UPDATE: Drinking Water System Damage and Recovery from the 2021 Marshall Fire, Colorado

January 15, 2022

Andrew Whelton, Ph.D.
awhelton@purdue.edu

PURDUE UNIVERSITY

Chad Siedel, Ph.D., P.E.
President • Corona Environmental Consulting

Erica Fisher, Ph.D., P.E.
Assistant Professor • Oregon State University

Brad Wham, Ph.D.
Assistant Research Professor • Center for Infrastructure, Energy & Space Testing Managing Director, CU Boulder

Impacted area is unlike the national U.S. average for demographics, income, and education

Parameter	National	Community
Median household income	$62,843	$127,292
B.S. degree or higher	32.1%	76.3%
Mean home value	$217,500	$576,800

PURDUE UNIVERSITY

Most destructive fire in Colorado's history, >$1B damage

Started at 12 Tribes property, Louisville (under investigation)

70 mph sustained winds, 100 mph gusts for many hours

>1,000 homes and many commercial buildings destroyed

PURDUE UNIVERSITY

Timeline (in progress)

Dec 30

At 11:00 am, fire began
At 12:00pm, > 35,000 people evacuation order
By 5 pm the fire was 1,600 acres

Dec 31

Fire was 6,021 acres
During evening, snowfall and fire containment occurred for region
But, pipes froze and broke for buildings in the affected area

Jan 2-4, I was talking with CDPHE, a few utilities impacted, and some community members reached out

Jan 5, 1:30 pm Town of Louisville called for help, 5:00 pm on plane to Colorado

Jan 6, Water system response and recovery meeting: CDPHE, USEPA R8, R9, Louisville, Superior, Purdue, Corona, CU-Boulder, OSU

Jan 7-8, Repressurization, bacteria + chlorine disinfectant testing

Jan 9-Present, More focused VOC testing of open and closed areas; smoky drinking water taste and odor being reported and investigation in Superior

PURDUE UNIVERSITY

Snowfall helped extinguish the fire and hotspots

Fire fighters had low or lost water pressure

Louisville water plant powerlines caught fire, took out water production

Superior emergency water plant generator caught fire and blew up

Louisville operators drove into the fire zone and opened the Superior interconnection to help neighbor

Louisville only had 1-2 ft of water in storage tanks upon inspection

Louisville sent untreated lake water into the distribution system to provide firefighters a chance to protect life and property

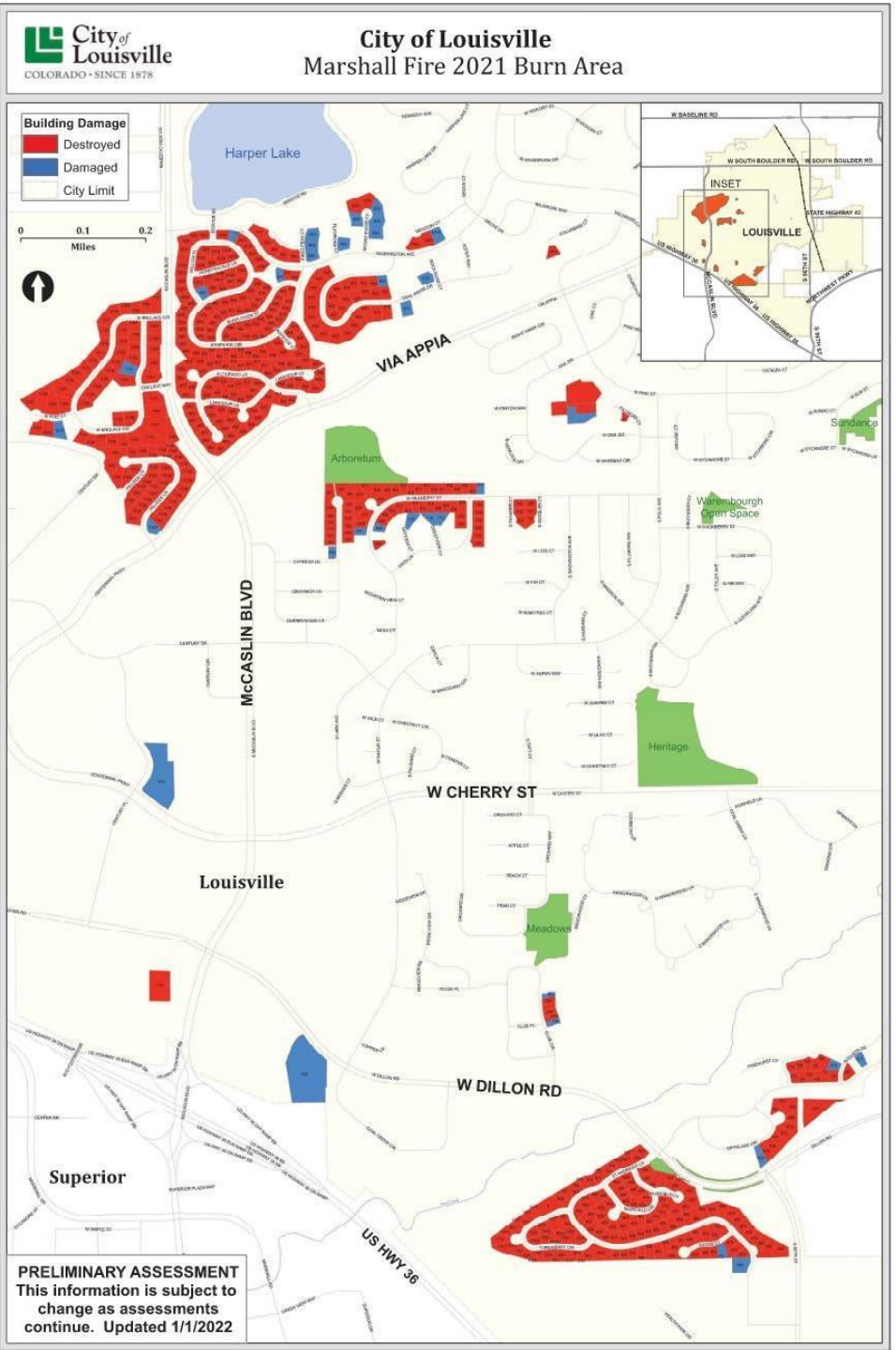
Liquified NG driven into fire zone to restore water treatment plant, Louisville

