February 17, 2025

RE: Update to State of California Code as it pertains to Drinking Water Safety After Wildfires

To Whom it May Concern:

We are submitting this brief in support of improving the ability of California communities to find and restore their drinking water and systems to safe use after a fire. At present, the current California code allows for, and partly enables, improper drinking water testing and use after a wildfire. The analysis and recommendations here are a step towards addressing current code deficiencies.

The recommendations provided are based on peer-reviewed evidence that has been collected since 2017 in California, Colorado, Hawaii, New Mexico, and Oregon. The peer-reviewed studies and documents are cited in the enclosed documents. The chemicals that should be tested for in drinking water after a wildfire are standard for commercial water testing laboratories.

Please do not hesitate to contact me at awhelton@purdue.edu

Sincerely,

Andrew Whelton, Ph.D.

Nikki Zavodny

Necessary Amendment to the California Code: Drinking Water Safety After Wildfires

Health and Safety Code – HSC; Division 104. Environmental Health; Part 12. Drinking Water; Ch. 4. California Safe Drinking Water Act; Art. 7. Requirements and Compliance 116596 (a)

Summary. Wildfires that attack communities can damage and chemically contaminate drinking water systems. The current California Code stipulations fail to ensure that the post-fire human health threats are found and water systems are returned to safe use. Since 2017, multiple lines of evidence demonstrate that after fires in multiple states, testing drinking water for benzene only fails to ascertain if the fire-impacted drinking water meets standards or is safe to use. Action is needed to amend the existing California Code so that households and businesses are not placed at risk.

Justification and Detail. Carcinogenic chemicals like benzene, methylene chloride, and vinyl chloride have exceeded safe drinking water limits after fires in and outside California. Other chemicals that exceeded California safe drinking water limits like methyl-*tert*-butyl ether (MTBE) and *tert*-butanol (TBA) have also been found. These chemicals are classified as volatile organic compounds (VOC)[1]. Fire-related chemicals enter water systems by being sucked into depressurized infrastructure and through thermal degradation of plastics. Since 2017, the level of fire-related chemicals in the drinking water in California, Colorado, Hawaii, Oregon, and New Mexico have prompted the drinking water to exceed levels that California and the federal government deems unsafe. Sometimes the levels found could characterize that drinking water and infrastructure materials it contacts as hazardous waste under the federal *Resources Conservation and Recovery Act*.[2] During and after wildfires, contaminated water can sometimes be delivered through buried drinking water pipes that distribute water to homes and businesses unless it is first discovered and removed.

In 2023, a new law was promulgated in California[3] that requires public water systems impacted by some, not all, fires to test drinking water for benzene, and only benzene. The current Code language fails to assure water systems are returned to safe use.

In 2024, the California Division of Drinking Water took the position that only the detection of benzene in drinking water after a fire would prompt the need to protect the affected households and businesses[4]. By the Division of Drinking Water's own post-fire drinking water order, drinking water with unsafe levels of non-benzene contaminants can be delivered to households and businesses after a fire.

In 2025 after the Palisades and Eaton Fires, the California Division of Drinking Water went on record to claim, "…benzene indicates whether or not other contaminants are present…".[5] This statement has been false since 2017.

Multiple lines of evidence make clear that the sole focus on benzene in wildfire contaminated drinking water fails to ensure that public health and local economies are protected:

1. After the 2017 Tubbs Fire in Santa Rosa, California, benzene was sometimes "not-detected" (<0.5 parts per billion or ppb) when methylene chloride (41 ppb) was detected above its federal

[1] Soni, V., Singh, P., Shree, V., Goel, V. (2018). Effects of VOCs on Human Health. In: Sharma, N., Agarwal, A., Eastwood, P., Gupta, T., Singh, A. (eds) Air Pollution and Control. Energy, Environment, and Sustainability. Springer, Singapore. https://doi.org/10.1007/978-981-10-7185-0_8
[2] 40 CFR 261.24 -- Toxicity characteristic
[3] California Code, HSC 116596.
[4] State of California State Water Resources Control Board Division of Drinking Water, Order DW 2024-FRE1-DDW, Order Requiring Water Quality Analysis And Subsequent Actions In Response to Wildfire. November 7, 2024. Sacramento, CA.
[5] Inside the battle to restore drinking water in Altadena and the Palisades - Los Angeles Times

