

Backflow Prevention & Cross-Connection Control Field Investigations

Emergency Response Plan Backflow Contamination Event

Summary:

This document describes protocol and procedures used to respond to any actual or potential contamination of the distribution system due to backflow, backpressure, or a direct cross connection.

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Overview:

For public water systems in the state of Colorado the term *backflow contamination event* means backflow into a public water system from an uncontrolled cross connection such that the water quality no longer meets the Colorado Primary Drinking Water Regulations (Regulation 11) or presents an immediate health and/or safety risk to the public. If a supplier of water learns of a suspected or confirmed backflow contamination event, the supplier must notify and consult with the Colorado Department of Public Health and Environment (department) on any appropriate corrective measures no later than 24 hours after learning of the backflow contamination event. While specific information relative to backflow prevention & cross-connection control (BPCCC) can be found in Regulation 11, an exact method to handle backflow contamination events is not identified in the regulation. The following document will describe protocol and procedures to contain a backflow contamination event. Procedure and terminology from the National Incident Management System (NIMS) has been incorporated for ease of use.

Terminology:

- *Backflow* - the reverse flow of water, fluid, or gas caused by back pressure or back siphonage.
- *Backflow Contamination Event* - backflow into a public water system from an uncontrolled cross connection such that the water quality no longer meets the Colorado Primary Drinking Water Regulations (Regulation 11) or presents an immediate health and/or safety risk to the public.
- *Backflow Prevention Assembly* - any mechanical assembly installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the mechanical assembly is appropriate for the identified contaminant at the cross connection and is an in-line field-testable assembly.
- *Backflow Prevention Method* - any method and/or non-testable device installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the method or non-testable device is appropriate for the identified contaminant at the cross connection.
- *Back pressure* - hydraulic event by which water is forced back into the supply source
- *Back siphonage* - hydraulic event by which water is siphoned back into the supply source
- *Containment* - the installation of a backflow prevention assembly or a backflow prevention method at any connection to the public water system that supplies an auxiliary water system, location, facility, or area such that backflow from a cross connection into the public water system is prevented. Generally located after the meter but before any other connection.
- *Contaminant* - Any physical, chemical, biological, or radiological substance or matter in water such that the water quality no longer meets the Colorado Primary Drinking Water Regulations (Regulation 11) or presents an immediate health and/or safety risk to the public.
- *Cross Connection* - any connection that could allow any water, fluid, or gas such that the water quality could present an unacceptable health and/or safety risk to the public, to flow from any pipe, plumbing fixture, or a customer's water system into a public water system's distribution system or any other part of the public water system through backflow.
- *Unacceptable Health and/or Safety Risk* - Can be biological, chemical, radiological or physical in nature. Risks to human health are assessed by the level of acute or toxic potential. An example safety risk from cross connections includes risks of injury from explosion when a natural gas cross connection has occurred.
- ICS - Incident Command System
- Pollutant - Any substance which is a non-toxic ascetic concern.
- *Water Supply System* - A water distribution system, piping, connection fittings, valves and appurtenances within a building, structure, or premises. Water supply systems are also referred to commonly as premise plumbing systems.

Emergency Response Levels:

For more information and/or terminology for ICS please consult the following website:

<https://training.fema.gov/nims/> or

<https://www.osha.gov/SLTC/emergencypreparedness/gettingstarted.html>

For training on ICS & NIMS please consult the following website:

<https://www.fema.gov/nims-frequently-asked-questions>

- **LEVEL 1: NORMAL** (Routine - ICS not enacted)
Personnel and equipment presently on duty can handle system problems. The "Emergency Command Center" not activated or manned.
- **LEVEL 2: ALERT** (Minor Emergency - ICS enacted)
Personnel and equipment presently on duty can handle system problems, but may require off duty or additional personnel to be put on alert, be re-routed to other than their normal working areas, or work additional shifts. The "Emergency Command Center" activated and manned.
- **LEVEL 3: MAJOR EMERGENCY** (Significant Portions of a City's Distribution System Affected) Problems are somewhat beyond the capabilities of the drinking water system personnel, equipment or supplies (disinfection trailers, pressure washers, prepackaged drinking water, chlorine, etc.), and may require a "Declaration of Emergency" to authorize expedited procedures. Requires employees to work additional shifts and may need additional assistance of personnel and equipment, either by mutual aid or private contracts. The "Emergency Command Center" activated and manned.
- **LEVEL 4: DISASTER** (Entire City's Distribution System Effected/ Potentially Effected). Problems are clearly and immediately beyond the capability of the drinking water system. Recovery time will exceed one week, costs will be great, large amounts of assistance of personnel and equipment by mutual aid or private contracts will be required, extended shifts will be needed for at least one week. A "Declaration of Emergency" will be required; the "Emergency Command Center" activated and manned.

