

Best Management Practices

Turbidity Monitoring and Reporting

Developed by



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Turbidity Monitoring and Reporting

Your water system—whether large or small—could be negatively impacted by turbidity. It's important, therefore, to understand turbidity and to develop appropriate response strategies.

What is turbidity?

As defined in the 6th Edition of the *Guidelines for Canadian Drinking Water Quality* (GCDWQ), “turbid water is caused by the presence of very fine suspended matter such as clay, silt, organic and inorganic matter, soluble coloured organic compounds, plankton, and other microscopic organisms.

“Turbidity measurements relate to the optical property of water that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample. The common unit of measurement in Canada is the Nephelometric turbidity unit (NTU). The GCDWQ recommend an MAC (maximum acceptable concentration) of less than 1.0 NTU.”

Why should BMPs be applied to turbidity monitoring and reporting?

BMPs as they relate to turbidity monitoring and reporting can be defined as programs designed to use turbidity measurement as a tool to detect changes and trends in water quality at source or in the distribution system. They also help determine future treatment needs and customer inquiries, provide an opportunity to remediate irregular conditions by increasing disinfection dosage, and support uni-directional flushing and main replacement programs.

A turbidity monitoring and reporting program that reflects BMPs:

- **increases protection of potable water supply;**
- **reduces risk to public health;**
- **increases public confidence;**
- **ensures compliance with operating permit;**
- **demonstrates due diligence;**
- **provides early indication of water quality deviations;**
- **provides reasonable capital and operating costs;**
- **provides historical record of water quality trends;**
- **optimizes disinfection treatment; and**
- **guides preventative response.**

A turbidity monitoring and reporting program that reflects BMPs also helps build consistency throughout the province.

Information Links

Guidelines for Canadian Drinking Water Quality

Best Practices for Utility-Based Data: National Guide to Sustainable Municipal Infrastructure

Recommended Reading...

Water Distribution Operator Training Handbook

Second Edition, American Water Works Association
(303-794-7711) www.awwa.org

Water Quality and Treatment: A Handbook for Community Water Supplies

American Water Works Association
(303-794-7711) www.awwa.org

Environmental Sampling and Analysis Lab Manual

Maria Csuros, 1997

Distribution Systems Operation and Management

American Water Works Association Standard
(303-794-7711) www.awwa.org

What BMPs should be applied to small systems?

Small water systems (e.g. those servicing a trailer park or subdivision) can implement a turbidity monitoring and reporting program that includes the following steps:

1. Contact the Drinking Water Officer (DWO) to review program scope and potential requirements.
2. Research successful turbidity monitoring and reporting programs implemented by other small systems.
3. Conduct a risk assessment.
4. Identify equipment needs.
5. Prepare Budget.
6. Obtain equipment and train operators.
7. Sample turbidity at source and/or in distribution system. (Determine sampling frequency with input from DWO, considering source water quality, customer complaints, age and type of pipe, chlorine residuals, and total coliform. To maximize efficiency, combine with chlorine and coliform tests).
8. Report findings to DWO (e.g. monthly, maximum, mean, minimum).
9. Resolve turbidity areas with flushing.
10. Create historical databases to use as a reference for water main flushing, customer complaints, and future treatment needs.
11. Work with the DWO to create a deviation response plan.

What BMPs should be applied to larger systems?

1. Conduct Initial Research

- Explore successful turbidity monitoring and reporting programs in other communities
- Conduct risk assessment with input from Drinking Water Officer (DWO)
- Use historical data to identify negative impacts to water quality
- Review customer complaints

2. Build Program Framework

- Identify objectives and targets
- Identify manpower requirements and resources
- Identify equipment needs (e.g. portable vs. online turbidity meter)
- Develop program framework with input from DWO
- Develop budget
- Set schedule
- Prepare business plan
- Evaluate and refine plan (ongoing)

3. Garner Support and Funding

- Present business plan to senior staff and council or board (include regulatory requirements, liability considerations, recommended approach, and funding requirements)
- Provide frequent updates (ongoing)

If you need help...

