Environmental Protection Agency

Disruption of Service Events at Large Public Water Systems

This fact sheet covers response requirements for disruptions of service at "Large Systems," which include nontransient noncommunity (NTNC) public water systems (PWSs) serving a population of 1,000 or more and all community PWSs. This policy is not law.

Section 1. Background

A disruption of service means an event during which minimum pressure at any point in the distribution system of a PWS falls below 20 psig at ground level. The area where the pressure falls below 20 psig is called the "affected area." Disruptions of service can be caused in a variety of ways (water main break, power outage, well pump failure, etc.). They can pose a health risk and may result in contamination entering the water system. Therefore, Large Systems are required to complete the response requirements outlined in OAC Rule 3745-83-02 if a disruption of service occurs.

Key Terms	
Affected Area	The portion of a distribution system where the pressure of the system has dropped below 20 pounds per square inch gauge (psig) at ground level.
Disruption of Service	An event during which minimum pressure at any point in the distribution system of a public water system falls below 20 psig at ground level.
Impacted Service Area	Any service line that has been moved, replaced, or reconnected to the main during a main replacement. Includes any buildings, residences, or lines served by the impacted service line.
Major Disruption Event	Any disruption of service that is not a Type 1 or Type 2 event.
Positive Pressure	The water pressure is above 0 psig at ground level in the distribution system and positive flow is maintained.
Type 1 Event	A disruption of service where positive pressure is continuously maintained in the affected area, and there are no signs of contamination intrusion.
Type 2 Event	A disruption of service where positive pressure is maintained in the affected area until the affected area has been isolated from the rest of the distribution system and there are no signs of contamination intrusion.

Section 1.1 Affected Area vs. Impacted Service Area

The "affected area" includes the portion of the distribution system where the pressure falls under 20 psig (e.g., area that loses pressure or has low pressure under 20 psig). The affected area may be as large as the entire distribution system if the whole system loses pressure (power outage, tower drained, etc.), or the affected area may be isolated to a small portion of the distribution system (e.g., valved off area for main break). The affected area can be determined using pressure gauges, hydrant pressure recorders, storage tank or tower water level, or another method acceptable to the director.

An "impacted service area" is only present if there is a main replacement that includes at least one service line on the section of main being replaced. Any service lines that have been moved, replaced, or reconnected to the main during a main replacement are considered the impacted service area. The response requirements may vary for those in the affected area vs. the impacted service area, particularly in areas with lead service lines.

Section 1.2 Extent of the Distribution System for Service Line Disruptions

For some PWSs, the consumer owns part of the service line (City, Village, subdivision, etc.). In these systems, there are 2 parts of a service line: the PWS-owned side (closest to the main) and the consumer-owned side (furthest from the main), which are generally separated by the curb stop (See Figure 1). For disruptions of service, the distribution system includes the service line up to the curb stop. **Therefore, if the pressure in the PWS-owned side of a service line falls below 20 psig, it would be considered a disruption of service and the PWS would need to complete the applicable response requirements.** If the service line only loses pressure after the curb stop, then it would not be considered a disruption of service. For example, if there is a break on the service line after the curb stop and the PWS closes the curb stop before completing the repair and maintains pressure in the rest of the line, then that would not be considered a disruption of service.

