



# Backflow Incidents That Could Have Been Prevented

LEARN FROM 15 REAL-LIFE BACKFLOW CASE STUDIES

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## Protecting the Safe Water Standard

As a water professional, you are on the front line, tasked with ensuring that the potable water that flows from your customers' faucets is safe for consumption. Doing your job well requires that you understand the many risks to safe drinking water, including backflow.

To help you understand how backflow incidents can contaminate drinking water, this e-book presents examples of actual backflow incidents that lacked effective prevention measures. These summaries describe a variety of backflow incidents that occurred despite strict regulations, explain why they happened and how they were resolved, and show how they affected individuals, communities, and plumbing professionals.

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It is our  
responsibility  
as water  
professionals  
to maintain  
standards  
and continue  
to provide  
communities  
with safe,  
potable water.

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## Backflow Contamination in Palm Beach County Drinking Water

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The Palm Beach County Health Department issued a notice of violation against the city of Boca Raton for long-standing problems with the city's drinking water, including the presence of fecal matter. The notice demanded immediate corrective action on four major problems: inadequate cross-contamination safeguards in place to prevent wastewater from entering drinking water, an issue the city had been aware of since 2006; an illegal chemical injection system that had been hooked up to city water lines for eight years; the reconnection of disinfected wells to city lines without adequate microbiological surveys to ensure removal of harmful contaminants; and failure to conduct thorough tests for the presence of lead and copper in water lines.

*Sources: [www.abpa.org](http://www.abpa.org), [www.peer.org](http://www.peer.org)*

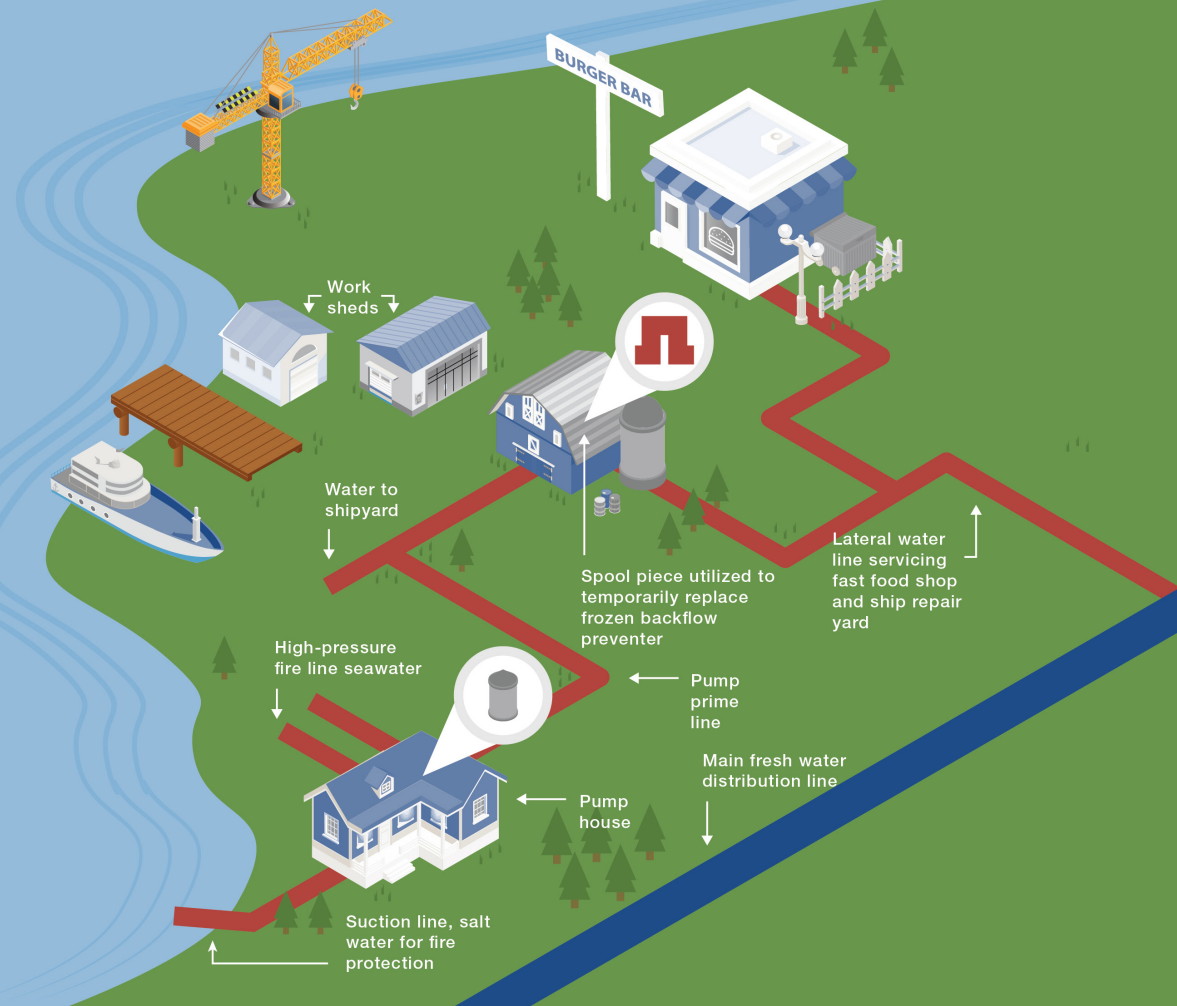
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# Backflow Causes Restaurant to Serve Seawater

