

Iowa Main Break and Depressurization Guidance

Any disruption in a water system that results in a loss of positive pressure may allow contaminants to enter the system. This document is intended to provide guidance to public water supply owners and operators in evaluating and responding to pressure loss situations from distribution system issues such as main breaks, valve repairs, or extreme fire flows, and operational disruptions such as a pump failure, power outage, telemetry failure, source failure, or storage depletion.

During a main break or other work that opens the system, the loss of positive pressure within the water system may allow disease-causing microorganisms from surrounding soil or groundwater to enter a distribution system pipe. The loss of pressure may also allow disease-causing microorganisms and chemical contaminants to be drawn into the pipe through backsiphonage due to the pressure differences. In addition, during the process of repair, contamination of the system may occur if the pipe has been opened to the environment and has come into direct contact with groundwater, runoff, soil, or contaminants in the area of the repair.

During any pressure loss situation, protection of public health and safety are the priority and primary concern. At the same time, it is important to minimize the disruption of water service to the customers. For this reason, boil water advisories may be recommended or required while bacteriological sampling is completed so the repaired water main may be returned to service. It is critical that sanitary procedures are followed throughout the process of response, repair, and returning the line or system to service.

AWWA Standard C651

For water main breaks, AWWA Standard C651-14 must be followed. The standard includes the following preventive and corrective measures to accomplish the repair in a sanitary manner:

- Keep the new pipe, fittings, valves, etc. clean and dry (protected from contamination)
- Prevent contaminants from entering the existing pipe by maintaining positive pressure as long as possible - until the pipe is fully exposed and the trench is dewatered to below the existing pipe
- Inspect, clean, and disinfect (by spraying or swabbing with a 1% chlorine solution) all exposed portion of the existing pipe, all materials used in the repair, and all tools used to make the repair
- After repairs are complete, flush, measure chlorine residuals, and collect bacteria samples if required

AWWA Standard C651-14 is available for review at the DNR Field Offices and at the DNR Water Supply Engineering Office in Des Moines. It may also be purchased from the AWWA Store online.

This standard includes specific practices for the repair of water main breaks and classifies breaks into four (4) categories listed below. Each category includes actions, recommendations, and requirements based on the contamination risk.

Controlled pipe repair without depressurization: The repair activities are well controlled and positive pressure is maintained to the area of the break and at the site at all times. The repair site is exposed and the trench is adequately dewatered so that the repair site can be cleaned and disinfected. These are main breaks that are repaired with clamping devices while the main remains under pressure. See the flushing recommendations below. No bacteria sampling is recommended or required. A boil water advisory is not recommended or required.

Controlled pipe repair with depressurization after shutdown without opening the pipe: After the repair site has been exposed and secured from trench soil and water contamination (the trench is adequately dewatered so that the repair site can be cleaned and disinfected), the water main is depressurized by a shutdown to complete the repair. The repair site should be cleaned and disinfected. See the flushing recommendations below. A boil water advisory and bacteria sampling are typically not warranted. In the case of potential contamination from a high hazard business in the affected area, consult with the DNR Field Office to determine if a boil water or alternative source advisory and bacteria or other sampling may be recommended or required.

Controlled pipe repair with depressurization after shutdown with opening the pipe: After the repair site has been exposed and secured from trench soil and water contamination (the trench is adequately dewatered so that the repair site can be cleaned and disinfected), the water main is depressurized by a shutdown to complete the repair. The pipe has to be opened (cut into) so the interior surfaces of the water system are exposed. The existing pipe should be inspected and cleaned by flushing water into the trench, where possible. The repair site must be accessible and the trench adequately dewatered so the repair site can be disinfected. All new pipe, valves, etc. must be disinfected before installation. See the flushing recommendations below. Bacteria sampling is recommended. A boil water advisory is recommended if any contaminants could have entered the pipe. A boil water advisory may be required if a high hazard business or high risk/vulnerable population is located in the affected area. Consult with your DNR Field Office for guidance.

Uncontrolled pipe break with a likelihood of water contamination or loss of sanitary conditions during repair: When the existing main could not be protected or kept free from contamination (such as muddy trench water flowing into the break, a leaking sewer line, catastrophic pipe failure or blowout, etc.) or when a controlled repair situation turns into a situation in which the internal pipe and water have become contaminated, then chlorination similar to that for a new main should be followed where practical. A boil water advisory, flushing, and bacterial sampling are required.

