The Next Step in SDWA Strategies for Improving Water Quality

Introduction

The AWWA Paper, "*Reliability of Drinking Water Quality Data Used for Compliance"* identifies the problems and misapplications for using data submitted by water systems as part of the SDWA. What is needed now, is a new proactive approach that incorporates the lessons learned by these common and available statistical methods for improving US water quality.

This paper identifies how a more proactive approach using the findings in this paper could be accomplished.

Problems with Advanced Laboratory Methods and New Technologies

Water systems are required to monitor and sample for a range of contaminants by the Safe Drinking Water Act to protect public health. The number of contaminants that must be monitored and sampled for have grown significantly since the enactment of the Safe Drinking Water Act almost 50 years ago. Every few years some more regulations or more tightening standards are enacted. One has only to examine the extra requirements imposed on ground water systems by the new Ground Water Rules or the ever increasing requirements to perform comprehensive sampling imposed by the Stage 2, Disinfectant By-product Rule. These Rules have increased water system cost, but as the noted paper demonstrates, are they really improving the quality of drinking water.

Part of the problem that drinking water systems face is the capabilities of the laboratory equipment we use to identify and measure contaminants. One has only to go back about 40 years to the Safe Drinking Water Act conception and then enactment and compare cost, resolution and reliability of the equipment used then to that used today to see the significant differences.

During the last 40-year time period, the ability to detect and measure the constituents found in drink water has improved in dramatically in reliability and in resolution as expressed in the detection limits and by the degree of accuracy in significant figures. It is common now to identify water constituents such as Trihalomethanes in parts per billion and tracer wastewater chemicals such as Sucralose in parts per trillion. But as we all have observed with laboratory results, the concepts of precision and accuracy still govern and significant figures do not always translate to significant findings.

We have all witnessed or become the victims of our ever-improving laboratory detection technologies and their abilities to identify rare analytes in the samples that water systems are required to collect. Some very common examples are laboratory errors that result from the residuals from cleaning laboratory glassware, the fumes from a diesel generator that was used to operate a pump in a remote well field or even from sampling activities performed nearby in a laboratory environment. The equipment performs remarkably well but the results must be evaluated by humans as to the sample result relevance.

Now we have the above AWWA study that confirms some additional problems that we already suspected. These are: 1.) there are natural fluctuation in the water we sample, 2.) field procedures introduce errors and false contamination, 3.) laboratories produce different levels of precision, and most importantly, 4.) we have the data and the statistical tool to identify the specific water system's samples and the specific errors that we have relied upon to invoke regulatory action and in some cases, impose upon them costly and unnecessary capital improvements.

The ultimate question is then, "what do we do with this new information and how can we best use it to continue to protect public health and improve water quality.

Using the AWWA Findings to Improve Perception of Water Quality

The AWWA Study was very clear that more and/or more frequent sampling will just produce the same erroneous information. It states that we should go back and historically analyze all the data to see if it was relevant. It states that some systems have already constructed new facilities based on erroneous numbers! It does not try to evaluate what would have been the results to do nothing. In this we can easily reach the overriding conclusion that it was better to do something with at times a little overkill, than have don nothing with the result of some serious health results. But overkill is not a prescription for the future when we can use the findings more effectively.

One solution might be that we could use future data submitted by water systems and rely on laboratories to use revised statistical methods and develop more margins of error, confidence intervals, correlation curves, etc. that determines if an MCL excursion is a violation or a non-violation. Likely this method would increase water system frustration and confidence in laboratories, likely increasing business for the labs that got System A the free pass, over System B that see regulatory actions against it for reporting the same MCL value. We can all predict the future in this world with more expert witnesses critiquing laboratory results and lawsuits flying left and right when costly capital facilities are ordered built by regulators.

So how can we use the new AWWA findings for improving water quality?

Using the AWWA Findings to Improve Actual Water Quality

What I am proposing here it a new concept of how we use data. It really is not new since we already use it in our Coliform Rule enhancements that provide a 5% window of violations for large systems and BMP reviews for everybody that has a violation, and to a certain degree, the one rule where we have MCL excursions that are not violations, the Lead and Copper Rule where we allow 10% excursions that are not classified as compliance violations.

So what we do with certain categories of MCL violations, is to treat them as triggers that dictate certain water systems actions whenever they are reported.

Using the MCL "Excursion" as a Trigger changes the concept of MCLs to the following:

First we recognize that MCL values that we submit to regulators are representative indicators not self-indicters.

The MCL excursion becomes a trigger to the system and the regulator that there is a potential problem because we identified an "excursion" by reporting a non-compliant MCL. The system now must investigate the problem and certify to the regulators that they have instituted and are using "Best Management Practices."

Just like we do with Total Coliform Rule, it is no longer good enough that a water sytem detected a problem and corrected it. We change whole dynamic and the question becomes, "did you correct the problem" and "how was the system previously managed to prevent this potential problem from occurring?"

When a water system has a MCL violation we don't resolve issues by alarming every customer that they have been drinking carcinogens ,we focus on eliminating potential problems. We use the MCL as a trigger for action realizing that there is a high probability that there is something that could be in the drinking water that could cause long-term health problems (chronic). The trigger requires the system to review their operating practices and investigate the specific variables that may have contributed to the problem, so that we can proactively and cooperatively eliminate the problem.