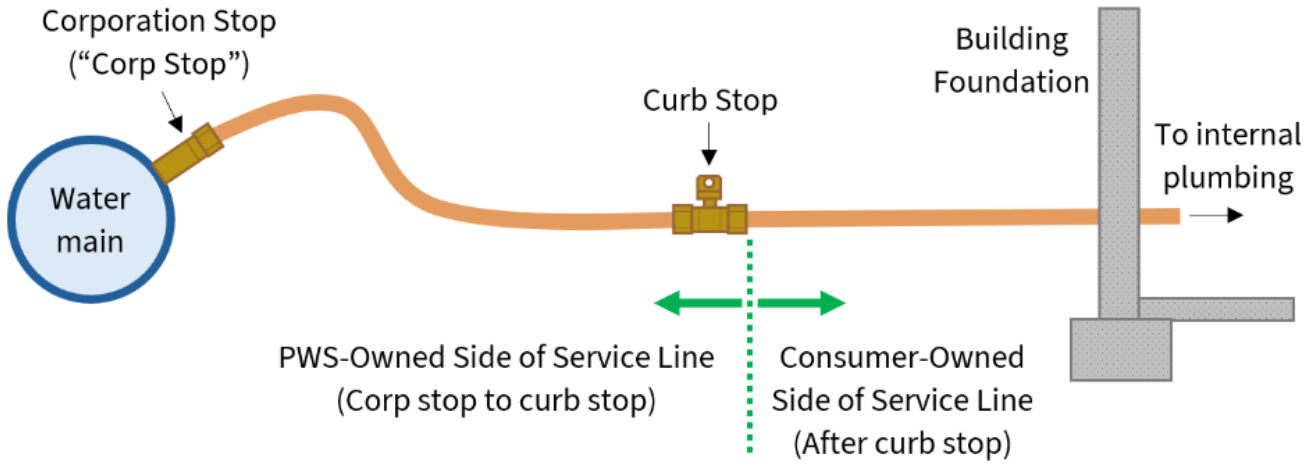

Figure 1. Below ground service line to a single building.

Section 1.3 Disruption of Service Types

There are three types of disruption of service events: Type 1 Event, Type 2 Event, and Major Disruption Event. The risk of contamination intrusion increases with each type (i.e., Type 1 = least risk, Major Disruption Event = greatest risk). As a result, the response actions and communication expectations also increase. PWSs should reference the Disruption of Service Type Flowchart for assistance with determining which disruption type has occurred.

Section 1.4 Disruption Type Elevation

If the PWS does not complete the response requirements for the applicable disruption of service type, the event is elevated to the next higher disruption type (e.g., Type 1 Event becomes a Type 2 Event, Type 2 Event becomes a Major Disruption Event). When an event is elevated, PWSs are required to follow the requirements of the elevated disruption type. For example, if pressure is not monitored, a Type 1 or Type 2 Event would be escalated to a Major Disruption Event and the PWS must complete the response requirements for a Major Disruption Event.

Section 2. Type 1 Event

A Type 1 Event is "A disruption of service where positive pressure is continuously maintained in the affected area, and there are no signs of contamination intrusion." In this type of event, the pressure has fallen below 20 psig but is above 0 psig in the affected area and positive flow is maintained. Therefore, the water must be flowing, even if it is flowing slowly. If the water stops flowing, it would be either a Type 2 Event (if positive pressure is maintained until the affected area can be isolated), or a Major Disruption Event. If there are any signs of contamination intrusion during the event, it is automatically escalated to a Major Disruption Event and the PWS must follow the Major Disruption Event response requirements.

An example of a Type 1 Event includes a community PWS with a line break where the pressure falls under 20 psig along a street, but the water continues flowing. The PWS uses hydrant pressure recorders to monitor pressure in the area and verify the extent of the affected area. The PWS excavates down to below the water main break and is able to put on a repair clamp to stop the leak. There are no signs of contamination intrusion and the PWS completes the required response actions in OAC Rule 3745-83-02(C)(2), which are summarized in Section 2.1 below.

Section 2.1 Type 1 Event Response Requirements

If a PWS experiences a Type 1 Event, they are required to complete the following response actions:

1. Monitor and record pressure upstream and downstream of the area (e.g., in-line pressure monitor, hydrant pressure recorder, storage tank/tower water level, or other Ohio EPA approved method). See Section 2.2 for additional information.
2. Excavate the pit to below the area to be repaired.
3. Maintain the water level in the pit below the area to be repaired.
4. Disinfect the waterline in accordance with AWWA Standard C651-14 section 4.11.3.1.
5. Complete the repair under positive pressure (Above 0 psig and maintaining positive flow).
6. After completion of repair, test or verify disinfectant presence.
7. Document all activities and events using a form or method acceptable to Ohio EPA. PWSs may use the Ohio EPA online reporting tool or their own tracking system if it records the same information as the online reporting tool.

