Small Systems

The Small Systems Committee has been working with CLEAR to develop and present hands on training opportunities for the water industry. Our latest sessions offered training for the DNR Regional Environmental Engineers regarding chlorine monitoring/sampling and for the municipal operators it was training on the monthly operator’s report form sent to the DNR.

The engineers met in Wisconsin Dells and had approximately twenty-two staff members participate in calibrating their equipment and validating results for free and total chlorine. The training was well received and it was expressed that they would like to experience other processes that the operators are required to understand and perform on a daily basis.

The EMOR training for the operators had participation from twenty-six municipalities that were all under six thousand in population. The initial power point overhead was provided by Chris Hartwig from the Department of Natural Resources IT area. After Chris had presented, we had the operators break out into separate rooms where they could get hands-on practice with several computers we had set up. They were able to register, get accepted by the switchboard and then physically input information about their wells, chemicals and pumping amounts.

Small System Workshops have been rescheduled for late August or early September for Onalaska and we will have to shift the other locations into fall due to unforeseen complications. We will also look to work with CLEAR and Membership with these.

Annual Conference topics and slots have been firm up. We will have several good presentations for the Small System Track and will follow up the Thursday presentions with a reception. We are hoping for good attendance and will get the word out on the reception with Tom Krueger using the WWA Constant Contact Form and a link to the Small System page. Please help us with this and remember to drop by. We are also currently working on a means of communicating with members and non-members to educate operators state wide to how beneficial it is and would be to become part of our Small System section. We will offer articles, forms, letters etc. through this contact link.

We are also soliciting submittals for the Small System Excellence Award. We have several committee members working on this project and hope to have these complete by mid-July. Our last conference call had Charlie Cameron from the Wisconsin DNR volunteering to pass along the form for nominating a municipality/operator to his fellow engineers for potential recipients.

Jim Prindle
Small System Chair
City of Onalaska

It’s All About
Protecting Public Health

One theme that seems to resonate from public health laboratories and regulatory agencies charged with conducting sanitary surveys for public water supplies is that they are all concerned about “public health.” Maybe this is true, but are we doing enough?

We have regulations that require periodic sanitary surveys to verify that the public water systems are meeting WDNR code requirements to insure the protection of public health. We check the well house, we check for bars in the windows, concertina wire around the well house, locked doors, installed remote cameras etc. all to prevent and deter a biological terrorism attack. We have a propensity to look only at mechanical issues. We check pumps, pump maintenance records, chemical feed pumps, dosing calculations, well caps and screens, cross connections and compliance with monitoring requirements, but we are missing one of the most important aspects in protecting public health.

What is the most important missing aspect? Ensuring that the public water supplier’s personnel have the proper instruments, training and procedures to insure that the water the public is drinking is truly safe. They should be includ-
ed in budgets and costs for projects. When public water systems construct new wells, well houses and water treatment plants are we including some of the most important items for protecting public health? Is the proper monitoring equipment provided for monitoring of the chemical(s) that are to be introduced into the system? Does the monitoring equipment have the necessary functions for the analysis? Is training in the use of the monitoring equipment provided?

Many public water systems provide one or more chemical additives. The primary chemical added to our water systems is chlorine, followed by fluoride. Additionally a public water supply may be feeding chemicals for corrosion control to raise pH to meet lead and copper limits or they may add orthophosphates to sequester iron and manganese. It is very important that we know the levels or residuals of chemicals that are added to a public water system in order to ensure that the water is safe to drink. The water delivered to the consumer’s taps must be correctly monitored and documented so that no more or less chemicals than needed are being added. Currently, there are no audits or checklist verifying that the equipment and meters used in the measurement for free chlorine residual, fluoride etc. are being accurately measured and documented.

There is a positive side to this. By accurately measuring the chemicals that you feed, you can: (1) save on chemical costs (why feed more than you need); (2) you are also assured that you are not over feeding a chemical that at higher concentrations can become more of a threat to public health than the protection of public health; and (3) collect and document defensible data in the event that a consumer wishes to challenge the safety of the water supply.

From Water Wells to Pumping Stations...
We’ve Come A Long Way to Keep the Water Flowing so your Community has Fresh Drinking Water!

Flouride Color Standards

Chlorine Color Standards

Public Health continued on next page
Let's look at a couple of the chemicals that we add to water systems, chlorine and fluoride, and explain what we should be doing.

**Free Chlorine Residual and Fluoride Measurement:**
We will deal with the most common free chlorine residual technique which is the DPD Colorimetric procedure and the most common fluoride measurement technique which is the SPADNS Colorimetric procedure.

**Meter verification:**
Obtain a good meter. Not all meters are accurate. Conduct a factory verification calibration check by using blanks and primary free chlorine and fluoride standards. This should be done at least monthly or more frequently if needed. If you are fortunate enough to be using the Hach Chlorine Residual (Low Level) Pocket Colorimeter II and Hach Fluoride Pocket Colorimeter II, Hach also has secondary gel standards for each. These secondary gel standards are great for meter checks, training new operators and weekly meter verification. Compare secondary gel standards to the primary standards for concentration verification.

**Sample measurement:**
You need to have a bench sheet so that you can document all of the data associated with the analysis. You need to specify the holding time from sample collection until analysis. Try and be consistent. Record your sampling procedures in your SOP so that all sample collectors and analysts are doing it the same way. Items to review for the procedure are: Did you zero the instrument correctly? Are you within the analytical range of the instrument? If the analytical range is exceeded, do you know how to make dilutions? How do you know the result is correct? You have to use blanks, run duplicates (run a duplicate weekly); spike samples with a standard, and check an unknown (obtain a free chlorine residual and fluoride quality control (QC) sample from a PT provider and run monthly).

