submitted by homeowners to the ME-HETL from 2005 to 2009 were screened and organized by township, resulting in a database of samples from 531 townships in Maine representing 11,111 individual wells. Because they were not randomly sampled, these wells may not be representative of all wells in any given area. In towns with 5 or more sampled wells, median and maximum values were calculated (385 townships). In towns having 20 or more sampled wells, the percentage of samples exceeding 10, 50, 100, and 500 µg/L were calculated (174 townships). Statewide maps showing these data were prepared, and provide a much greater spatial resolution of arsenic in private wells across the state than have previous studies. The distribution of high arsenic concentrations in wells follows some geographic patterns, which are generally geologically controlled. There are several clusters or belts of towns with high arsenic concentrations (> 50 µg/L), such as in southern coastal areas, the Kennebec County area, and towns along the central coast of Maine. In addition, several smaller clusters of wells with high concentrations of arsenic in groundwater were identified. There also are areas of the state with overall low arsenic concentrations (< 0.5 µg/L). Most townships with more than 20 wells in the database had at least one well with arsenic levels greater than the federal drinking water limit (10 µg/L). In a few townships, more than 50 percent of the sampled wells had arsenic levels greater than the drinking water limit.

0131
G5-3

Chemical Mixtures in Water from Public-Supply Wells in the U.S. – Occurrence, Composition, and Potential Toxicity

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Chemical mixtures are prevalent in groundwater used for public water supply, but little is known about their potential health effects. This large-scale ambient groundwater study evaluates chemical mixtures across multiple chemical classes, and includes more chemical contaminants than in previous studies of mixtures in public-supply wells. We (1) assessed the occurrence of chemical mixtures in source-water samples from public-supply wells, (2) determined the composition of the most frequently occurring mixtures, and (3) characterized the potential toxicity of mixtures using a screening approach. During 1993-2007, the US Geological Survey collected one untreated water sample from each of 383 public wells distributed across 35 states, and analyzed samples for as many as 19 inorganic and 72 organic chemical contaminants. Mixture component concentrations were compared to individual human-health benchmarks, and the potential toxicity of mixtures was characterized by addition of benchmark-normalized component concentrations. Most samples (84%) contained mixtures of two or more contaminants, each at a concentration greater than one-tenth of the respective benchmark. The sum of benchmark-normalized concentrations was greater than one for 58% of samples, indicating potential for mixture toxicity in more than half of public-well samples. Chemical mixtures contributed more to the potential toxicity in water samples than did individual contaminants. Mixtures that most frequently occurred and had the greatest potential toxicity primarily were composed of trace elements (including arsenic, strontium, or uranium), radon, and/or nitrate. Herbicides, disinfection by-products, and solvents were the most common organic contaminants in mixtures. The results of this study highlight the prevalence of potential exposure to mixtures of contaminants that occur at concentrations that approach individual human-health benchmarks. Our findings can be used to help set priorities for groundwater monitoring and suggest future research directions for toxicity assessments of chemical mixtures in water resources.

0005
G5-4

The Big Four: How Arizona's Most Comprehensive Groundwater Quality Assessment Relates to Discount Shopping

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In pursuing its mandated mission to characterize groundwater quality in the state, the Arizona Department of Environmental Quality's (ADEQ's) Ambient Groundwater Monitoring program has collected samples from 1,477 sites over a 15-year period between 1995 and 2009. The sample sites consisted mainly of domestic, stock, irrigation and municipal wells and, to a lesser extent, springs used predominantly for watering stock and wildlife. Sampling activity was conducted within 35 of the state's 51 officially designated groundwater basins and covered much of Arizona with the exception of Native American tribal lands.

All groundwater samples were analyzed for most inorganic constituents listed in the US Environmental Protection Agency Safe Drinking Water (SDW) Act. Approximately a third of the wells also had samples collected for SDW radionuclide constituents and lesser numbers of samples were collected for Volatile Organic Compounds and pesticide analyses.

Of the 1,477 sites sampled, 31 percent exceeded at least one health-based water quality standard, which provides a rough estimate of the percentage of wells state-wide not meeting SDW standards. Over 97 percent of exceedances were caused by elevated concentrations of four constituents: arsenic (41 percent), fluoride (22 percent), nitrate (18 percent) and gross alpha (16 percent).

The data provide comprehensive and reliable information on the occurrence and concentrations of groundwater contaminants. This is critical knowledge for the estimated 100,000 private domestic wells in the state whose owners represent about 5 percent of Arizona's population.

Unlike public water systems, private domestic wells are not subject to SDW regulations. Thus, collecting and analyzing water samples from private wells is not required and only occasionally conducted. One factor in well owner's reluctance to have their domestic water tested is expense; a comprehensive inorganic suite costs over \$650.

Testing for only the four constituents that constitute 97 percent of the water quality exceedances in this study is an economical (\$85) alternative for private well owners in Arizona. Although ADEQ recommends sampling for all the SDW constituents, testing for arsenic, fluoride, nitrate and gross alpha would be a dramatic initial step in evaluating the suitability of water for domestic use.