Section 2.2 Monitoring Pressure

For a disruption of service to be considered a Type 1 or Type 2 Event, Large Systems must monitor pressure upstream and downstream of the area so they can determine the extent of the affected area and determine if a disruption of service has occurred. If the PWS fails to adequately monitor pressure, the event is elevated to a Major Disruption Event. There are multiple ways for a PWS to monitor pressure. Some acceptable examples include:

1. **In-line pressure monitors** (e.g., pressure gauge that can be manually read or with a sensor that connects to a SCADA system).
2. **Hydrant pressure recorders**. These devices are typically battery powered and connect to hydrants. Some can wirelessly transmit data to provide alerts and alarms in response to pressure readings, while others must be connected to a portable device to view the data.
3. **Storage tank or water tower level.** In some instances, the storage tank or water tower level can be used to monitor pressure. However, this method may not always be appropriate. For example, if the disruption is far from the tower or the distribution system is large, the tower may not be a reliable indicator of conditions near the disruption. However, if the disruption occurs near the tower, or the distribution system is small, the tower level may serve as an acceptable indicator of pressure conditions. Contact Ohio EPA for guidance, if necessary.
4. **Hydraulic model.** PWSs who maintain a functioning and accurate hydraulic model can use that to identify the affected area. The PWS must have personnel knowledgeable in running the model available to run it during the disruption event.

If the PWS wants to use an alternate method to those listed above, contact Ohio EPA for approval.

Section 3. Type 2 Event

A Type 2 Event is "A disruption of service where positive pressure is maintained in the affected area until the affected area has been isolated from the rest of the distribution system, and there are no signs of contamination intrusion." The difference between a Type 1 Event and a Type 2 Event is the phrase "until the affected area has been isolated from the rest of the distribution system." Therefore, these events start off with positive pressure and maintain positive pressure until

the affected area can be isolated. If there are any signs of contamination intrusion during the event, it is automatically escalated to a Major Disruption Event and the PWS must follow the Major Disruption Event response requirements.

An example of a Type 2 Event would be a community PWS that has a line break which causes the pressure to drop below 20 psig, but the water is still flowing. The PWS excavates the area and determines that they will need to valve off the area before completing the repair because the break is too large for a repair clamp and the PWS will need to replace a portion of the main. The PWS maintains positive pressure in the affected area, as evidenced by in-line pressure monitors, until they close the nearby valves. Once the valves are closed, the pressure quickly drops to 0 psig. There are no signs of contamination intrusion, and the PWS completes the required response actions in OAC Rule 3745-83-02(C)(3), which are summarized in Section 3.1 below.

Section 3.1 Type 2 Event Response Requirements

If a PWS experiences a Type 2 Event, they are required to complete the following response actions:

1. Water use advisory not required, unless the Type 2 Event coincides with an individual lead service line (LSL) replacement, or a main replacement in an area known or likely to contain LSLs. Consult lead guidance.
2. Notify critical users as soon as possible, but within 24 hours. See Section 3.2 for additional information.
3. **Community water systems** shall provide water from an alternate source to consumers in the affected area within 24 hours from the beginning of the disruption event if the water system is not capable of providing water through the distribution system (e.g., no pressure in waterlines). PWSs should reference their contingency plan for a list of alternate sources and their plan for how to distribute the water.
4. Monitor and record pressure upstream and downstream of the area (e.g., in-line pressure monitor, hydrant pressure recorder, storage tank/tower water level, or other Ohio EPA approved method). See Section 2.2 for additional information.
5. Perform a controlled shutdown of the affected area (i.e., maintain positive pressure in the affected area until it can be isolated from the rest of the distribution system).
6. Complete the repair.
7. If conducting a waterline or appurtenance repair or replacement (valve, hydrant, etc.):
   - Excavate the pit to below the area to be repaired.
   - Maintain the water level in the pit below the area to be repaired.
   - Disinfect, repair, and flush the waterline in accordance with AWWA Standard C651-14 section 4.11.3.2.
   - If the Type 2 Event coincides with an individual LSL replacement or with a water main replacement with any LSLs in the affected area, complete actions in the lead guidance.
8. After completion of repair, test or verify disinfectant presence.
9. Document all activities and events using a form or method acceptable to Ohio EPA. PWSs may use the Ohio EPA online reporting tool or their own tracking system if it records the same information as the online reporting tool.