Maximum Contaminant Level or MCL (5 ppb) and its California MCL (1 ppb). *Tert*-butyl alcohol (TBA) was also found (29 ppb) above its California drinking water notification level (12 ppb).[6]

2. After the 2018 Camp Fire in Paradise California, methylene chloride was detected at a maximum level of 34 ppb and exceeded the federal MCL (5 ppb) and California MCL (1 ppb) when benzene was not detected.[7]
3. After the 2020 wildfires in Oregon, vinyl chloride (8.2 ppb) exceeded its federal MCL (1 ppb) [[and 0.5 ppb California MCL]] when benzene was not detected in one wildfire impacted water system. [8]
4. After the 2020 wildfires in Oregon, in another system MTBE (589 ppb) exceeded the [[California MCL (13 ppb)]] when benzene was not detected.[9]
5. After the 2022 Hermits Peak/Calf Canyon Fire in New Mexico, vinyl chloride (2.3 µg/L) exceeded the federal MCL (1 ppb) [[and California MCL (0.5 ppb)]] when benzene was not detected.[10]

In 2020, the United States Environmental Protection Agency acknowledged that while "Benzene was found in many of the samples collected during the Tubbs and Camp Fires[2]; however, it is not a perfect indicator of VOC contamination as some water samples that were free of benzene contained other VOCs."[11]

In 2024, the Water Research Foundation (Denver, Colorado) released the first ever evidenced-based guide for public water system decisions after a wildfire. Here, the specific chemicals that should be screened, drinking water sampling protocols, and water analysis methods were described. This foundation guide was created based on the experience and insights from public water systems impacted by wildfires in and outside California since 2017. The document states "Benzene is NOT a surrogate for the presence of other chemicals that may pose immediate or long-term health risks." https://waterrf.org/resource/concept-operations-conops-plan-water-distribution-system-testing-and-recovery…

[6] Wildfire caused widespread drinking water distribution network contamination - Proctor - 2020 - AWWA Water Science - Wiley Online Library
[7] Fire and Water: Assessing Drinking Water Contamination After a Major Wildfire | ACS ES&T Water
[8] Wildfire damage and contamination to private drinking water wells - Jankowski - 2023 - AWWA Water Science - Wiley Online Library
[9] *Concept of Operations Plan (CONOPS) for Water Distribution System Testing and Recovery.* January 23, 2025. Webinar for the California-Nevada Section of the AWWA. Whelton AJ.
[10] *Concept of Operations Plan (CONOPS) for Water Distribution System Testing and Recovery.* January 23, 2025. Webinar for the California-Nevada Section of the AWWA. Whelton AJ.
[11] U.S. EPA. *Addressing Contamination of Drinking Water Distribution Systems from Volatile Organic Compounds (VOCs) After Wildfires.* Office of Water (4608-T) EPA 817-F-21-011 October 2021. Washington, D.C.

Details of the Amendment

In the wake of the 2025 Palisades and Eaton Fires in the Los Angeles area, a revision to the current California Code pertaining to drinking water contamination after fires is needed. The following information is provided to help policymakers better understand actions necessary after wildfires to restore public drinking water systems to safe use.

++

1. Public Notification. After a fire, where public water distribution system depressurization occurs and structure fire(s) are occurring, a drinking water advisory shall be issued out of concern for chemical drinking water system contamination. Drinking water advisories recognized by the United States public health authority, the Centers for Disease Control and Prevention (CDC), include Boil Water, Do Not Drink, and Do Not Use drinking water advisories.[12] When chemical contamination is suspected for these conditions and inhalation exposure is likely exposure pathway, a Do Not Use drinking water advisory shall be issued.

2. When it is safe to enter the fire-impacted area:

(a) **Stabilization of the Water System.** Water meters shall be removed from burned properties where structure fire(s) occurred. This removal is primarily intended to limit the potential that contamination from the property enters the water distribution system by way of a cross-connection. Cross-connections can pose immediate health and safety risks to nearby drinking water users.

a. Water meters shall not be reinstalled until either the property service line is replaced, fire-related volatile organic compound (VOC) testing is conducted on the property owner service line showing that no chemical contamination remains, or a backflow prevention device is installed by and maintained by the public water system between the property owner service line and water system service line thereby preventing contamination of property to enter the water distribution system.

