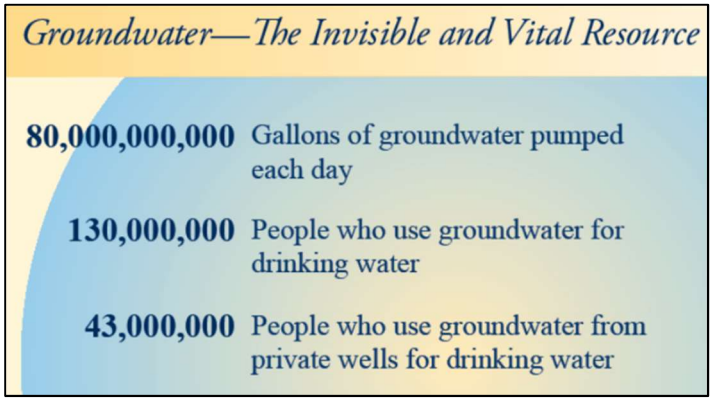
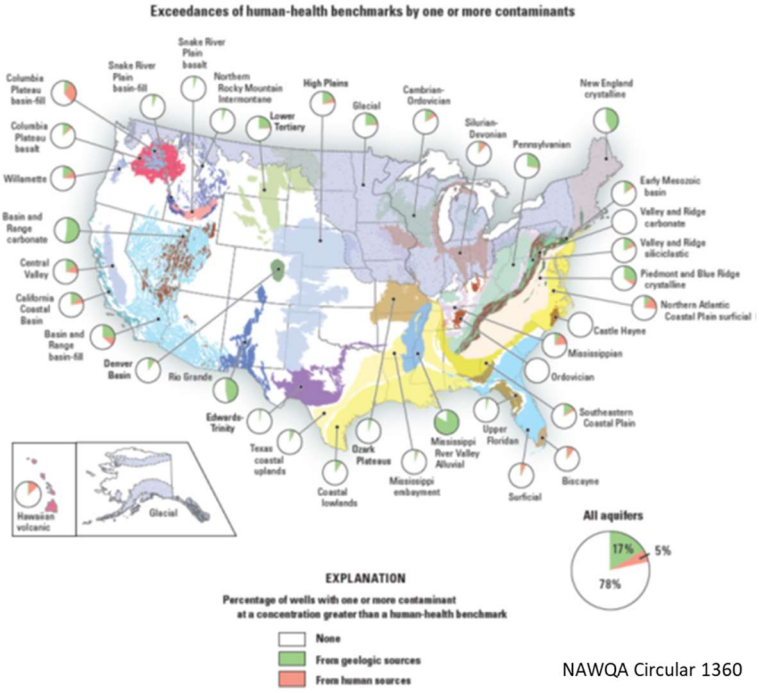
Geologic-sourced contaminants are widespread in drinking water aquifers: Arsenic, manganese, and other geologic-sourced contaminants are commonly found at high concentration in groundwater

During its third decade, the USGS National Water Quality Assessment (NAWQA) project is systematically assessing the quality of the Nation's most important drinking water aquifers. A coordinated national team contribute interdisciplinary skills (management and manipulation of very large data sets, software development, numerical and geochemical modeling, statistical analysis, geology, etc.) to design and implement long-term, national-scale groundwater assessments. NAWQA scientists also leverage monitoring data to develop machine learning models of groundwater quality, allowing predictions to be made in unmonitored locations. NAWQA team members have given numerous presentations and published hundreds of papers, reports, fact sheets, web pages, and other products that provide information about the quality of the Nation's drinking water aquifers – a vital water resource for human and ecological health.



NAWQA groundwater samples are analyzed for several hundred constituents, and water quality data are evaluated and interpreted in numerous ways to holistically understand groundwater quality and changes in quality. The untreated groundwater sampled for these studies is a source for both public-supply and domestic (private) wells. To provide human health context, sample results are compared to thresholds, which can be either a regulatory maximum contaminant levels or a non-regulatory health-based value. A sample is considered high for a given inorganic constituent if the analyzed concentration exceeds the threshold for that constituent; moderate is greater than ½ of the threshold.

Inorganic, geologic-sourced constituents such as manganese and arsenic, are common at high concentration in Minnesota groundwater, across the glacial aquifer system, and in many other important drinking water aquifers in the US. In the glacial aquifer system, we estimate that more than 4 million people rely on groundwater with high manganese (>300 micrograms per liter non-regulatory health-based screening level) and/or arsenic (>10 micrograms per liter US EPA maximum contaminant level).