Section 3.2 Critical User Notification

Community PWSs are required to identify any critical users as part of their contingency plan. Critical users are consumers who have a critical need for water (e.g., hospitals, dialysis centers, homebound individuals). If critical users are in the affected area, they must be notified of Type 2 and Major Disruption Events as soon as possible, but within 24 hours. If possible, critical users should be informed before the disruption begins so they can plan accordingly (e.g., before valves are closed).

NTNCs who serve at least 1,000 people may not have a contingency plan, and therefore, may not have critical users identified as part of that plan. However, these systems are required to notify consumers who have a critical need of water

as soon as possible, but within 24 hours of a Type 2 or Major Disruption Event. Thus, they should prepare a list of any such users.

Section 4. Major Disruption Event

A Major Disruption Event is "Any disruption of service that is not a 'Type 1' or 'Type 2' event." Therefore, this disruption type can cover a broad range of events, such as:

- A water main break where the PWS cannot isolate the area before the pressure drops below 20 psig.
- A water main break with contamination intrusion (e.g., muddy water enters the pipe).
- Equipment failure (e.g., A pump station failure that results in part of the town losing pressure before the area can be isolated, telemetry failure).
- A power outage at a water plant without an emergency generator.
- Failing to monitor pressure during a Type 1 or Type 2 Event.
- Failing to complete all of the response requirements during a Type 2 Event.

Section 4.1 Major Disruption Event Response Requirements

If a PWS experiences a Major Disruption Event, they are required to complete the following response actions:

1. Notify the appropriate Ohio EPA district representative or the Ohio EPA's environmental response hotline (1-800-282-9378) as soon as possible, but within 24 hours of the beginning of the disruption of service if **all of the following criteria are met**:
    - Repairs will not be complete within 24 hours of the beginning of the disruption of service.
    - The PWS anticipates the affected area will be without water provided through the distribution system for more than 24 hours.
    - The affected area includes more than 250 service connections, or more than 25% of the PWS's customers, whichever is least.

    Ensure that the public water system speaks with a person when notifying Ohio EPA. The use of email or voicemail does not satisfy this notification requirement.
2. Notify critical users as soon as possible, but within 24 hours. See Section 3.2 for additional information.
3. Activate notification procedures in the contingency plan.
4. **Community water systems** shall provide water from an alternate source to consumers in the affected area within 24 hours from the beginning of the disruption event if the water system is not capable of providing water through the distribution system (e.g., no pressure in waterlines). PWSs should reference their contingency plan for a list of alternate sources and their plan for how to distribute the water.
5. Document any potential contamination.
6. Issue a precautionary water use advisory to all potentially affected consumers as soon as possible but no later than 24 hours after the beginning of the event. If the Major Disruption Event coincides with either an individual LSL replacement or a water main replacement with any LSLs in the affected area, consult the lead guidance to determine if lead language or filter language is needed in the water use advisory.
7. In the case of water main repairs or replacements, disinfect, repair, and flush the waterline in accordance with AWWA Standard C651-14 section 4.11.3.3.
8. If the Major Disruption Event coincides with an individual LSL replacement or a water main replacement with any LSLs in the affected area, complete actions in the lead guidance.
9. If work is done on the well as part of the repairs (well alteration, repair, etc.) that could result in contamination entering the well, the PWS must complete the well disinfection procedure in OAC Rule 3745-9-08 which is described in the Disinfection of a Public Water System Well instructions. See Section 4.2 for additional information.

10. Test for chlorine residual and comply with the minimum and maximum chlorine residual requirements (Minimum of 0.2 mg/L free chlorine, or 1.0 mg/L combined chlorine; Maximum of 4.0 mg/L total chlorine or 0.8 mg/L chlorine dioxide).
11. Collect special purpose total coliform samples at locations representative of the affected area in accordance with Table 1 below after repairs are made, pressure has been restored to 20 psig or above and the chlorine residual is within acceptable limits.
12. Complete the response actions in Table 2 below based on the sample results. See Section 4.3 for additional information on sample collection.
13. PWSs must document the event using the Ohio EPA online reporting tool. Ensure the online report is submitted to Ohio EPA within 48 hours or the next business day, whichever is later, of the disruption of service being corrected (i.e., completed response actions and received safe total coliform sample results).