Flushing

In all situations, flushing is advised after the repairs are completed. Flushing is recommended to obtain three volumes of water turnover in the area of the repair. When the pipe has been depressurized, flushing should be at a velocity of at least 3 ft/sec or greater to scour the pipe in the area of the repair. If this is not practical, contact and consult with the DNR Field Office. In all cases, the water should be clear at the end of the flushing and normal chlorine residuals should be obtained throughout the area that was depressurized. Properly dispose of chlorinated water used for disinfection and/or flushing.

In all depressurized situations, advise customers in the impacted area to flush their internal plumbing after the repairs are completed.

In all situations, the repaired line may be returned to service immediately after flushing. In situations where the pipe has been depressurized, issuance of boil water advisories and bacteria sampling following the guidance above is required when the repaired line is returned to service.

Boil Water Advisory Situations

Pressure loss situations that may require a boil water advisory and bacterial sampling include:

- Water main breaks with controlled pipe repair with depressurization after shutdown with opening the pipe or uncontrolled pipe break with a likelihood of water contamination or loss of sanitary conditions during repair (see section above)
- No or low pressure in the distribution system and not contained (time or geographical area)
- Situations where the source(s) or treatment facilities are interrupted or unusable, including power loss situations
- Situations where a tower or storage facility has been emptied
- Pressure losses located near a contaminant source, such as near a river crossing, feedlot, co-located with a sewer line break, etc.
- Pressure losses located in an area with significant elevation differences
- Confirmed backflow or backsiphonage situation backflow or backsiphonage situation with bacterial contamination. If the backflow or backsiphonage situation is chemical or unknown, issue a "No Use" advisory instead.
- Pressure losses located in an area with the potential to create a high hazard backflow incident
- Pressure losses where a high hazard business is located in affected area (boiler, funeral home, industry, etc.)
- A situation where the minimum disinfectant residuals cannot be maintained in or around the impacted area
- Situations including high risk or vulnerable populations, such as a school, day care, hospital, nursing home, dialysis center, other medical facilities
- An inexperienced operator or individual from the water system dealing with the situation

Consult with the DNR Field Office to determine if sampling and a boil water advisory is necessary.

During normal business hours call the appropriate DNR Field Office to consult about sampling, boil water advisories, and public notice. After hours, call the 24 hour emergency response hotline. If a boil water advisory is required or recommended, determine:

- The extent and method of distribution (door hanger, hand delivery, phone, press release, Code Red or other method)
- The notification must include critical users (nursing homes, hospitals, schools, wet industries, etc.)
- The content of the notice

There is no federally mandated language for boil water advisories. Boil water advisory templates are included in Appendix 2. Consider the following when issuing a boil water advisory:

- Systems with Nitrate above 7 mg/L or Nitrite above 0.7 mg/L, must include language that infants must use an alternative source, such as bottled water, due to the potential to increase the nitrate or nitrite levels above the MCL with boiling.
- If a backflow or backsiphonage event has occurred, do not issue a boil water advisory as this will concentrate the chemical contamination. Instead, issue a “No Use” advisory.
- Determine if a water conservation advisory should be issued

The advisory must remain in place until absent (clean) bacteria sample results are received.

Bacteria Sampling

The minimum number of samples to be collected and analyzed for total coliform and chlorine residual is based on the number of service connections and the type of services in the area. See the information above for the explanation of high hazard service connections and high risk/vulnerable populations. The presence of high hazard service connections or high risk/vulnerable populations may increase the number of bacteria samples that are needed.

The number of samples is specified in the chart below for all water systems including consecutive systems (those that purchase water). For rural water systems, a minimum of 1 sample per every 5 miles of pipe depressurized is recommended. If this is not practical, consult with the DNR Field Office.

Number of Service Connections Impacted by the Depressurization	Controlled Repair with Depressurization Minimum Number of Samples Recommended*	Uncontrolled Pipe Break Minimum Number of Samples Required**
1 – 25	1	1 + 1 or 1 + 2***
26 – 50	2	2 + 2
51 – 100	3	3 + 3
101 – 500	4	4 + 4
501 – 2000	5	5 + 5
>2000	As directed by DNR	As directed by DNR

*Samples should be collected from each side of the repaired break if flow direction is uncertain/unknown or if it is a looped line. If the main is a dead-end line or a looped line that has been isolated (valve closed to force water in one direction) and flushed in one direction, then sample downstream of the repair.

