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Analytical Services, Inc.
130 Allen Brook Lane
Williston, VT 05495
800-723-4432
802-878-5138
802-878-6765 (fax)

E-mail
info@
analyticalservices.com

Web site
www.analyticalservices.com

Microscopic Particulate Analysis

ASI Technical Document #105

Introduction

In 1989 the EPA promulgated the Surface Water Treatment Rule (SWTR) in response to the 1986 Amendments to the Safe Drinking Water Act (SDWA). The overall goal of the SWTR is to protect consumers from pathogens. The SWTR recommends a multiple-barrier approach including source water protection, filtration and disinfection when surface water is used as source water for drinking.

The requirements of the SWTR also apply to ground water under the direct influence (GWUDI) of surface water which may include vertical and horizontal wells, infiltration galleries, springs, etc. The SWTR required the evaluation of all community ground water sources for GWUDI by June 29, 1994 and all non-community ground water sources by June 29, 1999.

Typically, GWUDI status is determined by state authorities using a combination of hydrogeologic criteria, sanitary surveys, well construction logs and analytical testing. Testing may attempt to prove or disprove direct hydraulic connection between surface and ground waters by correlating shifts in conductivity, temperature, pH, etc., and may include Microscopic Particulate Analysis (MPA).

Water supplies identified as being GWUDI must comply with requirements of the SWTR and treat their source(s) accordingly.

EPA Consensus Method

The EPA Consensus Method for MPA is based on identifying surface water "bioindicators" such as plant debris, algae, diatoms, insects, rotifers, *Giardia*, and coccidia which are characteristic of surface waters. In the Consensus Method, risk scores are assigned to each category of bioindicators. After tabulation of the number and type of bioindicators observed in a particular sample, an overall risk rating score is calculated. This score indicates the risk of surface water contamination.

The MPA method involves filtering a minimum of 500 gallons of ground water through a 1 micron (μm) nominal-pore-size fiber wound filter over a maximum 24-hour period. The filter is then processed in the laboratory by eluting the particles from the fibers, concentrating the eluant, and microscopically examining slides for bioindicators. The bioindicators are quantified and used to calculate a relative surface water risk factor as described above.

It is important to realize that much of the MPA Consensus Method was developed in the

late 1980's and a preliminary draft was published in the 1990 SWTR Guidance Manual. Thus, G*iardia* was recognized as a specific surface water pathogen of interest and was included in the method, whereas *Cryptosporidium* was included under the general classification of "coccidian". In addition, the method only suggests (rather than requires) monoclonal immunofluorescent antibody (IFA) staining for *Giardia* or *Cryptosporidium*, making their detection problematic at best.

In response to subsequent method development, the MPA method is offered by many laboratories with and without an additional sample purification and IFA staining procedure for the detection of *Giardia* and *Cryptosporidium*. It is ASI's experience that many state regulators require the additional analysis. ASI does not necessarily recommend this additional staining because the MPA filter has been demonstrated to yield poor recovery of *Cryptosporidium* and *Giardia*.

The MPA procedure has also been modified and used in several laboratories as a means of assessing filtration plant performance evaluation (FPPE). Recognizing this application, the EPA released a modified version called Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization (FPO) in 1996. For a discussion of this and other treatment plant optimization techniques, please see ASI Technical Document No. 101, Water Treatment Plant Optimization Techniques.

Data Interpretation

Interpretation of MPA data is directly dependent on the level of training and experience of the analyst performing the analysis and writing the report. ASI has analyzed over 10,000 MPA, G*iardia* and *Cryptosporidium* and Filtration Plant Optimization (FPO) samples since 1990. All ASI analysts who perform MPA have earned college degrees in microbiology or closely related fields, such as biology, limnology or aquatic biology and are fully trained on standard procedures and our proprietary Standard Operating Procedure (SOP) for analyzing MPA samples.

The EPA Consensus Method does not include a thorough Quality Assurance/Quality Control (QA/QC) section as do more current EPA methods. ASI has developed an extensive reference manual, which includes photomicrographs and permanent slides of relevant bioindicators. This library, our training procedures, and other elements of our QA/QC plan assures that ASI maintains the high standards our clients have come to expect and rely on.

Summary

We understand the impact of MPA results on water suppliers and communities nationwide that rely on ground water sources. Therefore, we provide our clients with explicit reports that describe the MPA methodology and interpretation of their sample results. As with our other services, our senior technical staff is available to provide consulting services regarding GWUDI results and answer any questions or address any concerns that clients may have regarding their samples and/or source waters.

Relevant Literature

1. USEPA. 1992. Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate analysis (MPA). EPA 910/9-92-029.

2. SAIC. 1997. Final report: Microscopic Particulate Analysis (MPA) Correlations with *Giardia* and *Cryptosporidium* Occurrence in Ground Water Under the Direct Influence (GWUDI) of Surface Water Sources. EPA Contract No. 68-C6-0059.

3. USEPA. 1994. National Primary Drinking Water Regulations: Enhanced Surface Water Treatment Requirements; Proposed Rule. *Fed. Reg.*, 40 CFR, Parts 141 and 142.

4. USEPA. 1992. Use of Microbial Risk Assessment in Setting U.S. Drinking Water Standards. EPA 814/S-92-001.

5. USEPA. 1996. Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. EPA 910-R-96-001.