

**Guidance for Flood Event Monitoring by
Public Water Systems with Ground Water
Sources**

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I. PURPOSE:

This document is intended to provide guidance to public water systems with ground water sources and Ohio EPA staff for evaluating and responding to possible contamination of source water wells during flood events. Recommendations for evaluating baseline water quality of wells in floodplains are also provided. The steps in this guidance are recommendations only, however, alternate courses of action should be discussed with your district office representative.

Note: This guidance is not intended to address water systems that use ground water under the direct influence of surface water (GWUDI). However, GWUDI water systems susceptible to flooding should also be prepared to respond to flood conditions and some of the recommendations in this guidance may also be appropriate for those systems. We recommend that GWUDI water systems contact a district office representative for specific guidance.

II. BACKGROUND:

In accordance with rule 3745-81-76 of the Ohio Administrative Code (OAC) a well used for a drinking water source must be shown to be free of total coliform bacteria contamination before it can be designated as a ground water source. Drinking water from these sources may not be subject to treatment prior to distribution and continued integrity of the well is critical to maintaining a safe water supply. However, flooding in Ohio has shown that some wells placed in floodplains are susceptible to contamination by floodwaters, which may be due to a change in the integrity of the well. This guidance suggests steps to be taken before, during, and after flood events to help ground water systems manage potential contamination from floodwaters and is intended to be used in conjunction with a water system's contingency plan.

III. GUIDANCE

Before Flood Events

Public water systems with ground water sources located in floodplains should periodically (e.g. semi-annually) take samples from each well to test for pH and conductivity and make a visual determination of turbidity in order to establish a baseline for comparison. Visually inspecting each well is also recommended for indicators of well integrity, such as:

- secure well vents - are there signs of cracking or leaking?
- secure well caps - are they water tight?
- water level ports - are they plugged and water tight?
- general wellhead condition - signs of cracking of concrete pad or potential leaking of annular space?

Systems should also ensure they have an adequate supply of total coliform sample bottles to allow for timely sampling during flood events. Inspection reports and sampling results should be maintained so they are available for reference. Each community public water system should address these issues in its contingency plan.

During Flood Events

1. When flood waters reach the wellhead, take the well offline, if feasible.
2. If taking the well offline is not feasible, the following actions are recommended based on the level of treatment provided, if any, and prior history of well contamination by flood waters:

For public water systems that do not add chlorine, the following actions are recommended:

- issue a water use advisory notifying consumers of the possible contamination and instructing them to boil or refrain from using the water, as appropriate;
- contact your Ohio EPA district office as soon as possible to consult about the severity of the situation and further requirements or guidance. If it is determined that the situation poses an acute risk to human health a Tier I public notice may be required¹. During non-business hours, the Ohio EPA Emergency Hotline (1-800-282-9378) should be used.
- inspect the wellhead as soon as it can safely be accessed and daily thereafter for signs of damage;
- the water use advisory should not be lifted until the flood waters have receded from all of the wellheads in a wellfield and two consecutive raw water total coliform negative samples are received (details are provided under “At the Conclusion of Flood Events” below).

For public water systems that add chlorine, but do not have at least 30 minutes contact time,

OR

public water systems that have at least 30 minutes chlorine contact time, but have had previous well contamination from flood waters, the following actions are recommended:

- as a precaution, increase chlorine residual to at least 1 mg/l free chlorine or 6 mg/l combined chlorine throughout the distribution system²;
- issue a water use advisory notifying consumers of the possible contamination and instructing them boil or refrain from using the water, as appropriate;
- contact your Ohio EPA district office as soon as possible to consult about the

¹ Typically, a Tier I public notice is only required when a violation occurs. In situations such as a flood the Director may find that conditions present an acute risk to human health making a Tier I notice necessary, even though there may be no violation. Indicators of an acute risk may include total coliform monitoring of raw water; increased chlorine demand; change in water turbidity; change in pH or conductivity; signs of well damage or other reasons to question the integrity of the well. Please see paragraph (B) of OAC rule 3745-81-32.