NORFOLK



VIRGINIA



## Backflow Causes Restaurant to Serve Seawater

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On January 29, 1981, a nationally renowned fast food restaurant in Norfolk, Virginia complained to the Water Department that customers were rejecting all drinks—including soda-fountain beverages, coffee, and orange juice—because of a salty taste.

A check with adjacent water customers revealed another complaint of salty water from a nearby waterfront ship-repair facility. Both the restaurant and the shipyard were served from the same water-main lateral, which stemmed from the main distribution line. Officials promptly conducted a cross-connection control inspection of the ship-repair facility and revealed the following details:

- The backflow preventer installed on the service line to the shipyard had frozen and burst earlier in the winter. It had been removed and replaced by a sleeve in order to maintain the water supply to the shipyard, thereby eliminating all protection against backflow.
- The shipyard fire protection system consisted of high-pressure seawater maintained by both electric and diesel-driven pumps.
- The pumps were primed through the use of a city water line, which was directly connected to the high-

pressure fire system. With the priming line left open and the first service pumps maintaining high pressure in the fire-service lines, raw salt water was being pumped under positive backpressure through the sleeve into the public water-distribution system.

To correct the problem, the city-water prime line to the pumps was removed and a new backflow preventer was promptly installed at the service line in place of the sleeve. To prevent future freeze-ups, heat tape was wrapped around the backflow preventer.

*Sources: U.S. Environmental Protection Agency, Cross-Connection Control Manual, 1989*

## Glycol Contaminates School Water in Kentucky

The absence of a backflow prevention system at an elementary school in Bowling Green, Kentucky allowed glycol, a chemical used in the HVAC system, to enter the drinking water. When a contracting company attempted to pump water from the potable supply into geothermal pipes, pressure caused backflow of a small amount of chemicals into the drinking water. School officials urged students to watch for symptoms and seek medical attention if necessary. To keep the drinking water safe in the future, workers installed a backflow preventer on the HVAC system lines.

*Source: Bowling Green Daily News*

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## Meat Contamination at a Packing Plant