Initial Evaluation:

Different responses may be needed depending on who first identified the potential cross-connection and the potential for backflow/ backpressure. The first responder may be a: backflow tester, sampler, water quality field investigator, operator, or BPCCC program staff.

MAP: If you are in the field you may not have access to a map of the location and it may not be immediately necessary to have one. However, if your initial evaluation uncovers a severe problem you will need to obtain or have contact with someone with a map. The map should allow you to verify valves, hydrants, water mains and other distribution system concerns such as pressure zones.

These initial questions need to be identified and evaluated:

- **Is there an active contamination event? What is the source of the contamination?**
- **Is there any corresponding work in the area that could be impacting water quality (line flushing, main breaks, construction work)? Were there any changes in water quality at the treatment plant?**
- **Is the backflow contamination event still occurring or has the potential to occur again?**
- **Is the cross-connection aesthetic or toxic? What is it?**
- **Has public health or safety been impacted or put in risk? Do consumers need to be notified?**
- **Has the cross-connection been contained? Does the impacted property have a backflow prevention assembly or method?**
- **What is the affected area?**
- **What is the suppliers sampling protocol? What parameters are sampled for: chlorine residual, total coliform & fecal coliform (BacT's), organics, inorganics?**
- **Does the department need to be notified? Are there other specific reporting requirements for this hazard?**
- **What is the appropriate Level of response? Does the ICS need to be activated?**

If the toxic substance is contained and/or the water quality issue is confirmed to be non-toxic the response may be considered **Level 1** and appropriate parties may be contacted to resolve the issue (i.e. remove/control cross connection, appropriately flush and dispose of contaminated material). This generally applies to events contained to single properties with minimal employees and no public access. If the contamination event has spread to any outlying areas or where large numbers of employees and/or the public may be affected the response may be escalated to a **Level 2**. If the contamination has reached the public water system the response should be escalated to a **Level 2**.

If there is a toxic substance that is uncontained or if some or any of these questions is unknown the cross-connection should be assumed to be uncontrolled and potentially toxic. The response should be immediately elevated to **Level 2** status whereby the Emergency Communications Center (ECC) is activated and personnel are put on alert. It is unlikely a **LEVEL 3** or **LEVEL 4** Response will be limited to a single property; contamination of the distribution system and multiple properties is probable.

LEVEL 1 RESPONSE - (Single Property & No Threat to the Distribution System)

INCIDENT COMMAND: Staff essentially acting as the incident commander, although the Incident Command System is not activated at this level.

SITUATION: Investigating a backflow - contamination event at one facility; one meter; internal event, contained to one property.

EVALUATION & IMMEDIATE RESPONSE:

I. Determine ownership; confirm event is in your jurisdiction

- Confirm that backflow contamination event occurred or is suspected to have occurred?
- Is there a backflow prevention assembly or method that contains the contamination event?
 - If there is no containment of the contamination event and the public water system could be impacted must elevate to Level 2 Response.
- What type of backflow prevention assembly/method? Is the assembly/method appropriate for the identified contaminant?
- When was the last date the assembly was tested or the last date that the method was inspected?
 - Confirm the tester name, company name, and phone numbers of the parties who last tested the backflow prevention assembly.
- What is the contaminant(s)?
 - What is the toxicity of the contaminant?
 - Are there MSDS sheets available? Trade names?
 - If the toxicity is unknown assume that the contaminant may be toxic.
- Are design maps available for the affected building/ properties water supply system?
- Establish any necessary contact & identify potentially responsible party.
- Record property name address, phone numbers, email.
- Are the building/property occupants aware that the water from the water supply system may not be safe to drink?
 - If the answer is no, notify the property owner and occupants that the water may not be safe to drink. Propose that the facility put up temporary signs to notify occupants at high traffic areas and areas where they may come into contact with the water (entry ways, bathrooms, drinking fountains, breakrooms, kitchen, living spaces, etc.)

