State of Alaska, Department of Environmental Conservation
Division of Environmental Health
Drinking Water and Wastewater Program
555 Cordova St.
Anchorage, Alaska 99501

Important Information

For Water Operators
and Owners

Northern Flows

DW/WW Program Directory

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Northern Flows

Alaska's Drinking Water & Wastewater Program Newsletter
Issue 9 •Winter 2001/2002

Message from the Manager

We hope you have all enjoyed a happy and healthy holiday season! This is the time of year we can sit back, relax a little, and reflect on the past years' accomplishments and our hopes and plans for the coming year.

One of the ways EPA measures how well a State program is doing, is to keep a list of Public Water Systems (PWS) that are Significant Non Compliers or SNCs. SNCs are PWS's that have multiple violations in monitoring and reporting in regards to specific rule requirements. Monitoring and reporting daily, weekly, or monthly activities is the only way water systems, the state, and EPA can confirm that PWS's are providing safe and healthy drinking water. A major accomplishment last year, due to Drinking Water and Wastewater (DW/WW) Program staff efforts and the diligence of PWS owners and operators, was a reduction in the number of Alaska water systems on the SNC List, from 250 to 143. Congratulations! We have made a lot of progress over the last year to ensure Alaskans are getting high quality drinking water, lets try and do even better in 2002!

As we look forward to the coming year, with many changes and new rules, keep in mind DW/WW Program staff are here to do everything they can to help you. If you haven't already received your monitoring summary for calendar year 2002, you will be shortly. These summaries will tell you what is needed to ensure continued public health protection, and if you are out of compliance, what you will need to do in the near future or over the course of the next year to achieve or stay in compliance. The monitoring summary will also include a reminder that all Class A PWS's will need to collect a "raw" untreated water sample for Arsenic during calendar year 2002. Some Class "A" PWS will also need to collect a treated water sample and have it analyzed for Arsenic. As a reminder, all PWS's will need to get their calendar year 2001 Consumer Confidence Reports (CCR) in to ADEC by July 1, 2002. But, keep in mind that you can get the information you need to complete your CCR anytime after January 31st, so if you start early you can turn it in early! Other issues that PWS's will need to address this year will include: increased requirements for Certified Operators, and the monitoring and reporting requirements for the Interim Enhanced Surface Water Treatment Rule, Disinfectants/Disinfection By-Products Rule, Lead and Copper Rule minor revisions, and the new Public Notification Rule.

Our program has again undergone more changes in staff, a few have retired, such as Joe Cottingham, Southeast Alaska area DW/WW Program Coordinator, and Scotte Ramstad, Environmental Technician in the Drinking Water Protection group, Anchorage office. We wish them well in their retirement. We are also looking forward to working with our new South-central Alaska DW/WW Program Coordinator, Heather Newman. Please join me in welcoming her.

Our Drinking Water Protection group is working steadily on the completion of PWS Source Water Assessments. In the coming year they will focus on the areas around Fairbanks, North Pole, the Northern Parks Hwy, as well as the Seward and Sterling areas. This year, assessments will continue to be completed by third party contractors and our in-house staff.

In closing, the staff here at the DW/WW Program and myself hope this coming year will find and bring you much happiness and health.

James R. Weise

James R. Weise
Program Manager

This Issue

The Operator's Report

PWS Upgrades: Planning and Funding

Many public water systems rely on rivers, lakes, or other surface water sources to supply their drinking water needs. The source of water may also be from an infiltration gallery or a shallow well that is under the influence of surface water. The quality of these surface water sources is impacted by microbial contamination from humans and animals, and inorganic and organic matter leaching out of the soils. The high probability of contamination occurring because of these factors makes it necessary to both filter and disinfect surface water sources.

The filtration process removes both turbidity and many of the harmful organisms (pathogens) such as *Giardia* cysts and *Cryptosporidium* oocysts, while adequate disinfection kills most remaining bacteria and viruses. Turbidity is caused by suspended small-sized particles such as clay, silt, insoluble organic and inorganic matter, plankton and other microscopic organisms. Chlorine, a commonly used disinfectant, will react with these suspended particles and become unavailable to kill the pathogenic organisms. In addition, turbidity can shield organisms from the chlorine making the disinfection process less effective. Fortunately, most turbidity can be removed by effective filtration. Therefore, a balance of low turbidity and proper chlorine levels are required to provide adequate protection from harmful organisms. Both disinfection and filtration are generally required to produce safe, high quality, drinking water from surface water sources. In rare cases, filtration is not required (filtration avoidance) when the source water has been shown to contain very low levels of turbidity and coliform bacteria and the watershed is pristine and/or protected.