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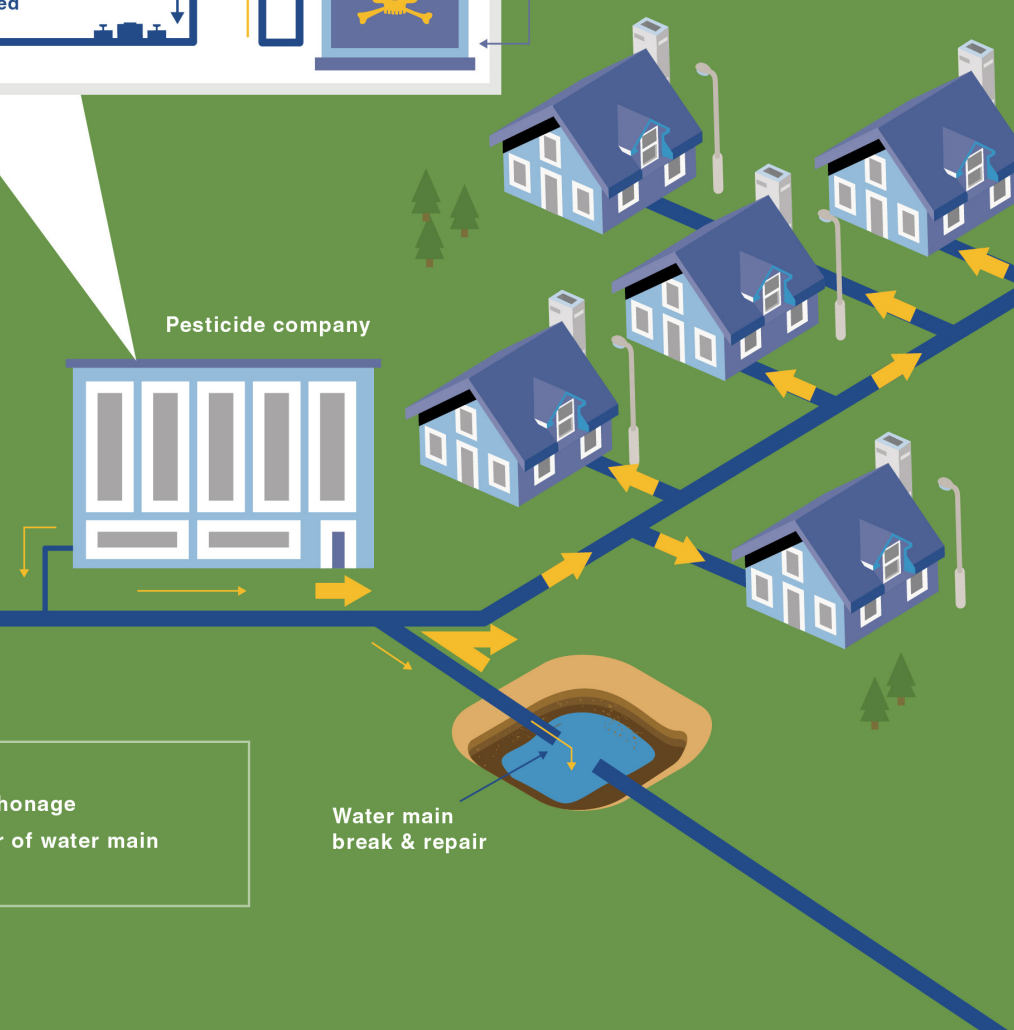
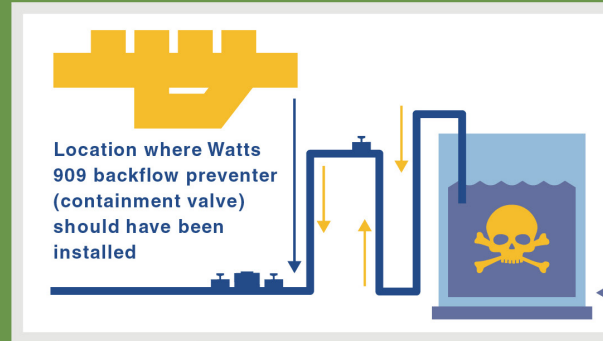
In a meat packing plant in Marshalltown, Iowa, \$2 million of pork was contaminated by waste water when the wrong pipe was hooked up to a newly drilled well. Plant employees unwittingly sprayed contaminated water on hog carcasses and cuttings during the cleaning process. Sewage water from the kill floor and water used to deodorize rendering operations entered the potable water line due to a cross-connection, concluded food safety and quality service officials.

The plant subsequently installed, tested, and maintained backflow preventers—spending more than \$3 million resolving the problem and leaving 200 people temporarily out of work.

*Source: Food Chemical News*

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# Pesticide Discovered in Water Supply of 63 Homes



KEY

- ← Flow of pesticide during backsiphonage
- ← Flow of pesticide following repair of water main



## Pesticide Discovered in Water Supply of 63 Homes

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A pesticide used for termite control was found in the water supply of a northern New Jersey municipality, leaving 63 homes without water. A construction crew inadvertently broke a water main while widening a bridge, and in the two hours it took to repair the break, pest-control chemicals back-siphoned from a pesticide company into the water main. Several hours after workers repaired the

water main break, a customer called the Water Department to complain that the water was milky and smelled bad.

Officials immediately cut off the water supply to the 63 affected homes and notified them not to drink the water or use it to cook, bathe, or wash clothes. The pesticides (including Dursban, chlordane, heptachlor, and lindane) are not harmful in small doses; however, ingestion of

moderate doses triggers vomiting, and large doses cause breathing difficulties—which can be life-threatening.

Officials arranged for a tank truck with potable water to be parked in the affected block, and made available shower facilities at the local public schools. Officials then flushed and super-chlorinated the affected water pipes.

*Source: Drinking Water & Backflow Prevention, Volume 5 Number 3 (March 1988)*

## Backpressure Incident in New England Town

As workers at a gas company used water from a private hydrant to purge a tank of propane, they failed to notice that the pressure in the tank (85-90 psi) was greater than the pressure in the water line (65-70 psi). As a result, backpressure backflow pushed propane vapor into the water lines for an estimated 20 minutes—enough gas to fill a mile of an eight-inch water main. The propane contaminated the town water supply, forced 500 people from their homes, and caused fires in two houses.

