

MICROSCOPIC PARTICULATE ANALYSIS

Microscopic Particulate Analysis (MPA) tests the biological make-up of a water source by microscopic examination. The test helps determine if a well source is "Ground Water Under The Influence of Surface Water" and subject to the requirements of the Surface Water Treatment Rule. MPA is also effective in determining filtration efficiencies by comparing the particulate content of raw and finished waters.

GROUND WATER VS. SURFACE WATER AND THE SWTR

According to the *Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources*:

"The Surface Water Treatment Rule pertains to all public water systems which utilize a surface water source or ground water source under the direct influence of surface water. The SWTR defines a surface water as all waters which are open to the atmosphere and subject to surface runoff. Ground water under the direct influence of surface water is defined as: any water beneath the surface of the ground with (i) significant occurrence of insects or other microorganisms, algae, organic debris, or large-diameter pathogens such as *Giardia lamblia*, or (ii) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climate or surface water conditions. Direct influence must be determined for each individual source in accordance with criteria established by the Primacy agency."

"The traditional concept that all water in subsurface aquifers is free from pathogenic organisms is based upon soil being an effective filter that removes microorganisms and other relatively large particles by straining and antagonistic effects (Bouwer, 1978)."

"Only those subsurface sources which are at risk to

contamination from *Giardia* cysts will be subject to the requirements of the SWTR."

LIKELY GWU SOURCES

Ground water sources which are likely to be influenced by surface water include shallow wells (less than 50 feet deep), springs, infiltration galleries, horizontal radial collectors, and wells located near a surface source (within 200 feet).

SOURCE EVALUATION PROTOCOL

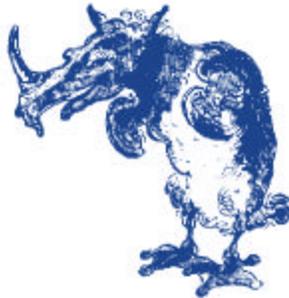
1. Records Review:

Records review is conducted to decide if the source is obviously surface water. If the source is a well go to step 2. If the source is an infiltration gallery, spring or other subsurface source, go to step 3.

2. Review of Well Sources:

For wells greater than 50 feet deep, well construction should include a surface sanitary seal using bentonite clay, concrete or other acceptable material; a well casing that penetrates a confining bed; a well casing that is only perforated or screened below a confining bed. The source location should be greater than 200 feet from a surface source.

Water quality records should indicate no record of total coliform or fecal coliform contamination in untreated samples over the last 3 years; no history of turbidity problems associated with the source; no history of known or suspected contamination with *Giardia* or similar pathogens such as *Cryptosporidium*; no correlation of temperature, turbidity, or chemical data with the well and a nearby surface water source. If all criteria are not met, more evaluation is needed. This should include an On-site Inspection and possibly a Microscopic Particulate Analysis.



MICROSCOPIC PARTICULATE ANALYSIS

3. On-site Inspection:

The on-site inspection should look for evidence of surface water entering the source through defects such as; lack of surface seal on wells; infiltration gallery laterals exposed to surface water, springs open to the atmosphere, surface runoff entering a spring or other collector. It should also look for distances to obvious surface sources.

If the survey is inconclusive, a Microscopic Particulate Analysis should be performed.

4. Microscopic Particulate Analysis:

Particulate analysis is intended to identify organisms that only occur in surface waters as opposed to ground waters, and whose presence in a ground water would clearly indicate that at least some surface water has been mixed with it.

THE METHOD

The MPA is performed by examining the sediment from a large volume of water (500-1000 gallons) which has been concentrated by filtration.

The source water is concentrated by passing it through a yarn-wound depth filter with a nominal porosity of 1 micron. When the desired sample volume is reached the filter cartridge is sent to the laboratory for processing.

At the laboratory the filter "yarn" is removed from the core. It goes through a series of washing steps in order to release the sediment trapped within the filter element.

Once the sediment is released from the "yarn" it is concentrated by centrifugation. The centrifugation step drives the sediment containing the microorganisms to the bottom of the vessel. This sediment concentrate is called a pellet and the liquid above it is called the supernatant. After centrifugation the supernatant is poured off leaving behind the pellet.

The pellet containing the microorganisms is divided at this point for additional processing: part for Bright Field

Microscopy and part for Fluorescence Microscopy. The sediment equivalent of 100 gallons is examined and the indicator organisms enumerated by Bright Field. A special staining procedure using monoclonal antibodies is used for detection and enumeration of *Giardia lamblia* cysts, *Giardia* species cysts, and *Cryptosporidium* Oocysts.

SURFACE WATER BIO-INDICATORS

The primary indicators include *Giardia*, *Coccidia* (ie. *Cryptosporidium*), Diatoms, Other Algae, Insects/Larvae, Rotifers and certain Plant Debris. Secondary indicators include Plant Pollen, Nematodes, Crustacea, Amoeba, Ciliates/Flagellates.

SAMPLING

Samples must be taken from each individual source before any disinfection, blending and before reaching the distribution system. Sample volume recommended is 500-1000 gallons collected at approximately 1 gallon per minute. Volume is dictated by time available for sampling, turbidity, and particulate content of the water source.

A minimum of 2 samples should be collected when the source is likely to be contaminated by surface water (ie. heavy rainfall or snow melt and extended period of little or no rainfall). If there is any ambiguity in the particulate analysis results, additional samples should be collected.

Samples should be shipped on wet/blue ice via over-nite delivery. Maximum transit/holding time should not exceed 24 hours from completion of sampling.

FURTHER INFORMATION

For more information regarding the Microscopic Particulate Analysis, please contact BioVir Laboratories at 1-800-GIARDIA (442-7342) or 707-747-5906.