Although filtration does many things to help keep the water safe to drink, currently, only one acceptable measure is used to show that it is working properly. That measure is the test for turbidity. Turbidity is measured with a turbidimeter and is reported in nephelometric turbidity units (NTU). If you are using a conventional or direct filtration process (includes a chemical coagulation step in the process), then 95% of your monthly turbidity readings for treated water must be below 0.5 NTU (0.3 NTU for systems serving more than 10,000 people). If you are using an alternative filtration process, not involving coagulation, then 95% of your monthly readings for treated water must be below 1.49 NTU. Every day that the water is being filtered, the turbidity level must be measured and recorded. Small systems serving less than 500 people are required to measure turbidity daily. Systems serving over 500 people are required to record turbidity levels every 4 hours. If the turbidity levels get too high, it may indicate that not enough particulate matter or pathogens have been removed by the filters.

After filtration, chlorine must be added in sufficient quantity and allowed to remain in contact for a specific period of time to ensure that the pathogens are killed (commonly called Contact Time or CT). Residual chlorine readings are required daily at the entry point to the distribution system. The results should be recorded in the operators' report. The minimum required concentration for entry point chlorine is 0.2 mg/L. However, many systems will need to have higher concentrations at the

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CCR Update

Regulation Update

Remember! Your PWS Consumer Confidence Report (CCR) for calendar year 2001 is due July 1, 2002, ***BUT*** did you know you **can** start working on the report anytime after February 1st! You may want to get it done, submit it early and get it out of the way so that it doesn't interfere with your fishing season! Also remember that if you are overdue on past CCR's (for 1998-2000) you can combine the information in one CCR. Contact your local Drinking Water and Wastewater Program Staff for guidance on how to combine the reports. ~

Public Notification Rule

The new Public Notification Rule (PNR) applies to all public water systems (PWS) that violate Alaska's drinking water regulations under 18 AAC 80 or other situations that pose a public health risk. All PWS's must begin complying with the new PNR requirements beginning May 6, 2002. Depending on the severity of the situation, a PWS has from 24 hours to one year to notify their customers after a violation occurs. EPA has specified three categories, or tiers, of public notification. Depending on what tier a violation falls into, PWS have specific time frames to distribute the notice, and guidelines on "How To" deliver the notice. ADEC has a current Memorandum of Understanding (MOU) with Region 10 EPA on the implementation of this Rule until May 6, 2004. ~

What Is The New Arsenic Rule?

From February 22, 2002 through January 22, 2006, beginning with Consumer Confidence Reports (CCRs) that are due by July 1, 2002 and ending with those CCRs due July 1, 2006, a CWS that detects arsenic from 10 ppb and up to 50 ppb must include the following arsenic health effects language prescribed by the CCR rule.

"Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer."

Beginning February 22, 2002, all community water systems (CWS) that detect arsenic from 5 ppb up to 10 ppb must include in its CCR due by July 1, 2002, a short educational statement using language similar to the following:

"While your drinking water meets EPA's standard for arsenic, it does contain low levels of arsenic. EPA's standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic, which is a semi-metallic element known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems." ~

The Operator's Report Continued

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entry point in order to meet CT requirements and ensure that pathogens are killed. The number of chlorine tests required daily depends on the population served. Systems serving less than 500 people are required to test at least once a day. Systems serving over 500 are required to test at least twice a day, with the largest systems testing continuously.

If the entry point chlorine level is too low, the water flowing throughout the distribution system may not remain adequately disinfected. The minimum distribution system chlorine concentration is the level at which you can detect it with your chlorine test kit. At least a trace amount of chlorine is required throughout the distribution system. A chlorine residual test should be done at the same time and place as the total coliform bacteria sample. Remember to record it on your operator report.

