Resilience
[rəˈzɪliəns]
NOUN
The ability to bounce back from misfortune or change
Amazing People

Beautiful Butte County

Paradise Rocks
Prefire: 4,200 students
4+ Elementary schools, 4 middle/ high schools and more

20+ places of worship
Thursday, November 8, 2018

5:30 am – PG&E notifies 911 about a fire located in Pulga, Butte Co, CA

7:33 – Houses on fire, Concow

7:41 – Fire in Paradise

8:03 – Sheriff calls for evacuation

8:24 – 911, no one can come help you, get out

Later – Routes blocked, evacuate, find shelter

For hours some trapped inside as the fire rolled through
Fire Speed: 60 football fields per minute

More than 33% of the population never received an evacuation order from California’s phone-based warning system.
The 2018 Camp Fire – Deadliest and Most Destructive in CA

President of the State of California
State of California
November 8, 2018

Proclamation of a State of Emergency

WHEREAS on November 8, 2018, the Camp Fire began burning in Butte County and continues to burn; and
WHEREAS this fire has destroyed homes and continues to threaten additional homes and other structures, necessitating the evacuation of thousands of residents; and
WHEREAS the fire has forced the closure of roadways and continues to threaten critical infrastructure; and
WHEREAS high temperatures, low humidity, and erratic winds have further increased the spread of this fire; and
WHEREAS the Federal Emergency Management Agency has approved a Fire Management Assistant Grant to assist with the mitigation, management, and control of the Camp Fire; and
WHEREAS the circumstances of the fire, by reason of its magnitude, are or are likely to be beyond the control of the services, personnel, equipment, and facilities of any single local government and require the combined forces of a mutual aid region or regions to combat; and
WHEREAS, under the provisions of Government Code section 8558.6, I find that conditions of extreme peril to the safety of persons and property exist in Butte County due to this fire; and
WHEREAS, under the provisions of Government Code section 8571, I find that strict compliance with the various statutes and regulations specified in this order would prevent, hinder, or delay the mitigation of the effects of the Camp Fire.

NOW, THEREFORE, I, CARL NGUYEN, Acting Governor of the State of California, in accordance with the authority vested in me by the State Constitution and statutes, including the California Emergency Services Act, and in particular, Government Code section 8625, HEREBY PROCLAIM A STATE OF EMERGENCY to exist in Butte County due to the Camp Fire.

IT IS HEREBY ORDERED THAT:

1. All agencies of the state government utilize and employ state personnel, equipment, and facilities for the performance of any and all activities consistent with the direction of the Office of Emergency Services and the State Emergency Plan. Also, all citizens are to heed the advice of emergency officials with regard to this emergency in order to protect their safety.
2. The Office of Emergency Services shall provide local government assistance to Butte County, if appropriate, under the authority of the California Disaster Assistance Act, Government Code section 8680 et seq., and California Code of Regulations, Title 19, section 2500 et seq.

153,336 acres
~13,972 residences destroyed
14,793 structures destroyed
3,800+ students lost their homes
85 fatalities
3 firefighters injured
50,000 people displaced
96% of all residential buildings destroyed

95% of all commercial buildings destroyed

Before fire: 26,000+ people
After fire: ~1,500 people
<table>
<thead>
<tr>
<th>Public Water Systems (% Homes Gone)</th>
<th>Population</th>
<th>Source Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paradise Irrigation District (PID) (-96%)</td>
<td>26,032</td>
<td>Surface</td>
</tr>
<tr>
<td>Del Oro Water Company – Paradise Pines (-38%)</td>
<td>11,324</td>
<td>Surface</td>
</tr>
<tr>
<td>Del Oro Water Company – Lime Saddle (-50%)</td>
<td>1,106</td>
<td>Surface</td>
</tr>
<tr>
<td>Del Oro Water Company – Magalia (-89%)</td>
<td>924</td>
<td>Ground</td>
</tr>
<tr>
<td>Del Oro Water Company – Stirling Bluffs (0%)</td>
<td>548</td>
<td>Surface</td>
</tr>
<tr>
<td>Del Oro Water Company – Buzztail (-34%)</td>
<td>106</td>
<td>Ground</td>
</tr>
<tr>
<td>Foothill Solar Community</td>
<td>180</td>
<td>Ground</td>
</tr>
<tr>
<td>Forest Ranch Mobile Home Park</td>
<td>25</td>
<td>Ground</td>
</tr>
<tr>
<td>Forest Ranch Mutual Water Company</td>
<td>92</td>
<td>Ground</td>
</tr>
<tr>
<td>Gran Mutual Water Company</td>
<td>202</td>
<td>Ground</td>
</tr>
<tr>
<td>Humboldt Woodlands Mutual Water Company</td>
<td>75</td>
<td>Ground</td>
</tr>
<tr>
<td>Meadowbrook Oaks Mobile Home Park</td>
<td>50</td>
<td>Ground</td>
</tr>
<tr>
<td>Mountain Village Homeowners Association</td>
<td>40</td>
<td>Ground</td>
</tr>
</tbody>
</table>