*Source: The Eagle-Tribune (Lawrence, MA)*

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## Clinic Suffers Backflow Contamination

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A bitter taste and strong chemical odor in the water supply led a North Carolina clinic to contact the Wilson Water Distribution Division. Upon investigation, officials determined the source of the problem was a garden hose connected to a hose bibb that did not have a vacuum breaker in place. The garden hose had been used to add water to the clinic's x-ray development chemical mixer. Submerging the garden hose in the chemical mixer without a vacuum breaker on the hose bibb

created an indirect cross-connection, causing X-ray developer and fixer chemicals to enter the drinking water.

City Water Distribution Division employees worked with a contractor to cut a section from the eight-inch-diameter water main and replace a leaking tapping sleeve with a tee. Negative pressure had caused the chemicals in the mixer to be back-siphoned through the garden hose, contaminating the clinic's water supply.

*Source: Pacific Northwest Section of the American Water Works Association, Summary of Backflow Incidents*

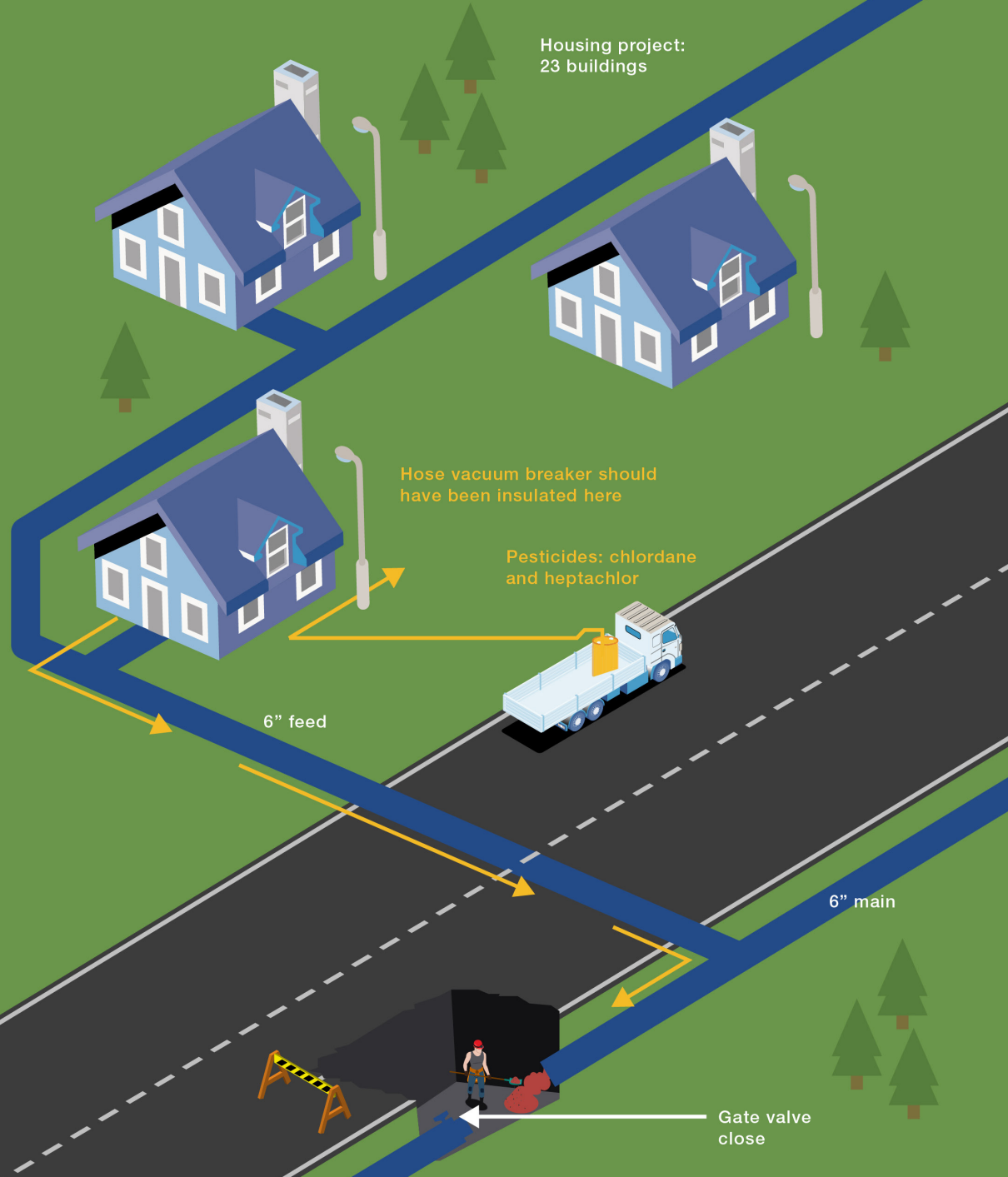
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# Insecticide Pollutes Community Drinking Water

PITTSBURGH



PENNSYLVANIA



## Insecticide Pollutes Community Drinking Water

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A serious backflow incident forced the Allegheny County Housing Authority in Pittsburgh, Pennsylvania to spend approximately \$300,000 to replace the plumbing piping (both inside and outside) of Groveton Village, a large development in Robinson Township. The neighborhood consisted of 23 buildings, each with four apartments, owned and operated by the Housing Authority.