The operator report is used by the water system operator to record daily operational readings, and to track the effectiveness of the filtration and disinfection systems. Ensuring that the filtration system is functioning properly and the amount of chlorine injected is adequate are the most important parts of an operator's duties. At the end of the month, Public Water System operators are required to mail or fax their operator report to the appropriate Drinking Water and Wastewater Program Office for review. The report needs to be submitted by the 10th day of the month. At a minimum, the following information needs to be included in/on the Operator Report:

- Public Water System name
- Public Water System Identification Number (PWSID)
- Month and year of the report
- Daily readings of **Turbidity** and **Entry Point Chlorine**
- Notation on the days when water is being filtered
- Monthly **Distribution Chlorine** reading and date of reading
- Fluoride readings every day that it is added
- Operator's signature and date

There are many PWS operators throughout Alaska that record the required information and submit their operator reports to the Drinking Water and Wastewater Program on time. We would like to thank those operators for their hard work in helping to provide safe drinking water for their communities. Operator forms can be obtained from the Drinking Water and Wastewater Program staff. Forms will also be available on the DW/WW Program Website soon. →

http://www.state.ak.us/dec/deh/water/forms.htm

If you would like assistance in preparing an operator report form or have any questions regarding monitoring requirements, please contact your local Drinking Water and Wastewater Program Office. ~

Disinfecting Your Water Using a Chlorine Disinfection Method

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We want to use the least amount of chlorine for cost and for the new D/DBP Rule. Let's try less than or equal to 0.4 mg/L chlorine concentration. Reading from Table K, a value of 55 for CT is obtained. The chlorine concentration would be 55 min mg/L divided by 120 minutes equals 0.458 mg/L, which is higher than our assumed value, and therefore verifies 0.4 mg/L chlorine concentration is sufficient to achieve the appropriate log inactivation. There must be a residual or trace of free chlorine at the end of the process.

Taking daily readings of temperature, pH and the free available chlorine at the first user are very important to manage your system and maintain adequate disinfection. Changes will be easier to manage when you are familiar with how the disinfection process works and how to affect changes in your public water system.

You must also remember that you have the means to change what chemicals you are adding to your system during the treatment process. And if you can increase the temperature, chemical demand for chlorine will generally decrease. The opposite is also true, when water gets colder, chemical demand to disinfect will generally increase.

When you are chlorinating you should realize that adding more chemicals than needed could cause other problems. Remember that under 18 AAC 80.300(b)(C) disinfection by-products are limited and controlled. Testing for the total trihalomethanes (TTHMs) goes into effect for larger water systems (greater then 10,000 people) on January 1, 2002. Groundwater systems that disinfect and Class A surface water systems that have a population less than 10,000 must test for TTHMs by January 1, 2004.

If you have questions about disinfection, please check the referenced regulation or call the local ADEC office. ~

Shotgun quiz

What is the CT you would need if the water temperature is 0.4° C, pH is 6.0, log inactivation is 0.5*, and the first user chlorine level was at 0.2 mg/L free chlorine residual?

- 23 minutes
- 115 minutes
- 110 minutes
- not enough information to solve.

* A conventional filtration system is in place, which resulted in only a 0.5 log inactivation being needed at this site.

Answers to shotgun quiz

Either b or c is correct depending on how you solved the problem.

If you use the Tables, CT = 23 min-mg/L, and when 23 min-mg/L is divided by 0.2 mg/L is 115 minutes.

If you use the equation $CT=(0.5)(5.057\,(e^{(-0.0693 \times 0.4)})(e^{(0.361 \times 6)})(e^{(0.113 \times 0.2)}) = 2.5285\,(e^{2.16088}) = 21.94427$ min-mg/L, then divided by 0.2 mg/L equals 109.72 minutes or 110 minutes.

National Rural Water Association (NRWA)

NRWA has hired Brad Ault as their "Training Specialist" for Alaska. Brad will be coordinating much of his activities for calendar year 2002 with ADEC DW/WW Program staff. Brad can be reached at (907) 694-6792 or E-mail: aknrwa@gci.net. ~

Disinfecting Your Water Using a Chlorine Disinfection Method

Disinfection is the process that destroys harmful microorganisms in your drinking water. There are a number of different ways to disinfect water. Adding chemicals, ozone, using ultraviolet light or radiation, filtration or even boiling the water can accomplish disinfection. Each method has its good and bad points.

Choosing the method of disinfecting a drinking water supply should be done during the design of the public water system and is based on specific site conditions. Things that are taken into consideration when choosing the disinfection method include: turbidity, pH, temperature, chemicals already in the raw water, and chemicals added during the treatment of the raw water. The most common disinfectant used in Alaskan public water systems is chlorine.

