October 9, 2003

Office of Water Quality Water-Quality Information Note 2004.03

Subject: Microbiology—provides information that can be used by USGS personnel to inform public water suppliers and domestic well owners on the microbiological quality of drinking-water supplied from ground water; specifically addressed are total coliforms, fecal coliforms, *Escherichia coli*, and somatic and F-specific coliphage.

The USGS is becoming more involved in monitoring for microorganisms in public and domestic ground-water supplies used as drinking waters. For example, the USGS National Water-Quality Assessment Program (NAWQA) began monitoring ground-water supplies for total coliforms, *Escherichia coli* (*E. coli*), and coliphage as part of its Source Water Quality Assessment (SWQA). Guidance is needed on what the presence of these microorganisms means in terms of regulatory requirements, water quality, and risk to users of the drinking-water supply. Regulations and notification requirements may differ among States for domestic wells, and steps to take if a domestic well is contaminated are often left to the purview of local health departments. The purpose of this note is, therefore, to provide information that USGS personnel may use to inform well owners of the microbiological quality of ground-water drinking-water supplies while also gathering information on local requirements and practices.

Guidance is given for total coliforms, fecal coliforms, *E. coli*, and coliphage because the U.S. Environmental Protection Agency (USEPA) has established standard laboratory methods for these microorganisms and because sample collection and analysis methods for these microorganisms are simple and relatively inexpensive. Cell culture methods for infectious enteric virus detection are standard and were promulgated as part of the Information Collection Rule (U.S. Environmental Protection Agency, 1996) to monitor waters for viruses; however, these methods are expensive and time consuming. Although *Cryptosporidium* and *Giardia* are typically not considered a risk for ground-water supplies, their presence in ground water is not uncommon and indicates that the ground water should be regulated as if it were surface water. *Legionella* sp. is also regulated in, but no standard analysis method exists for, ground water. The molecular (polymerase chain reaction or PCR) methods and some cell culture methods used to detect enteric viruses in water are nonstandard research methods. If information is needed on microorganisms not discussed in this note, please contact the Office of Water Quality for recommendations on a case-by-case basis.

Actions required to protect public health (especially public notification requirements) due to contamination of a public water-supply well are defined by Federal regulations issued under the Safe Drinking Water Act (SDWA). All States except Wyoming have primary enforcement authority to implement these regulations. In adopting Federal regulations, States may choose to add additional requirements to those specified in the regulations. Thus, regulations may differ among States. Federal regulations require actions by both the public water-supply system and the primary enforcement authority in response to microbial contamination.

Water Resources Division Memorandum 90.38 states that “It is the policy of the Water Resources Division to promptly notify agencies that have a need to know when constituents in

water samples collected by or for the USGS exceed Maximum Contaminant Levels (MCLs) specified in the National Primary Drinking Water Regulations."

Unlike most chemical constituents, however, the MCLs for microbiological constituents are not easy to interpret. The Total Coliform Rule (TCR) (U.S. Environmental Protection Agency, 1989) established microbiological standards that apply to all community and non-community public water supply systems that serve at least 25 people. There are no MCLs for microorganisms for systems serving less than 25 people unless they have at least 15 service connections, although some States have established rules and requirements. The MCLs for the TCR are based on the presence or absence of total coliforms in a percentage of samples each month or on repeat samples; the number of samples collected each month depends on the size of the system (U.S. Environmental Protection Agency, 1989 and 2001). If a sample is total coliform positive, it must also be tested for fecal coliforms or *E. coli*, and repeat samples must be collected. If fecal coliforms or *E. coli* are detected, the system managers must notify the State immediately. There are no MCLs for somatic and F-specific coliphage.

It is our responsibility, therefore, to notify well owners of the detection of any microorganisms listed in the Total Coliform Rule as soon as possible so that they can use this information to take appropriate actions. The USGS can also provide well owners with negative results. The language below is included to help USGS personnel compose notification letters or information sheets for the well owners. USGS personnel must consider the size of the water system and local requirements and practices when composing notification letters.

Examples of language for notification letters:

> *Drinking-water standards are established by the USEPA and enforced by the States for community and non-community systems that serve 25 or more people. Although the USGS is not a regulatory agency and our sampling program was initiated for research purposes, it is important to review the microbiological results in terms of compliance with drinking-water standards to address public-health concerns. Microorganisms currently regulated under drinking-water regulations are total coliforms, fecal coliforms, and E. coli. Under the U.S. Environmental Protection Agency Total Coliform Rule, if a routine sample is total coliform positive, repeat sampling must be done within 24 hours of notification of a positive sample. The USEPA has not established regulatory standards for coliphage.*
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> *Your well **tested negative** for or **had a count of** ___ total coliform bacteria in a sample of 100 milliliters of well water. Total coliforms are indicator organisms. When present, they indicate that there is a possibility, but not a certainty, that disease-causing organisms may be present in the water due to contamination from human or animal waste. Total coliforms can also occur naturally in soil and on vegetation, so the presence of total coliforms in water does not necessarily indicate a waste-contamination problem or imminent health risk. Properly constructed and maintained wells and piping systems, however, should not contain total coliforms.*
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> *Your well **tested negative** for or **had a count of** ____ fecal coliforms in a sample of 100 milliliters of well water. Fecal coliforms are indicator organisms and is one group of bacteria in the total coliform group. Although fecal coliforms may originate in the intestines of warm-blooded animals and humans, they have also been found in non-fecal sources. The presence of fecal coliforms indicates that sewage or septage wastes may be entering the water system and increases the concern that disease-causing organisms are present in the water.*

*Your well **tested negative** for or **had a count of** ____ Escherichia coli (E. coli) in a sample of 100 milliliters of well water. E. coli is an indicator organism and is one species of bacteria in the total coliform group. E. coli originates in the intestines of warm-blooded animals and humans and is direct evidence of fecal contamination from warm-blooded animals. The presence of E. coli indicates that sewage or septage wastes are entering the water system and increases the concern that disease-causing organisms are present in the water.*

*Your well **tested negative** or **tested positive** for somatic and F-specific coliphage in a sample of one liter of well water. Coliphage are viruses that infect and replicate in bacteria. Coliphage do not directly infect humans and thus are directly harmful only to bacteria. Somatic coliphages are found in both fecal-contaminated and uncontaminated waters. F-specific coliphages infect bacteria grown at higher temperatures and are thought to come from warm-blooded animals or sewage. Coliphage are found in high numbers in sewage originating from municipal sewage treatment plants and are indicators of the sewage contamination of waters. Coliphage are also recognized to be representative of the survival and transport of viruses in porous media. To date, they have not been found to correlate with the presence of viruses or other pathogens that cause disease.*

If a well is positive for any microorganism, USGS personnel are to recommend that the well owner consult the local health department or State agency for guidance on actions to take, including repeat sampling and (or) disinfecting the well. If a pathogen is found in a public drinking water supply, the USGS should carefully examine the situation and assure data quality before notifying the primary enforcement authority.

References

U.S. Environmental Protection Agency, 1989, Surface water treatment rule—Total coliforms (including fecal coliforms and *E. coli*): Washington, D.C., Federal Register, v. 54, no. 124, June 29, 1989, p. 27544-27568.

U.S. Environmental Protection Agency, 1996, EPA Information Collection Rule microbial laboratory manual: Washington, D.C., EPA/600/R-95/178.

U.S. Environmental Protection Agency, 2001, Total coliform rule—a quick reference guide: Washington, D.C., EPA 816-F-01-035, 2 p.

WaQI Notes are archived on the Office of Water Quality web site,
http://water.usgs.gov/usgs/owq/WaQI/index.html