Insecticide contaminated the potable water supply and made the piping unserviceable. Chemical tests showed that the toxic chemicals chlordane and heptachlor, which have been banned from agricultural use since 1976, entered the potable water supply as the result of a cross-connection.

The insecticide contaminated the water supply system when an extermination company applied it as a preventative measure against termites. A pesticide contractor used water from a garden hose to mix chlordane and heptachlor in a tank truck; the end of the hose was submerged in the chemicals while the water lines to the area were being drained. A backsiphonage condition arose when a plumber cut into a main line to put in a gate valve and the water started to drain, because the drainage point was downstream of the tank truck. Consequently, an indeterminate amount of chemicals were siphoned out of the truck and fed into the system.

The insecticide contaminated the water service to 75 apartments, which housed about 300 people. After repeated efforts to clean and flush the lines, the Housing Authority ultimately decided to replace the water line and all affected plumbing.

There were no reports of illness; however, the Housing Authority told residents of Groveton Village not to use tap water for any purpose. Instead, volunteer fire department personnel trucked clean water into the area. The Groveton Village residents were without water for 27 days.

*Source: Stop Backflow News*

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## Family Wins Lawsuit Over Drinking Water Connected to Sewer Line

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A city employee discovered a cross-connection between water and sewer lines during a routine inspection of a Colorado family's home. After the employee reported the issue, the county's Water and Sanitation District shut off the family's water supply. The District learned that a local water treatment company was installing water softeners in homes without the proper permits, notified the company it had 30 days to rectify the issue, and informed its customers of the discovery. The Colorado family then sued the water treatment company and won.

*Source: Commerce City News*

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## Fire Foam Contaminates Water Supply

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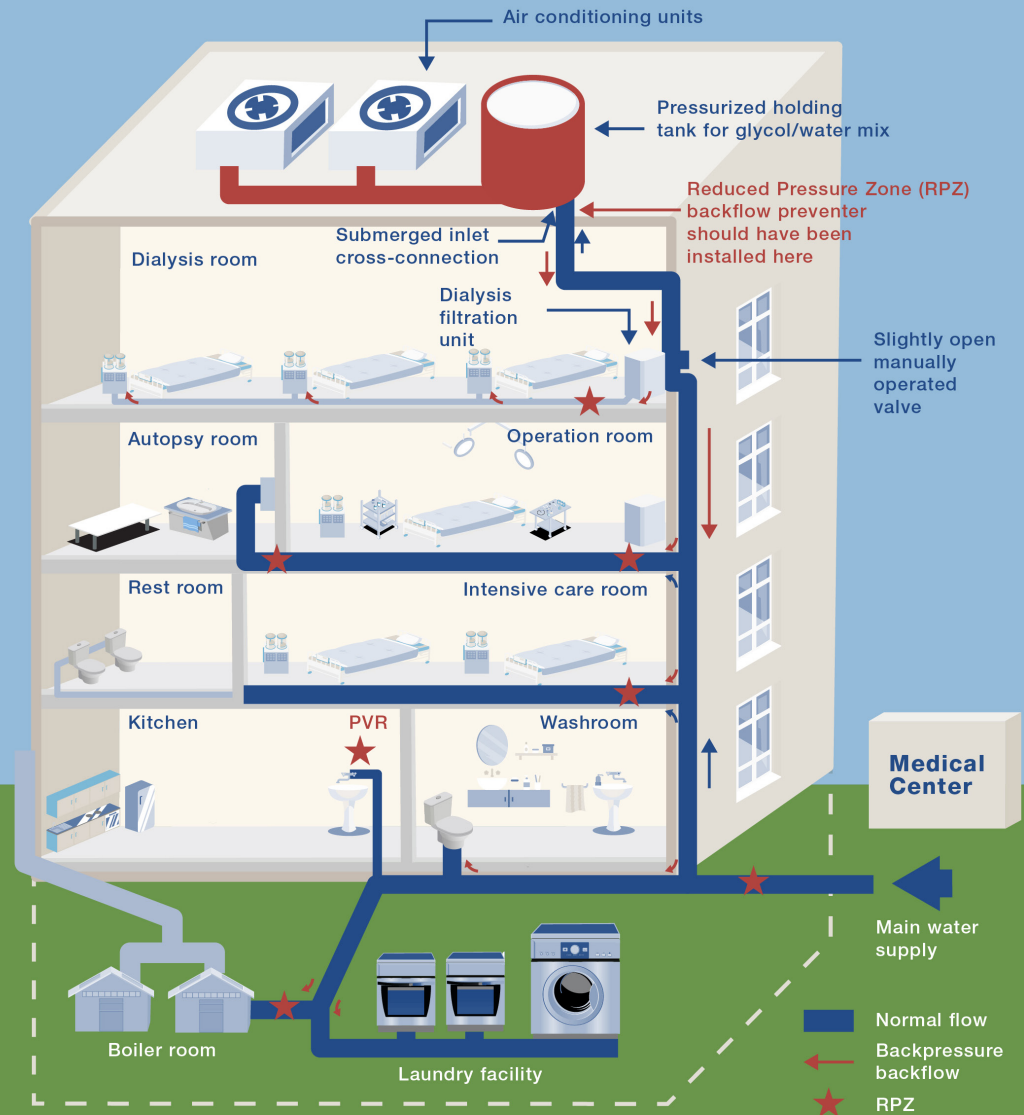
**A**s firefighters worked to extinguish a burning warehouse in Pittsburgh, two pumper trucks connected to fire hydrants experienced backpressure backflow. The trucks' lines overwhelmed drinking water lines, pushing fire-suppression foam into the local water system. Callers complained about soapy-looking water. The biodegradable foam can irritate skin and eyes, but does not pose a health threat when less than an ounce is ingested. The Pittsburgh Water and Sewer Authority advised people downtown and in the Strip District not to use water for several hours, until the foam could be flushed from the system.