You should determine the minimum detection level for your instrument. This is done by making a standard at five (5) times the expected MDL. Analyze seven aliquots of the standards (each result must be in the 85% to 115% range). Calculate the MDL by determining the standard deviation of all seven results and then multiply by 3.143.

For free chlorine residual measurements verify and document that you have no method interferences. You may suspect method interference if a false positive result is observed or the sample turns pink and then goes clear or the color keeps changing. For the free chlorine residual test other oxidants, organic chloramines, monochloramine, hardness, acidity, alkalinity, turbidity, color, iodine and ozone etc. can interfere with the DPD procedure. The major interference for free chlorine residual DPD analysis is manganese compounds with the manganese oxidation states of +3 to +7. Manganese can have a positive effect on the free chlorine residual; and if not accounted for, you may be under protecting your water supply.

For fluoride measurements special considerations need to be taken. Temperature is very important and your reagents, standard and samples should be at the same temperature (within +/- 10°C). Orthophosphates at concentration over 1 mg/L is a major interferent to the SPADNS fluoride test resulting in a positive interference. Aluminum at a concentration of 0.1 mg/L and above can cause a negative interference. Be sure and document whether or not you have interferences.

A checklist for troubleshooting the free chlorine and fluoride procedure is to verify that you are: following the procedure, checking your reagents for contamination or expiration dates, checking the pH of the sample (pH drives all colorimetric reactions and you need to make sure that your pH is within the method requirements especially if you are altering the pH of the water supply for corrosion control), check for and eliminate interference issues. Is the result outside the range of the test? Can you dilute out the problem? Do you get the proper spike recovery? If necessary, you may have to use standard additions.

The important thing is to document what you do and how you do it. Make sure you use a bench sheet. Document meter verification checks and any maintenance on the meter (i.e. cleaning, repair etc). Develop a written protocol (SOP). Document your reading for primary standards, secondary standards, sample results, interferences. Document! DOCUMENT! DOCUMENT!

So what should be added to the sanitary survey/inspection? We suggest the following guideline as a start:

**General Questions:**
- Does the operator have the proper equipment for this test? (Should use DPD for free chlorine, SPADNS for fluoride).
- Does the instrument read to 0.01 mg/L?
- Is the meter and cell holder clean? Are the sample cells clean, clear, dry, and unscraped?
- Have the reagents used for the test expired?
- Are they using certified standards monthly to verify procedure? Documented?
- If a meter is used, is the meter zeroed properly?
Is the meter internally calibrated? How is calibration verified?

Does the operator have a bench sheet?
- Must record date, time, calibration standards, results, analyst etc..

Is the procedure documented in an SOP? The SOP must describe in detail exactly what they do from sample point locations, sampling procedures, holding times, method etc.

Have interferences been identified or eliminated? Manganese present?

Has the free chlorine residual reading been properly reported to the regulatory agency? Any qualifiers?

Are corrective actions documented?

For auditing the free chlorine procedure we should ask the following questions:

- Are they measuring total or free chlorine? (Should be free for drinking water).
- Have the operator calibrate meter or set up titration system. Was the meter calibrated properly?
  - Give an unknown standard to the operator(s). Is the correct free chlorine result reported?

For auditing the fluoride (SPADNS) procedure we should be asking the following questions:

- If a meter is used, is the meter zeroed properly? Fluoride has an inverse relationship to concentration with the SPADNS method.
- Have the operator calibrate the meter. Was it calibrated properly?
  - Give an unknown standard to the operator(s). Is the correct fluoride reported?
- Are reagents, standards and samples at same temperature? Within a variance +/- 10C?
- Are they feeding orthophosphates? Does it affect the fluoride readings? How compensated for or eliminated?
- Has the fluoride reading been properly reported on to the regulatory agency? Any qualifiers?

In addition to the aforementioned audit suggestions as part of a sanitary survey/inspection, we offer training for public water systems in western Wisconsin through the efforts of Jim Prindle, Water Superintendent for the City of Onalaska along with sponsorship by WWWA and the input of Charlie Cameron, P.E. with the WDNR Drinking Water Program. We conduct hands-on training sessions for measuring chlorine or measuring fluoride for 10-15 people per session. We prepare standards and unknowns, and samples with interferences to test their ability to run the tests. This is not just a 20 minute lecture, power point presentation or seminar with a handout. These sessions last three hours and involve actually analyzing samples using the individuals' own meters. The participants are broken down into 3-4 person groups with a laboratory chemist at each table. This type of team cooperation is essential in making sure that the operators understand what they are monitoring for, why they are monitoring and how to monitor so that the data they record is accurate and defensible in a court of law.

We need to be very concerned about the water people drink. People don't drink pumps, wire, meters, oils, greases etc., they drink the water and we need to make sure that all those involved with adding chemical(s) to our water supplies are properly trained in using analytical meters and correctly analyzing samples and reporting results.

This hands-on training needs to be ongoing and should be required for all public water system employees charged with protecting the water quality used for public consumption. An audit of the procedures (whether done by a regulatory agency and/or done in-house) used for monitoring the levels of chemicals added should be the icing on the cake every 5 years (or more frequently). We need to have complete confidence in the public water systems employees that they know what they are doing in providing a water supply that is safe to drink.

It's all about "public health."

Log on to www.awwa.org, click on Professional and Technical Resources, and scroll down to Small Systems under Communities and Resources Pages for tools, reports, and information pertaining to Small Systems.