40,000 people issued a boil water advisory (BWA) after the fire

Private wells
13,227 exist in Butte County
2,438 wells in Camp Fire area
Request for our help came in January

- DOWC
  - Nov 9, BWAs issued
  - Nov 19, 21, BWAs lifted
  - Nov 25, Fire contained

- PID
  - Nov 9, BWA issued
  - Dec 5, Benzene only samples collected
  - Dec 20-30, Evacuation orders lifted

- Dec 19, Benzene exceeded MCLs in 2 of 3 systems
- Dec 24, SWRCB ODOR ADVISORY for DOWC & PID: only if there are odors, contact your water company and do not use water.

- Jan 9, No state mandated order prohibiting drinking Del Oro water at this time, if there are odors, contact DOWC and do not use.

- Jan 11, SWRCB UPDATE TO DEC 24 NOTICE Benzene found in both DOWC & PID; 2 different advisories exist, SWRCB approved both.

- Jan 15, Whelton reaches out to SWRCB and finds they don’t know what’s in the water. They welcome help. Purdue starts providing advice to State and PID to determine what’s in the water, and begins participation on Governor’s Camp Fire Water Task Force twice weekly meeting.

- Jan 15, PID contacts Dr. Whelton for help. Recommended by the City of Santa Rosa because of his Tubbs Fire advice and expertise.
CaIOES, SWRCB, BCHD, FEMA, PID, DOWC, Town, CalFire did not understand how to proceed

< 50 samples had been collected by PID & DOWC

Benzene testing only; State said benzene is only chemical present

Our onsite recommendations:

• Find out what’s in the water (not just benzene)
• Reevaluate water use restrictions
• Isolate ➔ Test (72hr) ➔ Decon/replace
• Population in homes needs help, they’ve been left to fend for themselves
The agencies did not understand VOC fate in water utility distribution systems and plumbing.

For water samples, *Stagnation Time* was needed.

Before you collect a water sample you must allow the chemicals to leach out into water.

Watch the video at https://youtu.be/ythX2fP3-S4

*How chemicals contaminate plastic pipes and drinking water*
Standing homes are scattered throughout the contaminated water systems: PID Example

| 2 sources |
| 1 treatment plant |
| 7 pressure zones |
| 172 miles of buried pipe |
| PVC (35%) |
| Steel (33%) |
| CML (19%) |
| AC (10%) |
| Irons (6%) |
| 1,400 fire hydrants |
| 10,600 service lines and meters |
| Cu, Brass, GIP, GSP, HDPE, PVC, PB |

### PID Pressure Zones vs. Standing Structures

<table>
<thead>
<tr>
<th>Remaining Structure Types not Destroyed in Paradise PID Pressure Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residence (Single/Multi Story) (341)</td>
</tr>
<tr>
<td>Multi Family Residence (Single/Multi Story) (14)</td>
</tr>
<tr>
<td>Mobile Home (All types) (26)</td>
</tr>
<tr>
<td>Commercial (All types) (40)</td>
</tr>
<tr>
<td>PID Tanks</td>
</tr>
<tr>
<td>Destroyed (1)</td>
</tr>
<tr>
<td>Fire Perimeter</td>
</tr>
<tr>
<td>City Limits</td>
</tr>
<tr>
<td>District Annexation (13)</td>
</tr>
</tbody>
</table>

Data Sources: Paradise Irrigation District, PIDMA, CAL Fire, ESRI, USGS, 35SP Gold 2015, NDI.
Damage
90%+ of their 172 mile water distribution system depressurized for hours to weeks

100s+ of leaks
11,000+ homes
Butte County allowed some commercial buildings to reopen if using a water tank.
Some meters did not survive

Some HDPE plastic service lines melted, decomposed, and cooled
1. Plastic Pyrolysis

2. Forest Biomass Combustion

VOCs
SVOCs

Benzene
Naphthalene
Toluene
Styrene
Xylenes
Benzo[a]pyrene
and more...