****These are the minimum number of samples required from the same sample sites. Samples must be taken at least 16 hours apart.**

***If the water flow is in one direction, take 1 sample downstream of the break, then another sample at the same location at least 16 hours later. If it is a looped line and opened to flow in either direction after the repair and flushing, collect the first sample downstream of the repair and collect two samples, one on each side of the repaired break, for the second sampling event at least 16 hours after the first sample.

Chlorine residuals must be measured at the same locations in the distribution system where the bacteria samples were collected.

DNR Field Office Notification and Contact Numbers

The DNR Field Office must be notified as soon as practical but no later than 24 hours after discovery when any of the following occur:

- A boil water, bottled water, or no use advisory is issued
- A boil water, bottled water, or no use advisory is lifted
- A loss of positive pressure occurs outside the area of isolation (a main break is isolated but a pressure loss occurs outside of this area)
- There is a high risk or vulnerable population, such as a school, day care, hospital, nursing home, dialysis center, other medical facilities, in an area that has been depressurized
- More than 25% of the system is depressurized

FO1 (Manchester): 563-927-2640

FO4 (Atlantic): 712-243-1934

FO2 (Mason City): 641-424-4073

FO5 (Des Moines): 515-725-0268

FO3 (Spencer): 712-262-4177 or 712-732-8350

FO6 (Washington): 319-653-2135

After Hours Emergency Response Hotline: 515-725-8694

Documentation

A water system is encouraged to document all water main breaks or pressure losses and the actions taken in a Water Main Break Log. See Appendix 1.

Before you have a situation, develop a communication plan that includes:

- public notice templates,
- identification of critical users and their contact information,
- identification of primary contacts, partners with trusted experts, and agencies, and
- identification of your local media including contact information and after hours contact information.

See Appendix 2 for an example of a communication plan.

It is recommended that a media contact be designated prior to a situation so all communication with the media is conducted with that designated person.

Main break categories and response:

The table in appendix 3 was developed to help guide operators in determining the category of the main break and the necessary responses.

Appendix 1

WATER MAIN BREAK LOG

CALENDER YEAR: _____

Water System: _____ PWSID #: _____

Date of Incident	Time of Discovery	Length of Time Water Was Off	Location of Main Break (street/cross street/location)	Pipe Size and Type	Type of Main Break or Pressure Loss:	Boil Water Advisory and Sample Result Documentation (-Boil Water Advisory Issued -Sample Results -Comments)	DNR Notification Date, Time, and Contact
Example 3/1/2016	7:15 am	Starting at 9:45 for 50 minutes	Intersection of K and M Streets, Anytown, Iowa	6" DIP, Clamp used	<input type="checkbox"/> Controlled Repair w/out Depressurization <input checked="" type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation	-No Boil Water Advisory Issued -No Samples Taken -Water flushed and normal chlorine residuals of 0.72 free; 0.98 total	No notification
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		

Date of Incident	Time of Discovery	Length of Time Water Was Off	Location of Main Break (street/cross street/location)	Pipe Size and Type	Type of Main Break or Pressure Loss:	Boil Water Advisory and Sample Result Documentation (-Boil Water Advisory Issued -Sample Results -Comments)	DNR Notification Date, Time, and Contact
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		
					<input type="checkbox"/> Controlled Repair w/out Depressurization <input type="checkbox"/> Controlled Repair with Depressurization <input type="checkbox"/> Uncontrolled Pipe Break <input type="checkbox"/> Pressure Loss Situation		

PRESSURE LOSS COMMUNICATION PLAN

Iowa

PRIMARY CONTACTS

Name	Title	Phone	Cell Phone	Email
	Water Superintendent			
	Operator			
	Operator			
	Operator			
	Mayor			
	Councilmember			
	City Administrator			
	City Clerk			

EMERGENCY CONTACTS

Name	Title	Phone	Cell Phone	Email
	One-Call			
	DNR Emergency Hotline	515-725-8694		
	DNR Field Office			
	County Emergency Management			
	Law Enforcement			
	Fire Department			
	First Responders			
	Excavation			
	Plumber			
	Electrician			