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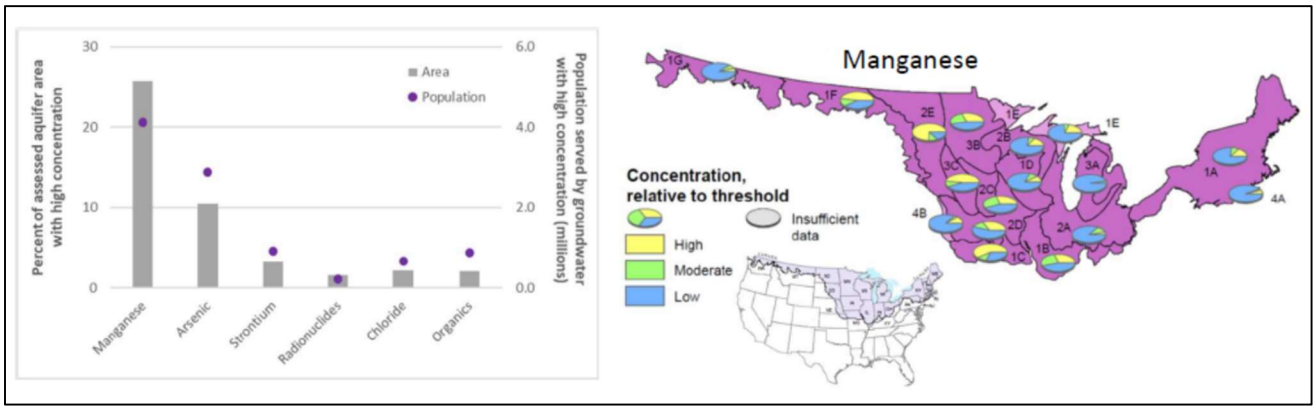
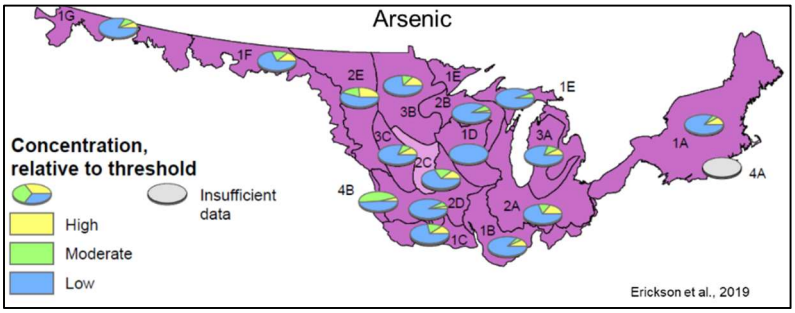
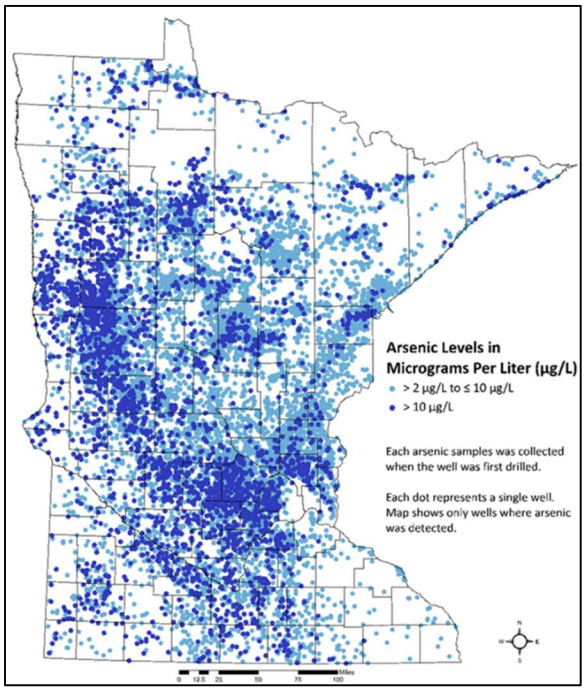
Manganese is an essential element and a widespread, geologic-sourced groundwater contaminant. High manganese concentrations can cause neurological damage; infants are especially vulnerable to exposure to excess manganese. Manganese does not have a regulatory maximum contaminant level and is not routinely monitored in Minnesota's domestic drinking water wells.



Arsenic is also a widespread, geologic-sourced groundwater contaminant. High arsenic concentrations can cause certain cancers, skin abnormalities, peripheral neuropathy, and other adverse health effects. In Minnesota, new drinking water wells are tested for arsenic. About 11% of new wells have high arsenic, and almost 50% have detectable arsenic. Water from a public-supply well is required to be tested by the well operator on a routine basis, and—if necessary—treated, to help assure that the water provided to consumers meets Federal and State water-quality standards. Routine testing of water from domestic wells is typically not required. Homeowners are responsible for testing, maintenance, or treatment of the water from their domestic well. The Minnesota Department of Health recommends that well owners with detectable arsenic consider treating their drinking water.





Upper Midwest Water Science Center (UMid) scientists are involved in groundwater quality assessment at multiple scales. In addition to national-scale drinking water resource work with programs such as NAWQA, UMid scientists actively collaborate with state agencies and others, for example the Minnesota Department of Health, Minnesota Ground Water Association, Minnesota Pollution Control Agency, The Freshwater Society, and the Department of Natural Resources.

Erickson et al., 2019: https://doi.org/10.1016/j.scitotenv.2019.133735