TO: **Susan Randlett, P.E.**
Village Safe Water

FROM: **Mike Wolski, P.E.**
UMIAQ, LLC

DATE: **June 14, 2012**

REVIEW OF WATER QUALITY DATA

This Technical Memorandum summarizes the current regulatory requirements thought applicable to this water system, and provides recommendations for upgrades and/or corrective actions.

BACKGROUND

The Takotna water system is classified as a Community public water system (previously designated by ADEC as Class A) using a surface water source (Public Water System Identification Number [PWSID#] AK2280163).

Takotna has no current, documented violations of the rules and requirements for drinking water, but has two regulatory rules of concern related to treatment for Crytosporidium removal and documentation for chlorine disinfection of Giardia and viruses. The following tables summarize regulatory rules and potential future issues with the water system, followed by a discussion of regulatory compliance issues.

REGULATORY REQUIREMENTS

Pertaining To Source Water Quality		
Rule	**Parameter**	**Issues**
Source Water Assessment	Susceptibility to Contamination.	Surface water sources or infiltration galleries are susceptible contaminants (bacteria/virus, nitrate/nitrites, volatile organics, heavy metals, and other synthetic organics). The source water assessment identifies potential sources of contamination so that strategies can be developed to reduce risks to the water source.

Pertaining To Treated Water Quality		
Rule	**Parameter**	**Issues**
Total Coliform Rule (TCR)	Sanitary Survey – every 3 years.	Proposed revisions require systems indicating coliform contamination in the distribution system to assess and take corrective action.
Consumer Confidence Report (CCR) 40 CFR Part 141, Subpart O	Annual report to consumers regarding water quality, noting any violations.	

Surface Water Treatment Rule (SWTR)	3-log (99.9%) removal/ inactivation of Giardia lamblia. 4-log removal/ inactivation of viruses.	
Interim Enhanced Surface Water Treatment Rule (IESWTR)	Control of microbial pathogens, removal of Cryptosporidium*	
Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)	Requires small systems to meet the same microbial-control requirements as IESWTR.	Alternative filtration such as bag filters, must meet the same filtrate turbidity criteria mandated by the state under the SWTR, and also demonstrate to the state that the system provides 2-log (99%) Cryptosporidium removal.
Long-Term 2 Enhanced Surface Water Treatment (LT2ESWTR)	Further controlling Cryptosporidium.	Takotna is designated Bin 1. LT2ESWTR does not apply.
Stage 1 Disinfectants and Disinfection By-Products Rule (DBPs)	Establishes max contaminated level (MCL) for various compounds.	Based on data collected and shown in **Figure 1** and **Figure 2**, the Takotna system is in compliance with the MCL set for TTHM and HAA5.
Stage 2 Disinfectants and Disinfection By-Products Rule (DBPs)	Supplements Stage 1 above with locational data.	Based on data collected and shown in **Figure 1** and **Figure 2**, the Takotna system is in compliance with the MCL set for TTHM and HAA5.
Lead and Copper Rule (LCR)	Lead – 0.015 mg/L Copper – 1.3 mg/L	Based on the results of first-draw sampling calculated 90th percentiles shown in **Figure 3** and **Figure 4**, the Takotna system is well below the action levels for lead and copper corrosion and in compliance with the LCR.

Arsenic Rule	10 µg/L	ADEC drinking water database shows Takotna's system is in compliance.
Radionuclides Rule	Combined radium-226 & radium-228 – 5 pCi/L Gross alpha particles - 15 pCi/L Beta/photon particles - 4 millirems per year Uranium - 30 µg/L	ADEC drinking water database shows Takotna's system is in compliance.

* The rule requires all PWSs using surface water sources to conduct periodic sanitary surveys, regardless of size. Systems like Takotna are required to complete a sanitary survey every 3 years. The requirement for periodic sanitary surveys has been met with the most recent survey completed in October 2009. The next sanitary survey was due December 31, 2012.

Future Regulated Contaminants	
Perchlorate Fluoride, carcinogenic VOCs, nitrosamines (e.g. nitrosodimethlamine (NDMA)), and chlorinated disinfection products methyl tertiary butyl ether (MTBE), sulphate	The state will advise all systems of what testing to perform should these contaminants become regulated in the future.