CRITICAL CUSTOMERS

Name	Title	Phone	Cell Phone	Email
	Schools			
	Hospital			
	Doctors/Dentist Offices			
	Nursing Homes			
	Food/Beverage Plants			
	Restaurants			
	Power Plants			
	Prisons			

MEDIA CONTACTS

Name	Title	Phone	Cell Phone	Email
	Radio			
	Television			
	Newspaper			

Other

Name	Title	Phone	Cell Phone	Email
	Iowa Department of Public Health	515-281-7689		
	State Hygienic Lab	515-725-1600		
John Lins	IOWARN	515-323-6234	515-208-1993	lins@dmww.com
	Iowa Homeland Security & Emergency Management	515-725-3231		

DRINKING WATER ADVISORY

The _____ Water Supply is recommending to boil the water before using for drinking or to use an alternative source

The _____ Water Supply had a problem in the distribution system and the system lost pressure on _____. Due to the potential for bacterial contamination, it is being recommended that the water be boiled before using for drinking or cooking or that an alternative source be used. *Add information or change to specific area if impacts are limited. If the system has nitrate levels greater than 7 mg/L or nitrite levels greater than 0.7 mg/L, use the template with "alternative source" language for infants.*

IT IS RECOMMENDED NOT TO DRINK THE WATER WITHOUT BOILING IT FIRST. Bring all water to a boil, let it boil for one minute, and let it cool before using, or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, and food preparation until further notice. Boiling kills bacteria and other organisms in the water. The water may be used for bathing and other similar purposes.

For more information, please contact _____, Water Superintendent or appropriate title at _____. General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1(800) 426-4791.

When water service is restored, there may be air in your water piping and the water may be discolored. It is recommended to run the first water from a faucet that does not have an aerator screen, such as a bathtub or hose bib. Open the faucet slowly to allow the air to escape. Once the water is flowing, allow the faucet to run until it is clear. The water may be cloudy at first due to air in the water or particles that dislodged as the pipes filled with water. This should clear fairly quickly. If water is cloudy throughout the house and it does not clear after allowing the water to run for several minutes, contact the person listed above.

The system has been repaired, repressurized, and bacteria samples will be collected. This advisory is a precaution until bacterial sample results are available. You will be notified when the results are available and the advisory is lifted. Add or change to explain situation and what is being done.

The system is working with the Iowa Department of Natural Resources to resolve the situation.

This notice is being sent to you by the _____ Water Supply.

PWSID#: _____

Date distributed: _____

DRINKING WATER ADVISORY

The _____ Water Supply is recommending to boil the water before using for drinking or to use an alternative source because the water may have high levels of nitrate.

DO NOT GIVE THE WATER TO INFANTS UNDER 6 MONTHS OLD OR USE IT TO MAKE INFANT FORMULA

The _____ Water Supply had a problem in the distribution system and the system lost pressure on _____. Due to the potential for bacterial contamination, it is being recommended that the water be boiled before using for drinking or cooking or that an alternative source be used. The nitrate levels may be above the Maximum Contaminant Level (MCL). Nitrate in drinking water is a serious health concern for infants less than six months old. *Add information or change to specific area if impacts are limited.*

- **DO NOT GIVE THE WATER TO INFANTS. *Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.*** Blue baby syndrome is indicated by blueness of the skin. Symptoms in infants can develop rapidly, with health deteriorating over a period of days. If symptoms occur, seek medical attention immediately.
- Water, juice, and formula for children under six months of age should not be prepared with tap water. Bottled water or other water low in nitrates should be used for infants until further notice.
- **DO NOT BOIL THE WATER for use for infants.** Boiling, freezing, filtering, or letting water stand does not reduce the nitrate level. Excessive boiling can make the nitrates more concentrated, because nitrates remain behind when the water evaporates.
- Adults and children older than six months can drink the tap water after boiling (nitrate is a concern for infants because they can't process nitrates in the same way adults can). However, if you are pregnant or have specific health concerns, you may wish to consult your doctor.
- **For adults and children over six months of age: IT IS RECOMMENDED NOT TO DRINK THE WATER WITHOUT BOILING IT FIRST.** Bring all water to a boil, let it boil for one minute, and let it cool before using, or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, and food preparation until further notice. Boiling kills bacteria and other organisms in the water. The water may be used for bathing and other similar purposes.