II. Is the backflow contamination event ongoing (active) or has it stopped?

- If it's active can it be stopped?
- Is there a backpressure or backsiphonage condition occurring?
- Determine if the contamination event is contained:
 - The public water system will need to determine
 - If the backflow prevention assembly used to protect the water system is appropriate for the identified contaminant and the assembly has been tested within the last year or,
 - if the backflow prevention method used to protect the water system is appropriate for the identified contaminant and the assembly has been tested within the last year,
 - If the assembly or method being used to contain the event has not been tested or inspected in the last year the water system should take

steps to ensure that the assembly is tested or that the method is inspected immediately.

- If the public water system determines that the assembly or method have failed the public water system could be impacted and must elevate to Level 2 Response.
- Perform water quality sampling of the distribution system to verify that it has not been impacted, evaluate against standard chlorine residual, temp, pH, conductivity, etc. Compare to results of the impacted water supply system.
- If the public water system determines that contamination event has been contained to the building/ property and that the public water system has not been impacted the supplier should notify the local and state health departments. The local and state health departments will take action to ensure that the building occupants are safe.

III. Coordinate with other sections as needed and determine public water system response

- If the contamination event has not impacted the public water system because the event is contained appropriately the public water system will need to determine its role moving forward. Some public water systems will choose to assist property owners throughout this process while others will be more hands off.
 - For public water systems that provide more assistance:
 - Put on-call staff and resources on notice.
 - Inform the Public Information Officer about the given event.
 - Contact dispatch as needed.
 - Contact Local and State Health Departments.
 - Collect additional water quality samples.
 - Advise property owners to contract with water professionals, plumbers, engineers, etc., to remedy the situation and notify owner of actions that may need to be taken such as flushing of the water supply system and appropriate disposal of the contaminated water and to perform water quality sampling to ensure that water is safe to drink after mediation activities have been performed.
 - For public water systems that provide less assistance:
 - Inform the Public Information Officer about the given event.
 - Contact Local and State Health Departments.
 - Advise property owners to contract with water professionals, plumbers, engineers, etc., to remedy the situation and notify owner of actions that may need to be taken such as flushing of the water supply system and appropriate disposal of the contaminated water and to perform water quality sampling to ensure that water is safe to drink after mediation activities have been performed.

LEVEL 2 RESPONSE - (Single Property & Threat to the Distribution System)

INCIDENT COMMAND: You may be the Incident Commander throughout the process or may relinquish your duties to a supervisor depending on your experience and title.

SITUATION: Investigating a backflow event at 1 facility; 1 meter; internal event which threatens the Distribution System either by degree of hazard or lack of ability to contain the contaminant.

EVALUATION & IMMEDIATE RESPONSE:

I. Determine ownership; confirm event is in your jurisdiction

- Confirm that backflow contamination event occurred or is suspected to have occurred?
- Is there a backflow prevention assembly or method that contains the contamination event?
 - If there is no containment of the contamination event and the public water system could be impacted the system must contact the Colorado Department of Public Health and Environment.
- What type of backflow prevention assembly/method? Is the assembly/method appropriate for the identified contaminant? When was the last date the assembly was tested or the last date that the method was inspected?
 - Confirm the tester name, company name, and phone numbers of the parties who last tested the backflow prevention assembly.
 - If the assembly or method being used to contain the event has not been tested or inspected in the last year the water system should take steps to ensure that the assembly is tested or that the method is inspected immediately and contact the system must contact the Colorado Department of Public Health and Environment.
 - If the assembly/method has failed there is no containment of the contamination event and the public water system could be impacted the system must contact the Colorado Department of Public Health and Environment.
- What is the contaminant(s)?
 - What is the toxicity of the contaminant?
 - Are there MSDS sheets available? Trade names?
 - If the toxicity is unknown assume that the contaminant may be toxic.
- Are design maps available for the affected building/ properties water supply system and the public water distribution system?
- Establish any necessary contact & identify potentially responsible party.
- Record property name address, phone numbers, email.
- Are the building/property occupants aware that the water from the water supply system may not be safe to drink?
 - If the answer is no, notify the property owner and occupants that the water may not be safe to drink. Propose that the facility put up temporary signs to notify occupants at high traffic areas and areas where they may come into contact with the water (entry ways, bathrooms, drinking fountains, breakrooms, kitchen, living spaces, etc.)