Operator Certification

Classification: Small Water Treated

Current Operator Credentials can be verified at:
https://myalaska.state.ak.us/dec/water/opcert/Home.aspx?p=OperatorSearch

Pertaining To Administrative Requirements

Compliance with the administrative requirements of the Drinking Water regulations changes with time, and is not in the scope of this report. Current Violations for monitoring can be found online at:
http://dec.alaska.gov:8080/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=2680&tinwsys_st_code=AK&wsnumber=AK2280163

Water Rights

A water rights application was filed in 1992 and permit issued by the Alaska Department of Natural Resources in 1996 (File number 12786) for public water supply from Gold Creek.

Pertaining To The Physical Configuration Of The System	
Rule/Citation	**Deficit**
Alternative filtration technologies must demonstrate to the state that filtration and/or disinfection achieve the removals and/or inactivation of microbial contaminants noted above.	Additional information is required to determine if there is a deficit.
Alternative filtration systems, such as bag filters, are required to maintain a combined filter effluent (CFE) turbidity of 1.0 NTU or less for 95 percent of the monthly turbidity measurements taken at least every four hours while the system is producing water. The CFE turbidity may not exceed 5 NTU.	Additional information is required to determine if the operators are meeting monitoring requirements.

Missing Data Needed To Answer Compliance

To calculate CT time compliance, the following information is required to be provided by the operators:

1. The peak hourly flow out of the CT/Storage Tank;
2. Water level in the water storage tank to ensure sufficient volume or water for contact duration;
3. Chlorine residual;
4. pH and temperature leaving the tank.

Note, if during high usage events the CT is not achieved, then the operators can increase the chlorine levels within the water system. Knowing the above parameters will allow a calculation to be performed so that chlorine levels can be adjusted to achieve compliance with CT during normal and peak flows.

REGULATORY REQUIREMENTS – FIGURES

The following figures show compliance results with various water quality tests. To achieve regulatory compliance for Crytosporidium removal, additional bag filters will have to be added to the treatment system. The addition of filters will not negatively affect the water quality sampling results.

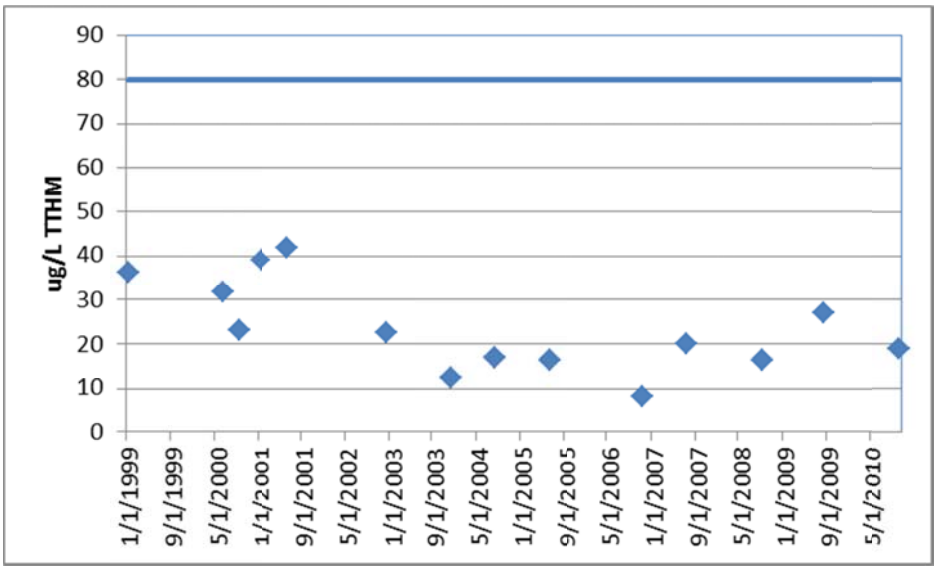

Figure 1 – TTHM Sample Results
Shows the Takotna system is in compliance with the MCL set for TTHM.