*Source: Pittsburgh Tribune Review*

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# Dialysis Machines Accidentally Contaminated With Anti-Freeze

THE MIDWEST





## Dialysis Machines Accidentally Contaminated With Anti-Freeze

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A coroner's jury ruled that the accidental contamination of renal dialysis machines at a large medical center in the Midwest was a "significant condition" in the deaths of two patients. However, this same jury stated that "after listening to several doctors and pathologists, the jury unanimously agrees that the ethylene glycol contaminant did not contribute to the death of either man." In spite of this confusion, the fact is that the deceased were two of six patients who underwent dialysis at the medical center. One patient died the following day and the other died 16 days later.

Ethylene glycol entered the dialysis equipment through a series of events triggered by a valve being left slightly open. The open valve permitted water to flow into a holding tank used to replenish a mix of glycol and water to the air conditioning system. Glycol is customarily used in air conditioning water to keep it from freezing in cold weather. With the valve partially open, water continually flowed slowly into the holding tank until the pressure

in the closed tank equaled the pressure in the water supply system—a dangerous situation.

As long as the supply pressure did not decrease in the line with the valve partially open, no backpressure flow would occur. However, if the supply pressure dropped for any reason, the hospital's potable supply lines would be contaminated with the glycol-water mix (as a result of the cross-connection at the holding tank combined with backpressure backflow).

Investigators theorized that someone in the medical center flushed a toilet or turned on a faucet, which dropped the pressure in the water pipes and allowed the glycol-water mixture to drain out of the holding tank and into the medical center's water pipes. Consequently, the contaminated water entered the dialysis filtration system used to purify water for the dialysis machines. This filtration system takes out trace chemicals, such as those used at the city water treatment plant; however, the system could not handle the sudden heavy load of chemicals.

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## Dialysis Machines Accidentally Contaminated With Anti-Freeze

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The effect on the dialysis patients was dramatic. Patients became drowsy and confused, and some fell unconscious. All were moved promptly to intensive care, where their blood samples revealed a buildup of acid. The patients underwent dialysis a second and third time, while investigators worked to determine the cause of the problem.

Tests of the water supply to the dialysis filtration system confirmed the presence of “an undesirable chemical in the water purification system.” Investigators located the defective valve that had

permitted the glycol-water mix to drain from the holding tank into the dialysis filtration system.

If the water supply to the glycol tank had been air-gapped or protected with a reduced pressure principle backflow preventer, the dialysis machines would not have been contaminated. This incident highlights the need for hydraulic containment of hazardous areas in hospitals and medical centers. Mortuary rooms, autopsy rooms, laundry rooms, boiler rooms, air conditioning units, and pharmacy rooms should all be isolated and contained with the use of backflow preventers on their potable supply lines.

*Source: Stop Backflow News*

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## Pink Water in Louisiana

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A homeowner in the village of Palmetto, Louisiana installed a water softener but failed to set up a backflow preventer, allowing chemicals to enter the water supply. As a result, the village's water turned pink. Officials sent five samples from different water sources in the village to the Department of Health and Hospitals. They also ordered residents not to use their water supply, including for drinking, bathing, or cooking. Two containers filled with water were stationed at the village's hall for residents to fill jugs, and the do-not-use water advisory persisted for two full days.

