ADEQ Arizona Department of Environmental Quality

APPLICATION FOR GROUNDWATER COMPLIANCE

4-LOG REMOVAL OF VIRUSES APPLICATION FORM

INSTRUCTIONS

The U.S. Environmental Protection Agency (EPA) published the Ground Water Rule in the Federal Register on November 08, 2006. The purpose of the rule is to provide increased protection against microbial pathogens in public water systems that use ground water sources. The EPA is particularly concerned about ground water systems that are susceptible to fecal contamination since disease-causing pathogens may be found in fecal contamination. Many Public Water Systems (PWS) in the State of Arizona apply a primary disinfectant to help eliminate these pathogens. In order to receive 4-Log Removal of Viruses credit from the Arizona Department of Environmental Quality (ADEQ, also referred to as the "Department" in this document), each system's processes will need to be reviewed and approved by the Department. In order for a PWS to receive this approval, each system will need to submit this application form and the required information to the Department.

In summary, EPA's proposed groundwater rule encourages drinking water systems using groundwater to achieve 4-log removal/inactivation of viruses; i.e. 99.99% removal/inactivation. Removal/inactivation occurs through filtration and/or disinfection. Achieving this level of treatment may or may not be difficult depending on the unique conditions of the system; i.e. storage time, water temperature, peak flow and chlorine concentration. Inactivation is a function of the disinfectant concentration and the amount of time the water spends in contact with the disinfectant before the first service connection. The steps contained in this application form will help determine whether 4-log removal of viruses can be achieved.

GENERAL APPLICATION PROCESS

1. Submit this form to the Arizona Department of Environmental Quality, Phoenix Office no later than October 1, 2009
2. There is no fee for this application submittal when the review is done by ADEQ.
3. Satisfy any deficiency requests arising from the Department's review of the submitted information.
4. Receive a determination from the Department regarding 4-log removal of viruses.

GENERAL MONITORING REQUIREMENTS UPON APPROVAL OF 4-LOG REMOVAL

All systems that use chemical disinfection must monitor the residual disinfectant concentration using analytical methods specified in EPA 141.74(a)(2) (Analytical and monitoring requirements) at a location approved by the Department. Each PWS is reminded of the following requirements that must be met upon approval of 4-log removal:

1. Systems that use chemical disinfection and serve more than 3,300 people must continuously monitor their disinfectant concentration. Systems must maintain the minimum disinfectant residual concentration determined by ADEQ. If continuous monitoring equipment fails, systems must take grab samples every 4 hours until the equipment is repaired. The equipment must be repaired within 14 days.
2. Systems that use chemical disinfection and serve 3,300 people or fewer must take daily grab samples or meet the continuous monitoring requirements described above for systems serving more than 3,300 people. If any daily grab sample measurement falls below the minimum state-required residual disinfectant concentration, the system must take follow-up samples every 4 hours until the residual is restored to the required level.
3. Systems using membrane filtration for 4-log treatment of viruses must monitor the membrane filtration process according to state-specified monitoring requirements and must operate the membrane filtration according to all state-specified compliance requirements. Reference can be made to EPA's Membrane Filtration Guidance Manual (November 2005 EPA 815-R-06-009) for information on membrane filtration system design and operation, membrane filtration testing requirements, and startup and implementation considerations.
4. Systems may use alternative treatment technologies (e.g., ultraviolet radiation [UV]) approved by the state, if the alternative treatment technology, alone or in combination (e.g., filtration with UV, filtration with chlorination) can reliably provide at least 4-log treatment of viruses. Systems must monitor the alternative treatment according to state-specified monitoring requirements, and must operate the alternative treatment according to compliance requirements established by the state.