In this new system, we don't immediately tell the water system with some Lead excursions that they must immediately adopt corrosion treatment and increase sampling, like we do now. We investigate the contributing factors first for a cause, such as stagnant water in an old building that has not been in use, or a vacation home where an owner didn't flush out the copper plumbing. We use both written BMPs and sensible investigative methods first to eliminate obvious problems and implement the more costly solutions only when the problems can't be solved.

Identifying "Best Management Practices"

The definition of Best Management Practices used here is the industry accepted methods found to be the most effective and practical means to achieve compliance with drinking water rules making the optimal use of the water system's resources.

So how do we develop these "Best Management Practices" (BMPs)? Currently, BMPs are not developed until they are on a regulatory "Consent Order (CO)." The Consent Order typically follows numerous violations and long-histories of non-compliance. It is issued as the final straw, at the time when the regulatory agency gives up tying to get compliance.

Here the system is required to come up with an acceptable "Plan of Action" to resolve a long-standing problem. The Plan of Action consists of BMPs that must be developed

uniquely, for every system that is affected by a CO. The irony is, the BMPs developed uniquely for one system are almost identical for every system that has the MCL problems.

How can I make these statements, because of the work that Florida Rural Water Association currently performs?

About two years ago, DEP asked FRWA to assist with resolving system problems identified on an EPA Water System "Non-Compliance List." This list identified the worst MCL problems over the last five years according to EPA.

The first step was to meet with the local regulatory agency, the owner or operator and investigate the MCL violations and the conditions that caused the problem. Within a month or so, the 32 systems on the list had been visited by FRWA, the problems that had been causing MCL violations had been identified and the needed fixes had been implemented. Below is a list of the outline of the BMPs that were used by FRWA circuit riders for resolving DBP problems. BMPs for Nitrate and Arsenic were also developed by FRWA.

Best Management Practices Used for
Reducing Disinfection By-Products by Non-Compliant
Water Systems

Eliminate Sources of Surface Water into Production Wells
Using Well Blends with Lower DBPs
Removing Precursor Material within treatment process
Changing the Point(s) of Chlorine Application
Lowering both the Chlorine Dose and/or Residual
Using Alternate Disinfection Strategies
Ensuring the WTP processes are absent of organic growth (ie. Ion Exchange and Activated Carbon Systems)
Ensuring that Water Tanks Turnover
Reducing Distribution System Water Age
Flushing water in slow moving areas and at dead-ends
Removing sediment that creates chlorine demand
Removing biofilm that converts inorganic to organic materials
Using blended phosphates in systems that have old CI pipelines

All of the 32 systems on the list could not be resolved by operational fixes. A small percentage did require new treatment improvements and some needed regulatory enforcement to get operating solutions kick-started. These were not the norm and the end result was compliance in all cases.

Moving Forward

The use of targeting, using triggers and implementing BMPs to resolve compliance issues that was used by FRWA is a very successful model that could easily be expande.

We need to move away from a system that resolves issues by forced regulatory action and to a system that identifies potential problems and solves them cooperatively.

To implement the new system, the first item of business would be to develop the "Best Management Practices" for minimizing the causes of common water quality problems.

BMPs are the operational plan of action that incorporates everything we can reasonably and prudently do achieve compliance. It all the things we do before new treatment must be installed. BMPs comprise the often-missing intermediate step and using them can save systems lots of money in capital expenses.

So what changes? An MCL is not a violation unless it is significantly above the or below the mean value determined by analyzing the EPA/State database with the statistical methods descried in the AWWA paper.

What AWWA paper concludes about MCL reporting is this:

1. PWSs with true mean concentrations below the MCL or false-positives may incur costly compliance penalties or treatment requirements; thus additional sampling is required before taking regulatory or legal action, and conversely,
2. PWSs with true mean concentrations above the MCL or false-negatives, may be under detecting problems; it is logical to assume that more sampling is required here but this will not diminish this problem!

Where demonstrated health implications are identified by unacceptable out-of-compliance in the monitoring results (current acute health implications or Tier 1), immediate, including long-term capital facility actions would be necessary and available to regulators. This determination would remain with the regulatory agency that could use the discretionary authority in a reasonable and defensible manner. However, for the vast majority of systems, this type of action is not warranted.

Chronic or Tier 2 and 3 health implications are recognized by EPA as important only in the very long-term. For long-term potential health problem potentials, there is little risk in providing more time to the systems to achieve compliance. Thus for chronic health potentials, we need to replace forced regulatory action with a new, more effective and timely strategy that leads to compliance. The new strategy simply requires the system to certify that BMPs for the particular analyte have been fully implemented and are being used to control future excursions.

Only after the regulator and the system agree that the results of using BMPs are not capable of reliably achieving compliance are more effective treatment methods required.

Best Management Practices for Tier 2 and 3 Health Affects

The noted AWWA paper is emphatic that increasing the frequency of testing or adding additional tests does not improve precision and thus these strategies are ineffective for identifying problems and forcing onerous solutions on water systems because of MCL reporting.

What is needed is proactive and engaged management of the potential problems that may have been identified by the MCL excursion. The new system suggested accomplishes this by using an MCL violation as a trigger for actions necessary to eliminate the problem

The recommended system changes the concept of chronic MCL violations from true acute violations and eliminates the need to alarm the public to one that provides relevant information to them on how their water system is effectively resolving a “potential” problem

The system proposed leads to heightened confidence in our water system managers and in our regulators who work cooperatively with our systems when these potential problems occur.