*Source: KLFY News*

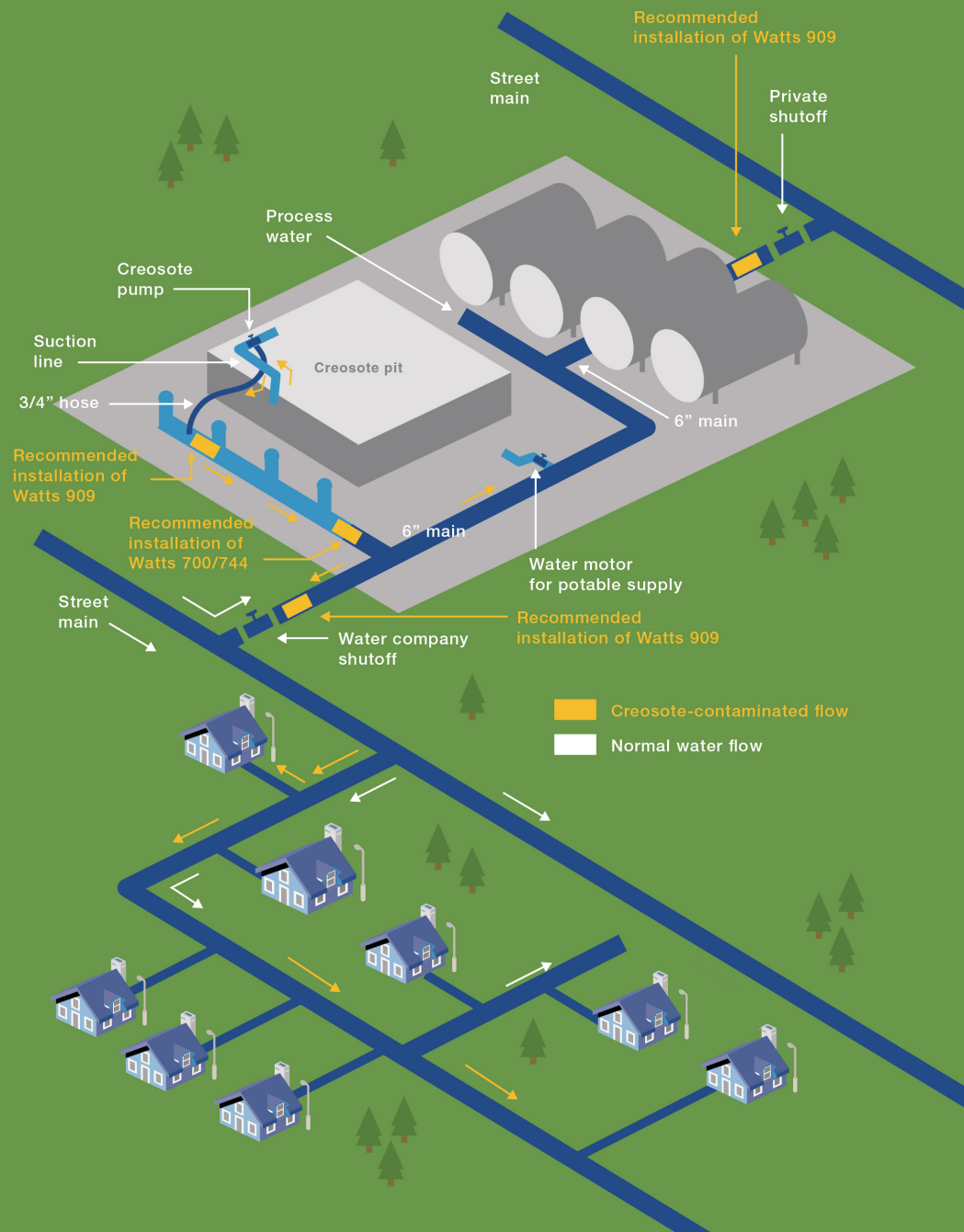
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# Backsiphonage of Creosote Contaminates Drinking Water

MACON



GEORGIA



## Backsiphonage of Creosote Contaminates Drinking Water

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Creosote, a chemical mass of carbon, entered the water distribution system of the Macon-Bibb County Water Authority in Georgia as the result of a cross-connection on a wood preservative company's property. The company used creosote under pressure to produce railroad ties and telephone poles.

While a private fire hydrant was being repaired, a ¾-inch hose was used as a priming line between a fire service connection and the suction side of a creosote pump—and creosote back-siphoned into and contaminated a section of the water distribution system.