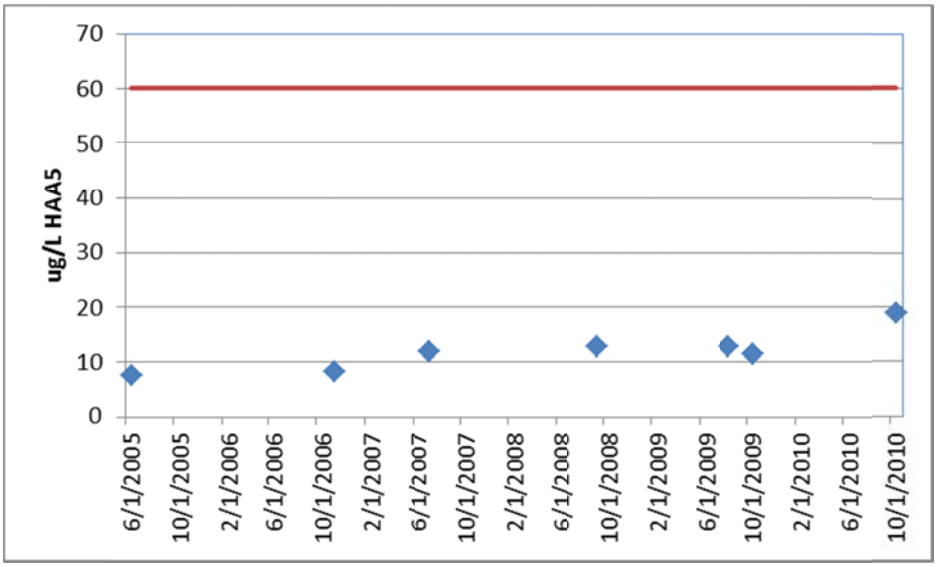

Figure 2 – HAA5 Sample Results
This figure shows that the Halo Acedit Acids, chemicals which can form from chlorination, are below the allowable level.

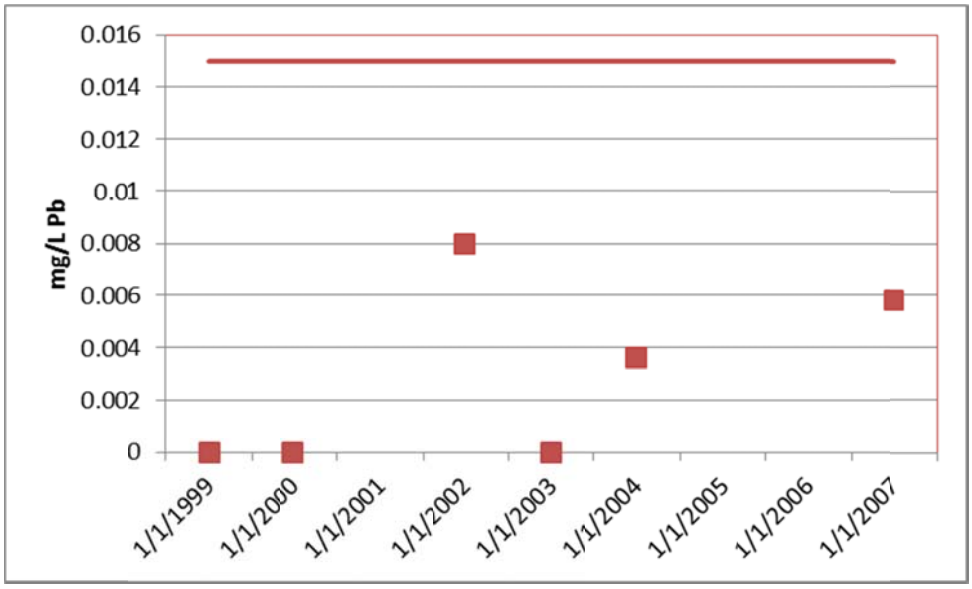

Figure 3 – First-Draw Lead 90th Percentile Values
This figure shows that copper at the customer's tap is well below the allowable level.

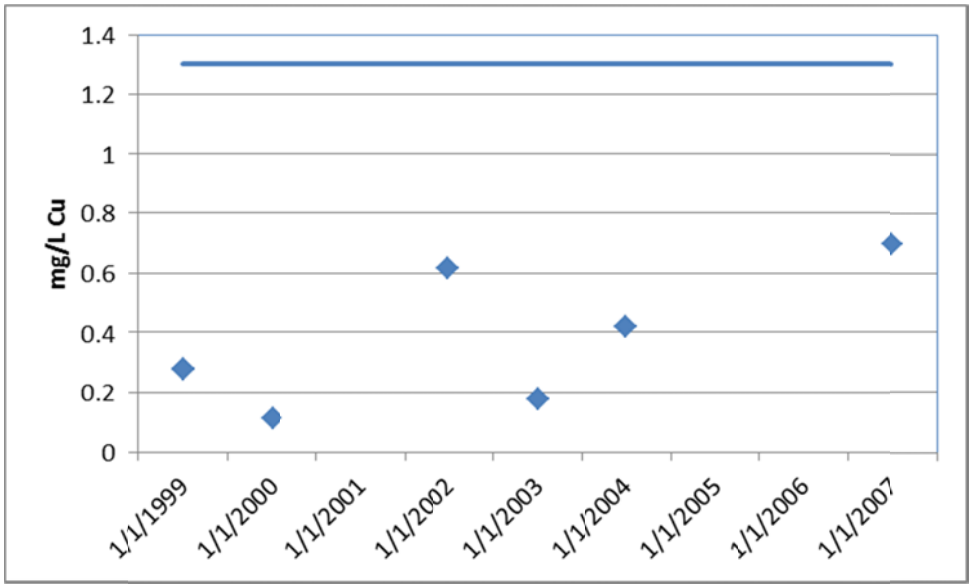

Figure 4 – First-Draw Copper 90th Percentile Values
This figure shows that lead at the customer's faucet is well below the allowable level.