(b) **Public Water Distribution System Testing.** Testing for fire-related VOCs at nearby fire hydrants, service lines, water meters, and other appurtenances shall be carried-out.

a. The following fire-related VOCs must be tested for using United States Environmental Protection Agency Method 524.2, United States Environmental Protection Agency Method 524.4, or a method similar.
b. Method detection limits should be at or more sensitive than 0.5 parts per billion.
c. The list of 51 fire related VOCs include:
   Acetonitrile
   Acetone
   Acrolein
   Acrylonitrile
   Benzene

[12] CDC. (2024, September 5). *Drinking Water Advisories: An Overview*. Water, Sanitation, and Hygiene (WASH)-Related Emergencies and Outbreaks. https://www.cdc.gov/water-emergency/about/drinking-water-advisories-an-overview.html

Bromochloromethane
Bromodichloromethane
Bromoform
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloromethane
4-Chlorotoluene
Dibromochloromethane
1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dichlorobenzene
1,4-Dichlorobenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethylene
1,2-Dichloropropane
Ethanol
Ethyl benzene
Ethylene dibromide (EDB)
Ethyl-tert-butyl ether (ETBE)
Iodomethane
Isopropylbenzene
Methylene chloride
Methyl ethyl ketone (MEK)
Methyl iso butyl ketone (MIBK)
Methyl-tert-butyl ether (MTBE)
Naphthalene
Styrene
tert-Butyl alcohol (TBA)
Tetrachloroethylene
Tetrahydrofuran (THF)
Trichloroethylene
Trichloromethane
1,2,3-Trichloropropane (TCP)
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl chloride
ortho-Xylene
meta-Xylene
para-Xylene

d. To remove the water advisory, representative VOC sample collection and analysis shall be conducted after a 72 hour stagnation period for affected components or the affected components shall be removed and replaced with new components. A 24 hour or 48 hour stagnation period may be used as an *initial* indicator for damage assessment testing, but shall not be used for final certification that the drinking water infrastructure and water itself has been returned to safe use.

3. Public Notification of Results. Once water testing results for the public water system are obtained, laboratory reports shall be made publicly available within seven calendar days. Within that seven-calendar day period, the public water system shall make the guidance and orders issued to the water system from the State of California Division of Drinking Water or DDW publicly available.

Please note that the current invocation in the code of "300 acres" for determining when such an order is needed for drinking water safety has zero scientific basis. The driving factors to drinking water chemical contamination are (1) depressurization, (2) structure burning, and (3) chemical contaminants entering the water distribution system. The area of a wildfire has shown no relationship to the potential of chemical drinking water contamination.

This information provided does not pertain to mitigation, pre-fire actions, that could reduce the potential for chemical drinking water contamination to occur.

Additional references used for preparation of this document

State of California Environmental Protection Agency. (2019). *Cross-Connection Control Policy Handbook*. *California State Water Resources Control Board*. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2023/cccph-adopt.pdf

Draper, W.M., Solomon, N.M.N., Heaney, Y.C., Crenshaw, R.B., Hinrichs, R.L., Esala, R., Chandrasena, P. Organic Chemical Contaminants in Water System Infrastructure Following Wildfire. *ACS ES&T Water*. 2022, 2, 2, 357–366. https://doi.org/10.1021/acsestwater.1c00401

Isaacson, K., Proctor, C.R., Wang, Q.E., Edwards, E.Y., Noh, Y., Shah, A.D., Whelton, A.J. 2020. Drinking water contamination from the thermal degradation of plastics: implications for wildfire and structure fire response. *Environ. Sci.: Wat. Res. Technol.* https://doi.org/10.1039/D0EW00836B

Jankowski, C., Isaacson, K., Larsen, M., Ley, C., Cook, M., Whelton A.J. 2023. Wildfire Damage and Contamination to Private Drinking Water Wells. *AWWA Wat. Sci.* https://doi.org/10.1002/aws2.1319