Utilities isolated damaged neighborhoods and shutoff curb stops to damaged properties in rest of systems

Cows on fire

More to come…

PURDUE UNIVERSITY



5 public water systems issued boil water advisories serving 38,000

Customers had damaged or destroyed properties

Properties with private wells also damaged and destroyed

PURDUE UNIVERSITY

Chemical drinking water testing ongoing

USEPA Methods 524.2, 524.4, 8260C for VOCs applied so far

Multiple commercial laboratories used, but challenges

- Sometimes labs can look for certain chemicals and not others
- Lab capacity for samples and rapid turn around times

Following best practice compiled from all prior wildfire water distribution system contamination studies by Purdue (stagnation, specific chemicals, etc.)

Testing water mains first, then service lines

PURDUE UNIVERSITY

Mutual aide from communities was critical

Boulder, Fort Collins, Erie, Westminster, and more…

Plastic and metal plumbing exists in standing homes

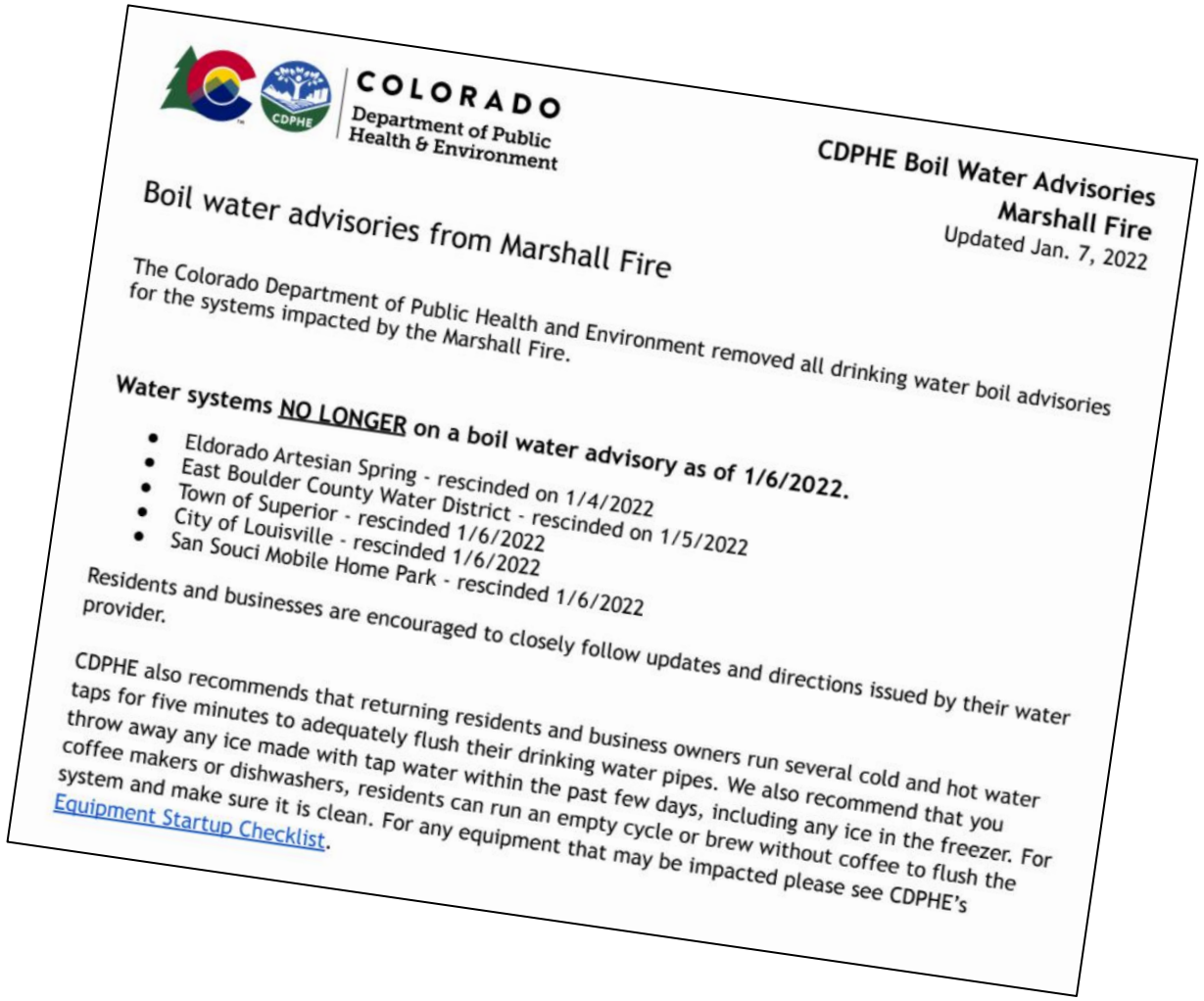
No contamination found yet. Continued testing underway.