At 9 A.M., the company called the distribution department of the Macon-Bibb County Water Authority and requested that its water service be turned off so repairs could be made to one of its private fire hydrants. At 3 P.M. the same day, the company told the Water Department the repairs had been made and requested that its water service be restored.

At 6 P.M., the Water Department began receiving customer complaints about bad-tasting water. It promptly responded by flushing adjacent fire hydrants and collecting samples for analysis. The samples revealed the presence of creosote, and the Water

Department immediately closed both valves supplying the wood preservative company.

Water and Sewage Authority crews opened fire hydrants located within a tight radius of the wood preservative company to reverse the water flow in the distribution system. This would bring the contamination back to the source, rather than dispersing it further throughout the water distribution system. All local radio stations were notified, as well as the local civil defense agency, the EPA, the fire department, and the police department. Hospitals and clinics were notified and briefed on the possible chemical constituents of the contaminants. People on life-support systems and those who suspected they had consumed some of the contaminated water were given instructions on what to do and whom to call.

Flushing continued and the water flow was completely reversed by 7:30 P.M. Until midnight, crews traveled between fire hydrants and houses, taking water samples. At 3:00 P.M. the next day, laboratory analysis indicated the system was free of contamination. The Water Authority notified residents they should flush their plumbing for thirty minutes (and their water bills would be adjusted accordingly).

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## Backsiphonage of Creosote Contaminates Drinking Water

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After flushing the wood preservative company's system for 24 hours, it was discovered that creosote had reached, and remained in, the far areas of the fire system. Backflow preventers were installed and all lines on the property completely flushed prior to restoring service.

Investigation into the cause of the incident showed that the wood preservative company, as part of its process, pumped creosote from collective pits to other parts of its operation. The pump automatically shut off when the creosote in the pit dropped to a predetermined level, and then restarted after the creosote returned to a higher level. The pump, however, often lost its prime prior to the pit refilling. To prevent the loss of the prime, the wood preservative company connected the suction side of the pump to a hose from a ¾-inch hose bibb located on the fire service line. The hose bibb remained open continuously in an effort to keep the pump primed at all times.

It had been necessary to remove the damaged hydrant to make repairs, and since the line was at a significantly lower level than the pit, the creosote then back-siphoned through the priming line connecting the creosote pit to the fire service line. After the hydrant was repaired and the water service was restored, the creosote in the fire lines had been flushed out into the main water distribution system.

If backflow prevention devices had been installed, the situation could have been averted. For example, reduced pressure zone backflow preventers could have contained the creosote contamination. The risk of the cross-connection would have been reduced by adding a ¾-inch reduced pressure zone backflow preventer to the priming line. And since the wood preservative company used a metered domestic water line that branched off the fire line service, a reduced pressure principle backflow preventer should have been installed at the meter to prevent contamination of the internal potable water supply.

*Source: Stop Backflow News*

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## Contractor Error Causes Cross-Contamination

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A private lawn maintenance contractor's unauthorized use of a city hydrant resulted in cross-contamination of the city's water system. The contractor failed to install a backflow device on the hose connected to the fire hydrant before filling a hydroseed tank with water. The tank's contents, a product containing seed, dye, and wood pulp, entered the city water system. Clogs at the local school prevented the flow of water. The Water Department flushed the lines in order to contain and draw out the seed, and the city's residents received a two-day drinking water advisory.

*Source: Lockport Union Sun & Journal*

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## Backflow Incident with Louisiana Swimming Pool

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A Liddieville, Louisiana family's improper filling of their pool caused cross-contamination of the home's water system. After two children fell ill with bacteriological infections, their mother called the Louisiana Department of Health and Human Services to request a test of their water. Department representatives informed her the system did not have a recent positive coliform sample, but asked about her residence and water usage. The complainant reported the water smelled like algae, and said a water system operator had come to flush out the line at her request months before.

The Department of Health representatives asked the resident if she had a swimming pool, and, when she said yes, inquired how she filled the pool. She reported filling it with a garden hose and affirmed she left the hose in the pool and had previously noticed it siphoning water. When the official asked about her chlorination system, she said she did not consistently operate it. The Department of Health identified these actions as the source of the problem and advised her to use an air gap when filling the pool, because her current methods could contaminate the distribution system. The Liddieville Water System initiated a flush, issued a boil-water advisory to all 441 connections in Franklin Parish, and started a program to alert customers about the problems with cross-connection.

*Source: American Backflow Prevention Association*





**TOGETHER, THREE WATTS BRANDS PROVIDE SOLUTIONS FOR A BROAD ARRAY OF BACKFLOW PREVENTION APPLICATIONS.**