Section 4.2 Work done on the Well

PWSs may need to call in a contractor to complete repairs on the well to restore pressure. The PWS must hire a contractor registered with the Ohio Department of Health (ODH) if any of the following work is needed on the well: drill, construct, alter, repair, or seal the well, or install a pitless adapter or pitless unit. ODH maintains lists (in-state contractors and out-of-state contractors) and a map of well contractors.

If work is done on the well that could result in contamination entering the well (replacing well pump, replacing portion of well casing, replacing pitless adapter, etc.), complete the well disinfection procedure. This procedure is outlined in OAC Rule 3745-9-08 and the Disinfection of a Public Water System Well instructions. Part of the instructions include raw sampling. The PWS must have at least 2 consecutive raw total coliform samples collected at least 30 minutes apart that are total coliform negative (TC-) ("safe") before proceeding to the next step. These are raw samples (before any treatment) and are required in addition to the distribution samples that must be collected as part of the disruption response requirements. Contact Ohio EPA if either raw sample is E. coli positive (EC+) or total coliform positive (TC+).

Section 4.3 Total Coliform Sampling from Affected Area

Collect total coliform samples after repairs are complete and pressure has been restored to at least 20 psig throughout the distribution system.

Section 4.3.a. Where to Collect Samples

Collect samples from representative locations in the affected area (i.e., where the pressure dropped below 20 psig). If the whole distribution system has low (under 20 psig) or no pressure, samples should be collected from representative locations throughout the distribution system. If only a portion of the distribution system has low or no pressure, then samples should be collected from representative locations in that portion (a.k.a. the affected area). All samples must be collected from the distribution system (after any treatment equipment). They cannot be collected from the raw tap, pressure tank, etc.

Section 4.3.b. How to Label the Samples

The total coliform samples should be marked as follows on the Sample Submission Report (SSR) given to the lab:

Sample Type = **Special**
Facility Code/Facility ID = **DS1**
Sample Monitoring Point (SMP) = **DS000**

Section 4.3.c. How Many Samples are Required

Reference Table 1 to determine how many initial samples to collect based on the number of service connections in the affected area (i.e., where the pressure dropped below 20 psig).

Table 1. Total Coliform Distribution Sampling from Affected Area.

Service Connections Affected	Minimum Number of Total Coliform Samples Required
0 – 15	1
16 – 1,000	2
1,001 – 2,000	4
2,001 – 3,000	6
3,001 – 4,000	8
4,001 – 5,000	10
5,001 – 6,000	12
6,001 – 7,000	14
7,001 – 8,000	16
8,001 – 9,000	18
9,001 – 10,000*	20

*After 10,000 service connections, 2 additional samples shall be added for every 1,000 service connections up to a maximum of 100 samples. Public water systems that have multiple treatment plants may use a proportional sampling method if established in the contingency plan or in the initial distribution system evaluation.

Section 4.3.d. Response Requirements Based on Distribution Sample Results

Table 2 outlines the requirements based on the results of distribution system sampling. Contact the Ohio EPA District Office with any questions.

Table 2. Large System Response Requirements from Total Coliform Distribution Sample Results

Results of Sampling	Response Requirements
All samples are TC- (safe)	• Can lift the water use advisory (if one was posted).
Any sample is TC+, and all are EC-	• Can lift the water use advisory (if one was posted), though the PWS can choose to keep it posted as a precaution. • Contact Ohio EPA. • Continue to monitor with an additional set of total coliform samples until one complete set is TC-. See Table 1 for the number of samples required in each set. It is recommended to flush the distribution system prior to collecting a new set of samples.
Any sample is EC+	• Contact Ohio EPA. • Issue a water use advisory (templates are available). • Collect 2 additional sets of samples, at least 24 hours apart. See Table 1 above for the number of samples required in each set; however, if 0 to 15 service connections are affected, collect a minimum of 2 samples per set. • Can lift the water use advisory once all samples in both sets are TC- and PWS has consulted with Ohio EPA. It is recommended to flush the distribution system prior to collecting a new set of samples. • Once the advisory has been lifted, submit a copy of the issued advisory and the completed verification form to Ohio EPA.