1110 WEST WASHINGTON, PHOENIX, AZ 85007
WWW.AZDEQ.GOV

ADEQ Arizona Department of Environmental Quality

APPLICATION FOR GROUNDWATER COMPLIANCE

4-LOG REMOVAL OF VIRUSES APPLICATION FORM

GENERAL INFORMATION

1 System Information

System Name _____

County select county

Public Water System ID (Assigned by ADEQ)

2 System Owner Information

Name _____ Phone _____

Title _____ Firm Name _____

Mailing Address _____ City _____ State _____ Zip _____

Email Fax

3 System Operator Information

Name _____ Phone _____

Title _____ Firm Name _____

Mailing Address _____ City _____ State _____ Zip _____

Email Fax

4 Description of System's Disinfection Treatment Process

_____

_____

_____

_____

_____

5 Public Water System Type (Check one box only)

- ☐ Community System < 3,300 population
- ☐ Community Water System > 3,300 population
- ☐ Non-Transient, Non-Community Water System < 3,300 population
- ☐ Non-Transient, Non-Community Water System > 3,300 population
- ☐ Transient, Non-Community Water System < 3,300 population

6 Primary Disinfectant Applied (Check one box only)

- ☐ Chlorine Gas
- ☐ Sodium Hypochlorite
- ☐ Calcium Hypochlorite
- ☐ Chlorine Dioxide
- ☐ Chloramines
- ☐ Other (please specify) : _____

1110 WEST WASHINGTON, PHOENIX, AZ 85007
WWW.AZDEQ.GOV

CALCULATION STEPS

- The calculations below must be done at the Entry Point to the Distribution System (EPDS) which is located prior to the first served customer.
- The contact time (CT) will depend on your ground water source's temperature, pH, peak hourly flow, system storage volume, and the free chlorine residual concentration in your water at the first user
- If your system disinfects with gaseous or liquid chlorine, use the calculations below to determine the contact time (CT) that is provided for your ground water.
- "CT" is an abbreviation for chlorine Concentration multiplied by Time.

1 Baffling Factor Determination

Choose a baffling factor based on system parameters from the baffling factor table shown below (as found in http://www.epa.gov/safewater/mdbp/pdf/profile/lt1profiling.pdf, pages 31-32). For example, a factor of 1 would be chosen because the groundwater system has no storage after disinfection other than the distribution system, i.e. flow is pipe flow.

Table 4-2
Baffling Factors

Baffling Condition	Factor	Description
Unbaffled (mixed flow)	0.1	None, agitated basin, very low length to width ratio, high inlet/outlet velocities
Poor	0.3	Single or multiple unbaffled inlets or outlets, no intra-basin baffles
Average	0.5	Baffled inlet/outlet with some intra-basin baffling
Superior	0.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders
Perfect (plug flow)	1	Very high length to width ratio (pipeline flow) perforated inlet, outlet and intra-basin baffles

Baffling Factor: _____

2 Free Chlorine Concentration

Determine the free chlorine residual at the EPDS in mg/l

Free Chlorine Residual: _____mg/l

3 Hourly Peak Flow pH

Determine the pH at the EPDS during hourly peak flow in mg/l

pH during hourly peak flow: _____mg/l

1110 WEST WASHINGTON, PHOENIX, AZ 85007
WWW.AZDEQ.GOV

4 Hourly Peak Flow Water Temperature

Determine the water temperature at EPDS during the peak hourly flow, in degrees Celsius

Note: Temperature In Degrees Fahrenheit = 32 + 9/5 * Temp In Degrees Celsius

Water temperature during hourly peak flow: _____ ^{o}C

5 Hourly Peak Flow

Determine the peak hourly flow in gallons per minute

Peak hourly flow: _____ gallons per minute

6 System Storage Volume after Disinfection

Determine the system storage volume after disinfection in gallons.

Storage volume may be in an elevated storage tank, contact basins, distribution system piping or a combination of all of these.

For example, storage volume based solely on 1,000 feet of 6 inch pipe is given by:
Storage Volume = π(radius squared in feet)(length in feet)(7.48gal/cubic foot) = $3.14(0.25)^2(1,000)(7.48)$

Also, if an elevated storage tank is present in the system, calculations for this tank need to be included in the Storage Volume. The distribution system log removal value and the elevated storage tank log removal values are added together to arrive at the total system log removal.

Storage Volume: _____ gallons

7 Total Detention Time

Determine the total detention time in minutes.

Total Detention time = Storage Volume (gallons) / Peak hourly flow (gallons per minute)

Total Detention Time: _____ minutes

8 Contact Time

Determine the Contact Time in minutes.

Contact Time = Total Detention Time (minutes) x Baffling Factor

Contact Time: _____ minutes

9 Calculated CT Value, $CT_{calculated}$

Determine the Calculated CT Value in minutes.