For more information, please contact _____, Water Superintendent or appropriate title at _____. General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1(800) 426-4791.

When water service is restored, there may be air in your water piping and the water may be discolored. It is recommended to run the first water from a faucet that does not have an aerator screen, such as a bathtub or hose bib. Open the faucet slowly to allow the air to escape. Once the water is flowing, allow the faucet to run until it is clear. The water may be cloudy at first due to air in the water or particles that dislodged as the pipes filled with water. This should

clear fairly quickly. If water is cloudy throughout the house and it does not clear after allowing the water to run for several minutes, contact the person listed above.

The system has been repaired, repressurized, and bacteria samples will be collected. This advisory is a precaution until bacterial sample results are available. You will be notified when the results are available and the advisory is lifted. You will also be notified when the nitrate sample results are below the MCL. Add or change to explain situation and what is being done.

The system is working with the Iowa Department of Natural Resources to resolve the situation.

This notice is being sent to you by the _____ Water Supply.

PWSID#: _____

Date distributed: _____

Water Supply Boil

Water Advisory Lifted

Customers of the _____ Water Supply were notified on _____, of a pressure loss in our system and were advised to boil their water before using for drinking. We are pleased to report that the work has been completed and the bacteria samples were satisfactory (contained no bacteria). **It is no longer necessary to boil your water before use.** We apologize for any inconvenience and thank you for your patience.

You may contact water operator/city clerk/office, _____ at _____, with any comments or questions.

This notice is being sent to you by the _____ Water Supply.
PWSID#: _____
Date distributed: _____

Appendix 3: Main Break Types and Responses

Controlled Pipe Repair Without Depressurization	Controlled Pipe Repair With Depressurization After Shutdown Without Opening the Pipe	Controlled Pipe Repair with Depressurization After Shutdown With Opening of the Pipe	Uncontrolled Pipe Break with a Likelihood of Water Contamination or Loss of Sanitary Conditions During Repair
Positive pressure maintained during the break	Positive pressure maintained during the break	Positive pressure maintained during the break	Loss of pressure at the break site
Positive pressure maintained during the repair	Positive pressure maintained until controlled shut down – pressure maintained until repair site is exposed and secured, Pipe is not opened	Positive pressure maintained until controlled shut down – pressure maintained until repair site is exposed and secured, Pipe is opened	Loss of pressure during repair, uncontrolled shutdown, may be catastrophic event or failure
No signs of contamination or intrusion	No signs of contamination or intrusion	No signs of contamination or intrusion	Possible or actual contamination or intrusion
Procedures	Procedures	Procedures	Procedures
Excavate to below break	Excavate to below break	Excavate to below break	Document possible contamination
Maintain trench water level below break	Maintain trench water level below break	Maintain trench water level below break	Excavate to below break
Clean and disinfect repair site and parts	Clean and disinfect repair site and parts	Clean and disinfect repair site and parts – flush into trench to clean	Clean and disinfect repair site and parts – flush into trench to remove any contamination
Repair under pressure (clamp or sleeve)	Control shutdown – depressurize area to make the repair	Control shutdown – depressurize area to make the repair	Disinfect line if possible
Flush until water is visually clear	Flush to scour pipe with 3 pipe turnover if possible. Flush until water is visually clear	Flush to scour pipe with 3 pipe turnover if possible. Flush until water is visually clear	Flush to scour pipe with 3 pipe turnover if possible. Flush until water is visually clear
Check chlorine residuals upstream and downstream from break	Check chlorine residuals upstream and downstream from break	Check chlorine residuals upstream and downstream from break	Check chlorine residuals upstream and downstream from break
Return the line to service	Return the line to service	Return the line to service	Return the line to service
No boil water advisory	Advise customers to flush their plumbing	Advise customers to flush their plumbing	Advise customers to flush their plumbing
No bacteria sampling	No boil water advisory unless potential contamination identified	A boil water advisory is recommended	A boil water advisory is required
	No bacteria sampling unless potential contamination identified	Bacteria sampling is recommended	Bacteria sampling is required
		Lift boil water advisory after absent bacteria results	Lift boil water advisory after two consecutive sets of absent bacteria results

Notes: Consult with your DNR Field Office with any questions.

The DNR Field Office must be notified when an advisory is issued or lifted.