REGULATORY COMPLIANCE ISSUES

Based on a review of the system components, there are two regulatory issues of concern for the existing water treatment system.

Issue 1: The existing bag filter is not approved for removal of Cryptosporidium.

When originally constructed, the state approved one bag filter for removal of both *Giardia lamblia* and *Cryptosporidium*. At the time of construction, the alternative filtration – bag filter was designed and approved as a *Giardia lamblia* removal filter and received 2.5-log credit from the state. In combination with a 0.5-log inactivation credit for chlorine contact time, the system complied with the requirements of the SWTR and was issued a Certificate to Operate by the ADEC.

The existing Rosedale bag filter installed at Takotna is not the same filter arrangement as the Rosedale system approved by other states, such as California and Washington, to provide 2-log removal of *Cryptosporidium* (those approved filters include a pre- and post-filter arrangement). The existing bag filter at Takotna alone could not be demonstrated to the State as suitable to remove 2.0-log *Cryptosporidium*.

Issue 2: The second issue relates to the state's requirement for a minimum 0.5-log inactivation of *Giardia lamblia* and 4.0-log viruses with disinfectant application and contact time (CT).

Compliance with CT is calculated based upon the design parameters of the treatment plant and flow rates. Ideally, additional information listed below should be obtained to check the compliance assumptions.

Determination of CT provided is based on:

1. The peak hourly flow out of the CT/Storage Tank;
2. Water level in the water storage tank to ensure sufficient volume or water for contact duration;
3. Chlorine residual;
4. pH and temperature leaving the tank; and
5. Baffle factor taking into account the tank configuration (i.e. efficiency relative to plug flow).

The system's original determination of 0.5 log inactivation credit used a baffle factor of 10% (0.10), based on EPAs general circulation model for unbaffled circular tanks.

The system can meet the CT requirements for normal average and peak flow rates (12 gpm, and 45 gpm respectively) if free chlorine residuals are adjusted to 0.3 mg/l and 1.2 mg/l respectively. Assuming a water temperature of 5 deg C, baffle factor of 10%, 0.5 log treatment, pH of 6.5, and a minimum water storage capacity of 7,800 gallons, the system can adjust free chlorine levels to meet CT requirements. Based on the previous assumptions, at 12 gpm flow rate, the system would have to maintain 0.3 mg/l free chlorine. At 45 gpm flow rates, the system would have to maintain 1.2 mg/l free chlorine. For extreme flow rates experienced during the Iditarod and other occasional events, ADEC has indicated that the treatment system does not have to meet CT values.

CONCLUSIONS AND RECOMMENDATIONS

Review of the data made available for this report indicates the existing water treatment system at Takotna meets most of the current regulatory requirements for drinking water quality, with the exception of the use of a state approved alternative filtration – bag filter, specifically for removal of *Cryptosporidium* first regulated under LT1ESWTR.

The water system may obtain a credit of 2.5-log and 2.0-log removal of *Giardia lamblia* and *Cryptosporidum*, respectively with two parallel trains of strain rite filters (component cost approximately $25K for two trains or primary and secondary filters).

In addition, although CT calculations show that the system achieves 0.5-log and 4.0-log inactivation of *Giardia lamblia* and viruses, additional water quality and flow data should be obtained during future water treatment plant modifications. Takotna should collect (or provide past logs, records) for the following data:

1. Bag filter filtrate turbidity;
2. Peak hour flow (including seasonal variations, if any) out of the chlorine contact/storage tank;
3. Water temperature;
4. pH;
5. Free chlorine residual out of the chlorine contact/storage tank;
6. Operational levels of the chlorine contact/storage tank;
7. Set point levels for chlorine contact/storage tank operation to maintain CT volume; and
8. Procedures during filter backwash.

In regard to possible future regulatory requirements for contaminants, Takotna could integrate into their planning process a review of alternative treatment process which could substantially and reliably remove organics; thus avoiding significant formation of currently regulated DBPs, as well as DBPs that may be regulated in the future.