Small Systems

- **Coastal Water Suppliers Association**
Pauline Berkman
250-338-7796
pauline@rid.bc.ca
- **Small Water Users Association**
Denny Ross-Smith
250-229-2262
smallwaterusers@shaw.ca
- **Water Supply Association of BC**
Bruce Wilson
250-765-5218
bruce@rutlandwaterworks.com

Large Systems

- **Len Clarkson**
Vancouver Coastal Health Authority
604-815-6841
len.clarkson@cgh.bc.ca
- **Dipak Dattani**
City of Burnaby
604-294-7390
dipak.dattani@city.burnaby.bc.ca
- **Fernando King**
City of Surrey
604-590-7224
frking@city.surrey.bc.ca
- **Don Miller**
Fraser Health
604-572-2600
don.miller@fraserhealth.ca
- **Adrian Weaden**
City of Kelowna
250-862-5510 (244)
aweaden@city.kelowna.bc.ca

4. Create Communication Plan and Materials

- Identify internal and external audiences' specific communication needs
- Prepare a written plan, including emergency response procedures
- Educate all appropriate staff about turbidity monitoring and reporting
- Access/prepare information and education materials for external audiences, if appropriate
- Educate external audiences, if appropriate
- Evaluate and refine plan (ongoing)

5. Introduce Source Water Sampling Program

- Sample turbidity regularly (determine frequency with input from DWO)
- Develop historical information and trending (report in line or bar graph, simple form)
- Provide equipment and training
- Develop source water response plan for high turbidity readings

6. Introduce Distribution System Sampling Program

- Sample turbidity regularly
- Use data (e.g. turbidity and chlorine residuals) to identify areas that may need flushing or to enhance universal flushing programs
- Use data to answer customer inquiries and to identify areas that may require flushing

7. Monitor and Refine Plan

- Ensure plan includes other water quality parameters (e.g. temperature, total coliform, fecal coliform (E. coli), free and total chlorine)
- Establish frequency as directed by DWO
- Evaluate and refine plan (ongoing)

8. Conduct Reporting

- Provide monthly turbidity results to council, senior staff, and DWO, as requested
- Provide yearly turbidity summaries to council, senior staff, health authority, and customers, as appropriate

More on turbidity...

Instruments that measure turbidity are called turbidity meters. They range in complexity and cost from battery-powered handheld units to continuous online monitoring systems.

As stated in the *Guidelines for Canadian Drinking Water Quality*, "Control of turbidity in public drinking water systems is important for both health and aesthetic reasons. Excessive turbidity detracts from the appearance of treated water and has often been associated with unacceptable tastes and odours. Turbidity can serve as a source of nutrients for waterborne bacteria, viruses, and protozoa, which can be embedded in or adhere to particles in the raw water or become trapped within floc formed during water treatment; turbidity can thus interfere with the enumeration of micro-organisms in finished water, as the micro-organism may not be detectable or may be grossly underestimated by current detection methods. The adsorptive properties of suspended particles can also lead to a concentration of heavy metal ions and biocides in turbid waters. Turbidity can interfere with disinfection processes and the maintenance of a chlorine residual: depending on the composition of the turbidity-causing material, interference with disinfection can range from negligible to severe. Turbidity has also been related to trihalomethane formation in chlorinated water.

"Viable coliform bacteria have been detected in waters with turbidities higher than 3 NTU, even in the presence of free chlorine residuals. Outbreaks of disease traced to chlorinated water supplies have been associated

with high turbidity. The occurrence and persistence of microorganisms within distribution systems have been correlated with turbidity and other factors.

"The effect of turbidity on disinfection efficiency may be frequently related to the type and nature of the particulates. Surface water sources in particular may be susceptible to organic substances and undesired organisms that can impede disinfection or otherwise cause drinking water quality problems. Appropriate technology is available to treat and monitor turbidity to low levels. Therefore, the MAC for turbidity in water entering distribution systems has been set at 1 NTU. Provision of treated water at or below this limit will minimize the introduction of unfavourable particulates and biological matter into the distribution system and thereby render better disinfection opportunity, effectiveness and maintenance. Special site-specific problems may require more rigorous attention for the production of low-turbidity water. Any sudden increase in the turbidity of unfinished water indicates deteriorating quality of the raw water or loss of control in the water treatment process.

"Certain water supplies, such as groundwater, may contain non-organic-based turbidity, which may not seriously hinder disinfection. Therefore, a less stringent value for turbidity in water entering a distribution system may be permitted if it is demonstrated that the system has a history of acceptable microbiological quality and that a higher turbidity value will not compromise disinfection."