Continue to provide technical support and advice

Plan to return in January for support and learning lessons for utilities and communities

CDPHE has been supportive to the utilities

Residents have been tremendously helpful. It's a community recovery.



COLORADO
Department of Public Health & Environment

CDPHE Boil Water Advisories
Marshall Fire
Updated Jan. 7, 2022

Boil water advisories from Marshall Fire

The Colorado Department of Public Health and Environment removed all drinking water boil advisories for the systems impacted by the Marshall Fire.

Water systems NO LONGER on a boil water advisory as of 1/6/2022.

- Eldorado Artesian Spring - rescinded on 1/4/2022
- East Boulder County Water District - rescinded on 1/5/2022
- Town of Superior - rescinded 1/6/2022
- City of Louisville - rescinded 1/6/2022
- San Souci Mobile Home Park - rescinded 1/6/2022

Residents and businesses are encouraged to closely follow updates and directions issued by their water provider.

CDPHE also recommends that returning residents and business owners run several cold and hot water taps for five minutes to adequately flush their drinking water pipes. We also recommend that you throw away any ice made with tap water within the past few days, including any ice in the freezer. For coffee makers or dishwashers, residents can run an empty cycle or brew without coffee to flush the system and make sure it is clean. For any equipment that may be impacted please see CDPHE's Equipment Startup Checklist.

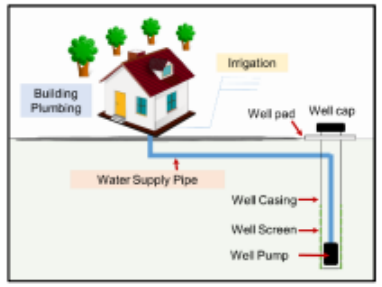
PURDUE UNIVERSITY

Properties still covered in disaster debris and require cleanup. Some residents urgently want to rebuild.

PURDUE UNIVERSITY

After a Wildfire:

Water Safety Considerations for Private Wells



Damage and Contamination Caused by Wildfires

Wildfires can directly damage private wells and springs causing an immediate health a
Water testing after wildfires has revealed contaminated drinking water, sometimes e
limits. A thorough inspection of the well and water systems is needed before trying to u
or property has been burned, make sure the fire debris is cleared before inspecting the

Signs of contamination may include the loss of water pressure, discolored water, hea
inside and outside buildings, broken and leaking pipes, valves, tanks, irrigation sy
Chemical contamination can occur due the water system and the heating or burning of
themselves, including plastics. If the water system lost pressure, microorganisms and c
the system.