Kristofer P. Isaacson, Akshat Verma, Andrew J. Whelton, Jeffrey P. Youngblood, Amisha D. Shah. Formation and aqueous phase leaching of organic compounds following thermal degradation of commercial drinking water plastic pipes. *Journal of Hazardous Materials.* Volume 489, 2025, 137562. https://doi.org/10.1016/j.jhazmat.2025.137562

Proctor, C.R., Lee, J., Yu, D., Shah, A.D., Whelton, A.J. 2020. Wildfire Caused Widespread Drinking Water Distribution Network Contamination. *AWWA Wat. Sci.* 2 (4), e1183. https://doi.org/10.1002/aws2.1183

PU-b, Center for Plumbing Safety. *After a Wildfire: Water Safety Considerations for Private Wells.* April 2021. Prepared by: Andrew Whelton, Caitlin Proctor. West Lafayette, Indiana USA.

https://engineering.purdue.edu/PlumbingSafety/resources/After-a-Wildfire-Private-Drinking-Water-Wells-2021-05-16.pdf

PU, Center for Plumbing Safety. *After a Wildfire: Water Safety Considerations for Agricultural Water Systems.* March 2024. Prepared by: Andrew Whelton, Louden Feltner. West Lafayette, Indiana USA.

Purdue University (PU-a), Center for Plumbing Safety. *After a Wildfire: Water Safety in Buildings.* April 2021. Prepared by: Andrew Whelton, Caitlin Proctor. West Lafayette, Indiana USA. https://engineering.purdue.edu/PlumbingSafety/resources/After-a-Wildfire-Water-Safety-in-Buildings-2021-05-16.pdf

Schulze, S.S., Fischer, E.C. Prediction of Water Distribution System Contamination Based on Wildfire Burn Severity in Wildland Urban Interface Communities. *ACS ES&T Water*. 1, 2, 291–299. https://doi.org/10.1021/acsestwater.0c00073

Solomon, G.M., Hurley, S., Carpenter, C., Young, T.M., English, P., Reynolds, P. Fire and Water: Assessing Drinking Water Contamination After a Major Wildfire. *ACS EST Water.* 2021, 1, 8, 1878–1886. https://doi.org/10.1021/acsestwater.1c00129

U.S. Environmental Protection Agency (EPA). 1992. "Method 524.2: Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry," Revision 4.1. Cincinnati, OH

U.S. EPA. 2013. "Method 524.4: Measurement of Purgeable Organic Compounds in Water by Gas Chromatography/Mass Spectrometry Using Nitrogen Purge Gas"

Whelton, A. J., Isaacson, K. P., Shah, A. D. (2024). Concept of Operations (CONOPS) Plan for Water Distribution System Testing and Recovery. *The Water Research Foundation*. https://www.waterrf.org/serve-file/resource/PROJECTPAPER-5106-1.pdf

Whelton, A.J. *Chemicals Found in Wildfire Impacted Drinking Water Systems.* August 2023. Purdue University, West Lafayette, Indiana USA. https://engineering.purdue.edu/PlumbingSafety/resources/Chemicals-Found-in-Wildfire-Impacted-Drinking-Water-Systems-Updated-Aug2023.pdf

Whelton, A.J., Coelho, P.D., Shuler, C., Kagawa-Viviani, A., Cole, K.D.P., Surdyk, S., Heffner, S. Two weeks after the 2023 Maui wildfires: drinking water experiences and needs. *Environ. Sci.: Water Res. Technol.*, 2024,10, 2341-2356. https://doi.org/10.1039/D4EW00216D

Whelton, A.J., Seidel, C., Wham, B.P., Fischer, E.C., Isaacson, K., Jankowski, C., MacArthur, N., McKenna, E., Ley, C. 2023. The Marshall Fire: Scientific and Policy Needs for Water System Disaster Response. *AWWA Wat. Sci.* https://doi.org/10.1002/aws2.1318

State of California Water Resources Control Board. Cross-Connection Control for Small Community Water Systems SWRCB Division of Drinking Water – Visalia District. CA.

Contributors. Andrew Whelton, Nikki Zavodny, Purdue University