II. Is the backflow contamination event ongoing (active) or has it stopped and has it impacted the public water system?

- If it's active can it be stopped?
- Can the public water system suspend service to the impacted building/area?
- Can the property owner isolate the impacted area?
- Is there a backpressure or backsiphonage condition occurring?
- Determine if the impact of the contamination event to the public water system:
 - Perform water quality sampling of the distribution system evaluate potential impact, evaluate against standard chlorine residual, temp, pH, conductivity, bacteriological, known chemicals that have been introduced, SOC, VOCs, and radionuclides as appropriate, etc. Compare to results of the impacted water supply system.
 - Provide results to appropriate staff and health departments.

III. Coordinate with other sections as needed and determine public water system response

- If the contamination event has impacted the public water system the event is not contained appropriately the public water system will need to determine its role moving forward. The public water systems will need to:
 - Put on-call staff and resources on notice.
 - Inform the Public Information Officer about the given event.
 - Contact dispatch as needed.
 - Contact Local and State Health Departments. If the event is non-toxic in nature (food grade chemical, dairy products, etc.) health department needs to be contacted but notification and response procedures could be different.
 - Begin potential public notification procedures public that water may be unsafe to drink. Door to Door. If system wide notification is needed this response may need to be elevated to a Level 3 Response.
 - Determine and delegate anticipated staff resources.
 - Identify water quality sample parameters and analytical laboratories.
 - Identify impacted pressure zone or impacted areas.
 - Determine if potentially impacted area can be isolated from the rest of the distribution system via main valves and pressure zones. If not possible response may be elevated to a Level 3 Response.
 - Establish potential safety parameters that may need to be taken.
 - Establish sampling perimeter and collect additional water quality samples.
 - Advise property owners to contract with water professionals, plumbers, engineers, etc., to remedy the situation and notify owner of actions that may need to be taken such as flushing of the water supply system and appropriate disposal of the contaminated water and to perform water quality sampling to ensure that water is safe to drink after mediation activities have been performed.
 - Determine appropriate flushing protocol and waste disposal practices for contaminated water. Contaminated water may not be received by the local waste water treatment plant. Coordinate appropriately.
 - Is the contaminant a hazardous substance? Follow all appropriate HAZMAT requirements as needed.

LEVEL 3 RESPONSE – Major Toxic Contamination of the Distribution System

INCIDENT COMMAND: You may be the initial Incident Commander but will be turning responsibility over to new Incident Commanders as they arrive on the scene. CDPHE will need to be contacted and may assist with emergency response procedures.

SITUATION: Investigating a backflow event 1) Which has affected a significant portion of the distribution system 2) Which is so significant that (regardless of size) requires multiple resources.

EVALUATION & IMMEDIATE RESPONSE:

I. Determine ownership; confirm event is in your jurisdiction

- Confirm that backflow contamination event occurred or is suspected to have occurred and has impacted the public water system?
- Contact the Colorado Department of Public Health and Environment.
- What is the contaminant(s)?
 - What is the toxicity of the contaminant?
 - Are there MSDS sheets available? Trade names?
 - If the toxicity is unknown assume that the contaminant may be toxic.
- Are design maps available for the affected building/ properties water supply system and the public water distribution system?
- Establish any necessary contact & identify potentially responsible party.
- Record property name address, phone numbers, email.
- Are the building/property occupants aware that the water from the water supply system may not be safe to drink?
 - If the answer is no, notify the property owner and occupants that the water may not be safe to drink. Propose that the facility put up temporary signs to notify occupants at high traffic areas and areas where they may come into contact with the water (entry ways, bathrooms, drinking fountains, breakrooms, kitchen, living spaces, etc.)

II. Is the backflow contamination event ongoing (active) or has it stopped?

- If it's active can it be stopped?
- Can the public water system suspend service to the impacted buildings/areas?
- Can the property owners isolate the impacted areas?
- Is there a backpressure or backsiphonage condition occurring?
- Determine if the impact of the contamination event to the public water system:
 - Perform water quality sampling of the distribution system evaluate potential impact, evaluate against standard chlorine residual, temp, pH, conductivity, bacteriological, known chemicals that have been introduced, SOC, VOCs, and radionuclides as appropriate, etc. Compare to results of the impacted water supply system.
 - Provide results to appropriate staff and health departments.