² This is required by paragraph (B)(6) of OAC rule 3745-83-01 for community and major noncommunity public water systems when there is a threatened outbreak of waterborne disease. It is also recommended for all systems whenever there is a threatened outbreak of waterborne disease.

severity of the situation and further requirements or guidance. If it is determined that the situation poses an acute risk to human health a Tier I public notice may be required¹. During non-business hours, the Ohio EPA Emergency Hotline (1-800-282-9378) should be used.

- inspect the wellhead as soon it can safely be accessed and daily thereafter for signs of damage;
- the water use advisory should not be lifted until the floodwaters have receded from the all of the wellheads in a wellfield and two consecutive raw water total coliform negative samples are received (details are provided under “At the Conclusion of Flood Events” below).

For public water systems that add chlorine, have at least 30 minutes contact time and have no previous history of well contamination from flood waters, the following actions are recommended:

- contact your Ohio EPA district office as soon as possible to consult about the severity of the situation;
- as a precaution, increase chlorine residual to at least 1 mg/l free chlorine or 6 mg/l combined chlorine throughout the distribution system²;
- conduct daily monitoring and inspections for the following indicators of well integrity as soon as you can safely gain access:
 - total coliform monitoring of raw and finished water
 - increased chlorine demand
 - change in water turbidity (visual determination based on comparison with pre-flood conditions)
 - change in pH or conductivity
 - signs of well damage or other reasons to question the integrity of the well;
- If any of these indicators raise a question of the well integrity, Ohio EPA recommends issuing a water use advisory instructing consumers to boil or refrain from using the water, as appropriate;
- If contamination is confirmed by total coliform positive sample result(s), contact your District Office representative. If it is determined that the situation poses an acute risk to human health a Tier I public notice may be required¹.
- If **all** indicators continue to support confidence in the well integrity, Ohio EPA recommends continued daily monitoring of conditions until flood waters recede.

At the Conclusion of Flood Events

1. If a water use advisory was issued but evidence of well contamination was not found, i.e.

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at least two consecutive negative total coliform bacteria samples were obtained, the water use advisory can be lifted once floodwaters have receded from the all of the wellheads in a wellfield.

2. If a water use advisory was issued and evidence of well contamination was found, such as total coliform positive sample results, the advisory should remain in effect until the raw water and finished water are demonstrated to be free of total coliform bacteria. The following criteria are recommended for making this demonstration.
 - Make any needed repairs to any affected well; ensure the well pump will operate properly. Pump water from the well at the wellhead or an outside faucet to remove contaminated water and sediments.
 - Disinfect each well. The procedures in rule 3745-9-08, although primarily intended for disinfection of new wells or wells undergoing maintenance, are still recommended as a good starting point. If those procedures are followed and total coliform samples continue to be positive, more rigorous disinfection procedures may be needed. It is recommended that the operator consult a qualified well contractor and the appropriate Ohio EPA district office for other procedures that may be appropriate in addition to those in rule 3745-9-08. Also, if well disinfection is not feasible, contact the appropriate Ohio EPA district office for further assistance.
 - Obtain two consecutive total coliform bacteria negative samples, taken at least 24 hours apart, from each well.
 - Obtain two consecutive normal turbidity level samples (visual determination based on comparison with pre-flood conditions), taken at least 24 hours apart, from each well.
 - Flush each dead end in the distribution system with at least three times the volume of water in the dead end.
 - Obtain at least two consecutive sets of total coliform bacteria negative samples, taken at least 24 hours apart, from sites representative of the distribution system. The number of samples for each set will be case-specific depending on the size of the water system and extent to which flooding has affected the distribution system.
 - For systems that add chlorine, it is recommended that at least 0.2 mg/l free chlorine residual be maintained throughout the distribution system, paying particular attention to dead ends in the distribution system.
3. If evidence is found that the flood event resulted in well contamination, Ohio EPA recommends that the public water system conduct an investigation to determine why there was a failure in well integrity. In the event that Ohio EPA does not have enough information to determine if a flood event has impacted a system, a limited scope site visit may be warranted.

IV. HISTORY

This document was originally drafted in 1997 to provide guidance on raw water monitoring of wellheads in floodplains during flood events. It was revised and reissued as a formal guidance on January 3, 2006.