With that in mind let's go through the chlorine disinfection process as an example. It starts with chlorine being added to the water, normally after the filtration process (in some instances it may be added earlier depending on the quality of the raw water and reactions taking place). The distance and amount of time it takes water to move from point "A" *(where the chlorine is first added)* to point "B" *(the first user in the distribution system)*, is called Contact Time (CT). **See Figure 1**. If there is not enough CT between points A and B, additional methods must be used to increase CT. Baffles may be added to the water storage tank(s) to let the treated water slowly move in a predictable manner to an outlet pipe and increase the CT. Adequate contact time ensures that the chlorine in the water is there long enough to disinfect and eliminate contaminants to within

acceptable levels, below the Maximum Contaminant Levels (MCL).

To determine whether or not your CT, and the amount of chlorine added to the system is sufficient to disinfect your drinking water to acceptable standards, you need to know a number of items.

1) The amount of free chlorine that is available at the first user of the system. Free chlorine is also called "residual chlorine", or the amount of chlorine left over at the end of the process. There must be a minimum of 0.2 mg/L of residual or free chlorine at the first user to ensure all the contaminants were eliminated or inactivated. The first user could be the treatment building or the first home connected to the distribution system. Why is disinfection measured at the first user? The first user is the control point to determine Contact Time. It is not however, the only point chlorine measurements need to be taken. The amount of free available chlorine entering the distribution system must be able to meet the chlorine demand of the entire system, including the user at the end of the line. Only by testing the chlorine levels throughout the distribution system can you feel confident that you have injected sufficient chlorine to meet the total demand. To meet the upcoming Disinfectants/Disinfection By-Products Rule, the difficult part will be to make sure that the least amount of chlorine is used to sufficiently meet the needs of the system. The reason we want to restrict the amount of chlorine used in the disinfection process is,

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Disinfecting Your Water Using a Chlorine Disinfection Method

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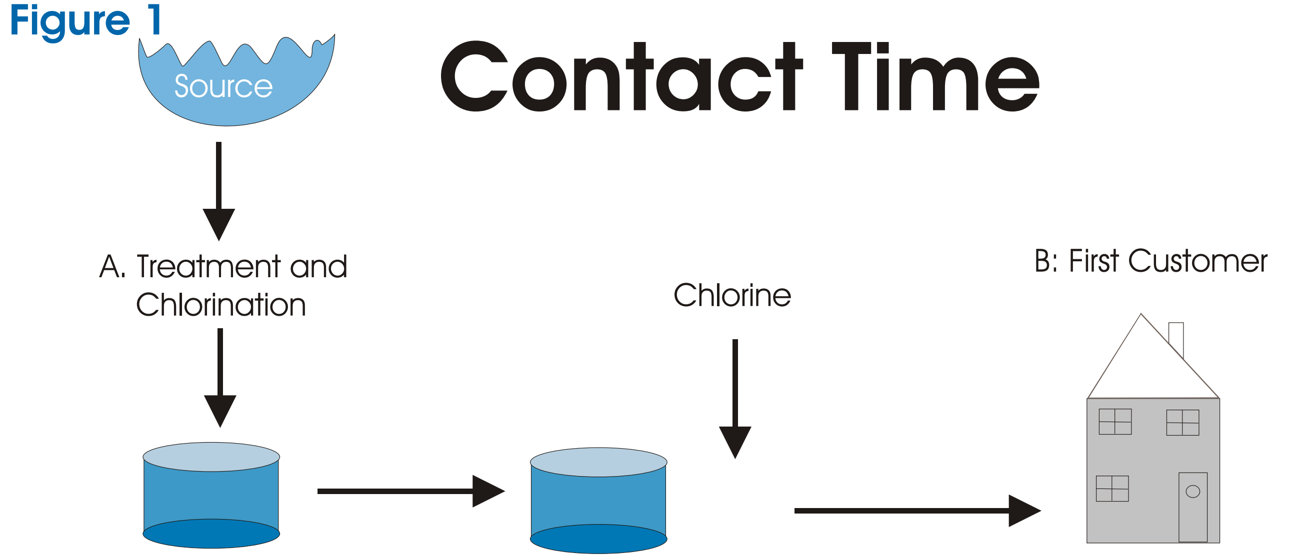
although the contaminants the chlorine eliminates are hazardous to public health, exposure to excessive chlorine, and the by-products produced when chlorine and other chemicals are mixed over a long period of time can also effect your health. All water system operators will need to adhere to this narrow margin of error. This is why calculating the CT will become an even more important part of a water operators fundamental job duties.

Figure 1



Inactivation ratios may have to be calculated for different segments of the treatment process

2) A tracer study is used to determine the length of time, (in minutes) it takes, under the expected maximum flow for the system, for the treated water to reach the first user. These studies are extremely important because they define your CT so that you don't have to rely on potentially inaccurate estimates for your system.