III. Coordinate with other sections as needed and determine public water system response

- If the contamination event has impacted the public water system the event is not contained

appropriately the public water system will need to determine its role moving forward. The public water systems will need to:

- Put on-call staff and resources on notice.
- Inform the Public Information Officer about the given event.
- Contact dispatch as needed.
- Contact Local and State Health Departments.
- Begin potential public notification procedures public that water may be unsafe to drink. Door-to-Door, media, social, media, road signs, reverse 911, emails, etc.
- Determine and delegate anticipated staff resources.
- Determine is supplier would like to activate COWARN Emergency response procedures.
- Identify water quality sample parameters and analytical laboratories.
- Identify impacted pressure zone or impacted areas.
- Determine if potentially impacted area can be isolated from the rest of the distribution system via main valves and pressure zones.
- Establish potential safety parameters that may need to be taken.
- Establish sampling perimeter and collect additional water quality samples.
- Advise property owners to contract with water professionals, plumbers, engineers, etc., to remedy the situation and notify owner of actions that may need to be taken such as flushing of the water supply system and appropriate disposal of the contaminated water and to perform water quality sampling to ensure that water is safe to drink after mediation activities have been performed.
- Determine appropriate flushing protocol and waste disposal practices for contaminated water. Contaminated water may not be received by the local waste water treatment plant. Coordinate appropriately.
- Is the contaminant a hazardous substance? Follow all appropriate HAZMAT requirements as needed.
- Consult Emergency Response Plan and evaluate additionally impacted parameters:
 - Bottled water/ boil water advisory procedures,
 - Fire protection,
 - Sensitive populations,
 - Medical needs,
 - Response action for potential contact with contaminated water,
 - Notify hospitals that public may be impacted.

LEVEL 4 RESPONSE - Total Contamination of the Distribution System:

INCIDENT COMMAND: You may be the initial Incident Commander but will be turning responsibility over to new Incident Commanders as they arrive on the scene. CDPHE will need to be contacted and may assist with emergency response procedures. Other State or Federal assistance may be required (may assume the position of Incident Commander).

SITUATION: Complete disaster where a backflow event is threatening to contaminate or has contaminated the entire distribution system.

EVALUATION & IMMEDIATE RESPONSE: See Level 3 Response Protocol

Consult Your Water System's Emergency Response Plan

Aid from COWARN will likely be needed:

<http://www.cowarn.org/>

Water Quality Procedure:

These procedures apply to the WQ staff which may include cross-connection control staff.

Always collect a bacteria sample in the event that it is needed. These samples will need to be properly collected and stored in a container with ice. If a hazardous substance is known and/or suspected additional samples may need to be collected for laboratories testing purposes. This determination should be made by the incident commander with the aid of specialists and management. If unsure, it is best to collect more samples than necessary.

Follow all applicable provisions of the Safe Drinking Water Act and Regulation 11. At minimum water quality parameters should be taken to include:

- Chlorine
 - Determine chlorine demand in mg/L.
- pH
 - Simple and effective indicator of potential change in water quality and determine if water is acidic or basic.
- Temperature
 - Determine if the water temperature is normal for the distribution system.
- Conductivity
 - Determine electrical conductance of the water.
- Turbidity
 - Determine the total suspended solids in the water based on refracted light.

Some test procedures are more time consuming therefore Chlorine, Temperature, and Conductivity are recommended as quick indicators of the water quality. All safety concerns should be addressed prior to sampling. If hazardous materials or any other hazards are present, safety precautions will be required.

Secondary Evaluation:

Once the event has been contained and managed a secondary evaluation will be needed:

BACKFLOW SECONDARY EVALUATION REQUIREMENTS:

- Require installation and/or testing of a backflow prevention assembly or method
 - Multiple assemblies may be required.
- Suspension of water service to a property may be needed.
- Coordination with other departments/ sections may be required to confirm compliance.
- Be sure each department/ section involved has no further issues to rectify.
- Make sure customer information has been updated as needed.
- Make sure property information including all necessary maps, meters, backflow prevention assembly information has been updated and recorded as needed.
- If water service was suspended restoration of service may be needed.
- Ensure that customers are properly educated such that similar backflow events may be avoided.
- Facility damage assessment.
- Prioritize work/repair as needed.
- Recovery checklist.

Ongoing Concerns

- Does this location need to be made into a water quality distribution sample site?
- Does this location need to be monitored in any other way?
- Does the customer/ user understand their testing and/or installation requirements?
- Does the customer need any ongoing education?