Persons impacted by wildfire should seek specific advice from their local

A Water System Damage Inspection Should be Conducted and Include:

- The wellhead or well house.
- The well casing, cap or seal.
- Above ground piping or structures.
- Spring box.
- Pressure tanks.
- Filters or water treatment system.
- Wiring or electrical components What is the condition of the storage tanks, vents, or overflow pipes?
- Is there standing water in the tanks?
- Is there any evidence of melted
- Is there any evidence of pressu
  way to check this is to turn on
  there is water flowing or you h
  system.
- Is there any ash or wildfire debr
- Does it seem like any ash, soot
  part of the water system?
- Do you notice any other damag

Repairs should be completed by a licensed and bonded well contractor or pump insta
follow appropriate protocols for repressurizing the system, avoiding backflow or cross-connections, disinfecting the service lines, and confirming the quality of water by certified testing before putting the system back online.

Using Water

Use a different water source, such as bottled water, until water testing proves the water is safe for all uses. The installation of external water tanks with periodic deliveries is sometimes preferred, but this requires confirming that the indoor plumbing is not contaminated.

If the source of the contamination can be determined, isolate it. If the water system needs to be flushed, be careful to contain the runoff if possible or direct it to a channel to avoid erosion and minimize spreading the contamination. Before you use the water, it is important to verify that there is no microbiological or chemical contamination.

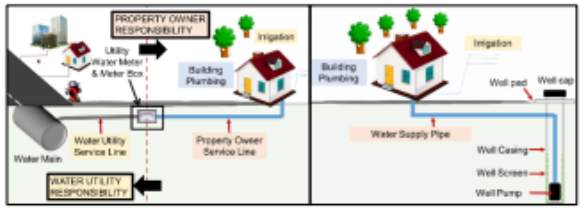
Private well and building water testing guidance from Purdue

https://engineering.purdue.edu/PlumbingSafety/resources/wildfire-response

PURDUE UNIVERSITY

After a Wildfire:

Water Safety Considerations Inside Buildings



Damage and Chemical Water Contamination Caused by Wildfires

Wildfires can directly contaminate water systems that deliver water to buildings as well as the building's own
e an immediate health and safety risk to water users. Drinking water can become chemically
nes exceeding hazardous waste limits. Boiling the water will **NOT** protect users from the
and may increase chemical exposure. An inspection of property and building water system
before trying to use the water. If a water utility delivers water to the property, the utility
damaged including the service line and water meter. Water utilities should initiate rapid
d inform you of the results. Private wells should also be inspected and tested.

can include the loss of water pressure, discolored water, heat damage to water systems
ldings; broken, melted, and leaking pipes, valves, tanks, water meters, irrigation system
hydrants. Heat damage to the building structure may indicate plumbing damage. Chemical
r due the water system and the heating or burning of the water system materials themselves,
water system lost pressure, microorganisms and chemicals can enter the system.

cted by wildfire should seek specific advice from their local health department.

age Inspection Should Be Conducted and Include:

box.
em.
ing or structures, including
where the water supply line
g.
g water treatment system, if one
es inside the building.
nnects the fixtures to the plumbing.
- The fixtures like faucets, showerheads, toilets, etc.
- Point of use water treatment systems on faucets, showerheads, and under sinks
- Appliances such as dishwasher, washing machine, dryer, humidifier, HVAC furnace, etc.
- Wiring and electrical components.
- Evidence of melted plastic components.
- Briefly turning on an exterior faucet to see if water is not flowing or you hear air escaping from the system. This may indicate pressure loss.
- Fire sprinkler system. Also, pay attention to any ash, soot, or wildfire debris near the water system, whether this has entered any part of the water system, and any other damage related to the fire.

Repairs should be completed by a licensed and bonded contractor with plumbing expertise. The contractor should follow appropriate protocols for repressurizing the system, avoiding backflow or cross-connections, disinfecting the water lines, and confirming the quality of water by certified testing before putting the system back online.

Using Water

Use a different water source, such as bottled water, until water testing proves the water is safe for all uses. The installation of external water tanks with periodic deliveries is sometimes preferred, but this requires confirming that the indoor plumbing is not contaminated. If the source of the contamination can be determined, isolate it. If the


Thank You &
God Bless
EMERGENCY RESPONDERS


THANK YOU! AND YOU! AND YOU! AND YOU! AND YOU!
Thank You BPD
Thank You, BOCO SHERIFF
Thank You Rocky M Fire!
Thank You National Guard!
Thank You Visiting Fire Crews
WE LOVE YOU

Because of the public works and other staff, communities will be able to have confidence in water safety when their system are repaired.

Water is the foundation of community health, safety, and economic prosperity.


Friends and Neighbors
friends
ARE THE
family
WE CHOOSE

More details and studies to come from several people and orgs. Stay tuned.

Andrew Whelton, Ph.D.

Professor of Civil, Environmental, and Ecological Engineering

Director, Healthy Plumbing Consortium, awhelton@purdue.edu

Center for Plumbing Safety, Purdue University, www.PlumbingSafety.org

https://engineering.purdue.edu/PlumbingSafety/resources/wildfire-response