3) The temperature of the water in the system is also important. It is measured in degrees Celsius (not Fahrenheit). Surface waters will change temperature throughout the seasons. Therefore, it is important to obtain current water temperature readings whenever you are determining Contact Time.

4) You also need to know the pH of the treated water. Depending on the treatment used, the pH can change throughout the treatment process. So, a good sampling point to determine the pH is at the first user. A pH meter, calibrated on the site, should be used to take the pH measurement.

5) Different treatment methods have been assigned various log inactivation and removal values based on their effectiveness for inactivation of *Giardia* cysts, viruses, and bacteria. Direct filtration removes contaminants, like *Giardia* cysts from the water. Chemicals that are added to the process, like chlorine, disinfect or neutralize contaminants, such as bacteria and viruses. The amount or percentage of contaminant removal or disinfection is known as log inactivation. Since the overall "log inactivation" required could be achieved by a combination of treatment techniques, you may need more or less inactivation "credit" from the disinfection process.

In the examples shown below, the log credit will be provided. For those of you who do not know how much of a log inactivation credit your treatment plant has been granted, contact your design engineer, local DW/WW Program staff, or the EPA Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources.

Now for the fun part! A problem to solve. Let's see if we can figure out if the CT is sufficient.

Let's select some site conditions for our problem. First, the available

Disinfecting Your Water Using a Chlorine Disinfection Method

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source of water is a surface water source that has a man made dam on a stream, it has an uninhabited watershed with protection in place to limit access. The source water is at a temperature of 0.5° Celsius, a pH of 6.5 in the winter and summer but varies to 7 during the spring and fall. This source has never frozen since the dam was constructed in the stream. Because the streams that feed the source are affected by the weather, there will be periods of time when the clarity of the water, or turbidity, will change. A chemical feed (a coagulant) and then a rapid sand filter are part of the water treatment system or process that will treat any increase in turbidity that may happen, prior to adding the chlorine disinfectant.

The formula to determine your CT is found in 18 AAC 80.660 of the Drinking Water Regulations.

The Hard Way

CT= (log inactivation)(5.057)$(e^a)(e^b)(e^c)$

Where:
e= natural logarithm, a constant that is approximately 2.71828;
a= -0.0693 x water temperature (°C);
b= 0.361 x pH;
c= 0.113 x chlorine concentration in mg/L

The Easy Way

Although the formula above will determine the CT required, it is sometimes easier to use the tables in the Drinking Water Regulations [18 AAC 80, Tables J-R (pages 154-168) as amended through Sept. 28, 2001]. Please be aware that the numbers from the table and those that are computed will be similar but not necessarily the exact same value.

Listing the known information:

- required log inactivation = 1
- water temperature = 0.5° C
- pH = 6.5 to 7

We need to make an assumption for our surface water chlorine concentration. We do know that at the beginning of the distribution system we should have at least 0.2 mg/L when using chlorine per 18 AAC 80.635(b) & (c)(3).

Various values for pH and log inactivation are located across the top of Table J. Make sure that you are looking at the correct table with the temperature = 0.5° C. At pH = 6.5, and chlorine concentrations less than 0.4 mg/L, one log inactivation can be achieved with a CT value of 54 min-mg/L. At pH =7.0, CT = 65 min-mg/L. Using a first user chlorine concentration of 0.2 mg/L and solving for time (in minutes) the results are:

- If pH is 6.5, then 54 min-mg/L divided by 0.2 mg/L = 270 minutes.
- If pH is 7.0, then 65 min-mg/L divided by 0.2 mg/L = 325 minutes.

Our calculations show us that with a chlorine concentration of 0.2 mg/L at the first user we would require 325 minutes of CT to achieve 1 log inactivation by the first user. By increasing the amount of chlorine injected, we can reduce the contact time required to achieve the desired log inactivation. Let's try using the table and see how a change in the chlorine concentration can alter the required time. Change the chlorine concentration to 0.6 mg/L, and by using Table J the min-mg/L are 56 and 67 for the appropriate pH.

- If pH 6.5, then 56 min-mg/L divided by 0.6 mg/L = 93 minutes.
- If pH 7.0, then 67 min-mg/L divided by 0.6 mg/L = 112 minutes.

Here is another problem. We know the following:

- log inactivation = 1.0
- T= 120 minutes (from a tracer study)
- pH = 7.5
- Water temperature is 5° C (heat is added to ensure that water in the distribution system does not freeze)

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