Calculated CT Value = Proposed Chlorine Residual (mg/L) x Total Detention Time (minutes) x Baffling Factor

Calculated CT Value, $CT_{calculated}$: _____ minutes

1110 WEST WASHINGTON, PHOENIX, AZ 85007
WWW.AZDEQ.GOV

10 Required CT Value, $CT_{required}$

Determine the Required CT Value in minutes.

Look up value from table B-2 based on pH and temperature as entered in columns 2 and 3; respectively. In the example the CT required is 6, pH of 7 and temperature of 10oC. You may interpolate CT values between temperatures not listed. The EPA Tables can be located at: http://www.epa.gov/safewater/mdbp/pdf/profile/lt1profiling.pdf, Appendix B, page 104, shown below:

TABLE B-2
CT VALUES FOR
4-LOG INACTIVATION OF VIRUSES BY FREE CHLORINE

Temperature (°C)	pH	
	6-9	10
0.5	12	90
5	8	60
10	6	45
15	4	30
20	3	22
25	2	15

Required CT Value, $CT_{required}$: _____ minutes

11 Inactivation Ratio

Inactivation Ratio is calculated as $CT_{calculated}$ / $CT_{required}$ _____

4-Log Inactivation is met when this ratio is >= 1.0

The Log Removal is equal to 4 X Inactivation Ratio: _____

12 4-Log Removal Conclusion

Based on the above analysis, check the line below that applies to your ground water system

☐ Our ground water system probably does not provide 4-log treatment of viruses

☐ Our ground water system probably provides 4-log treatment of viruses

☐ We do not know if our ground water system provides 4-log treatment of viruses

13 Additional Credits for Filtration

If the utility filters its water, an additional log removal credit can be added to the calculated log removal consistent with the credits in Table 7.2 *Typical Removal Credits and Inactivation Requirements for Various Treatment Technologies*, EPA LT1 Profiling manual, page 62. http://www.epa.gov/safewater/mdbp/pdf/profile/lt1profiling.pdf

For example if a utility is filtering its groundwater via slow sand filtration, a log removal credit of 2.0 would be added to whatever the calculated value above is.

1110 WEST WASHINGTON, PHOENIX, AZ 85007
WWW.AZDEQ.GOV

Table 7.2: Typical Removal Credits and Inactivation Requirements for Various Treatment Technologies

Process	Typical Log Removal Credits		Resulting Disinfection Log Inactivation Requirements	
	Giardia	Viruses	*Giardia*	Viruses
Conventional Treatment	2.5	2.0	0.5	2.0
Direct Filtration	2.0	1.0	1.0	3.0
Slow Sand Filtration	2.0	2.0	1.0	2.0
Diatomaceous Earth Filtration	2.0	1.0	1.0	3.0
Alternative (membranes, bag filters, cartridges)	Systems must demonstrate to the State by pilot study or other means that the alternative filtration technology provides the required log removal and inactivation shown in Table 7-1.			
Unfiltered	0	0	3.0	4.0

If a system uses a different kind of disinfection (e.g., UV, ozone, chloramines) and/or filters its ground water, the PWS may contact ADEQ at 602-771-4671 for assistance in determining how many logs of virus treatment your system provides.

14 CERTIFICATION

I, _____ certify that the _____ Public Water System will chose to comply with the EPA Ground Water Rule by demonstrating 4 Log Inactivation of Viruses, in accordance with all requirements outlined in the EPA Ground Water Rule. The Public Water System is aware that it will need to maintain the Department approved free chlorine residual at the Department approved sampling location in order to ensure that the public water system is providing enough treatment to protect the public.

Signatures of System Representatives			
Role	**Date**	**Typed Name**	**Signature**
Owner			
The owner is an individual, corporation, partnership, association, state or political subdivision thereof, municipality, or other legal entity.			
Applicant/System Legal Representative			
The system legal representative is the legally responsible agent and decision-making authority for a public water system (e.g. mayor, president of a board, public works director).			

Return this application form and supporting documents to: Arizona Department of Environmental Quality, Drinking Water Section, Water Quality Division, 1110 W. Washington St, Phoenix, AZ 85007.