Montaudo & Puglisi (1991)

Simonet et al. (1999)
February 7, 2019
CA State Lab Analysis of 1 PID water sample

<table>
<thead>
<tr>
<th>Compound</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthalene</td>
<td>692 ppb</td>
</tr>
<tr>
<td>Benzene</td>
<td>&lt; 2,217 ppb</td>
</tr>
<tr>
<td>Toluene</td>
<td>676 ppb</td>
</tr>
<tr>
<td>Xylenes</td>
<td>440 ppb</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>76 ppb</td>
</tr>
<tr>
<td>Methylene Chloride</td>
<td>9 ppb</td>
</tr>
<tr>
<td>Styrene</td>
<td>378 ppb</td>
</tr>
</tbody>
</table>

It's not just benzene.
### Severity: Water Distribution System Impacts

<table>
<thead>
<tr>
<th>Chemical that Exceeded a Drinking Water Limit</th>
<th>2018 Camp Fire (8 months after the fire)</th>
<th>Tubbs Fire (11 months after the fire)</th>
<th>Santa Rosa</th>
</tr>
</thead>
<tbody>
<tr>
<td>PID</td>
<td>Del Oro</td>
<td>Exceedance</td>
<td>Max, ppb</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>Benzene</td>
<td>&gt;2,217</td>
<td>530</td>
<td>Yes</td>
</tr>
<tr>
<td>Methylene chloride</td>
<td>45</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>693</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Styrene</td>
<td>378</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Tert-butyl alcohol</td>
<td>13</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Toluene</td>
<td>676</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Vinyl chloride</td>
<td>1</td>
<td>NA</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Long-term limit for an adult for 70 years
Short-term (1 day) limit for a 1 year old child

NA = Results were not available
In March, because many officials did not understand the issues inhibiting their decisions, we self-initiated training for them about VOCs, water system, and plumbing system contamination/decontamination.

**VOC Fate in Water Systems**

**Discussion to Support the Water Systems Task Force**

11:30 AM EST (8:30 AM PST)
March 4, 2019

Convener: Andrew Whelton, awhelton@purdue.edu
Caitlin Proctor, Juneseok Lee, Amisha Shah

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**Participants**

Purdue [presenter]
USEPA ORD [presenter]
Butte County Health Dept
Butte County Bldg Dept
Town of Paradise
SWRCB
CalOES
“Testing to date has not revealed an occurrence of organic chemical contamination within Del Oro Water Company’s three districts.”

The State told the public and media there was never contamination in Del Oro Water Company systems.

<table>
<thead>
<tr>
<th>Location</th>
<th>Result (ppb)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>14241 Caldwell Ct</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Ridgeside Ct. &amp; Andover</td>
<td>1</td>
<td>Dec 2018</td>
</tr>
<tr>
<td>13567 W. Park</td>
<td>0.48</td>
<td>Dec 2018</td>
</tr>
<tr>
<td>Hobart Ct. &amp; Ponderosa</td>
<td>ND</td>
<td></td>
</tr>
</tbody>
</table>

Benzene MCL 1 ppb
Early March 2019, California Department of Public Health conducts chemical exposure testing on employees with SWRCB

“In this experiment the water from the burn area was sampled for both chemical analysis and odor.”

<table>
<thead>
<tr>
<th>Odor Tester</th>
<th>Descriptor (selected from list)</th>
<th>Descriptor (selected from list)</th>
<th>Descriptor (selected from list)</th>
<th>Descriptor (volunteered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (v)</td>
<td>Fruity</td>
<td>Sweet</td>
<td>Nauseating</td>
<td>Gasoline</td>
</tr>
<tr>
<td>B (sr)</td>
<td>Harsh</td>
<td>Sweet</td>
<td>Nauseating</td>
<td>Old warehouse</td>
</tr>
<tr>
<td>C (sp)</td>
<td></td>
<td></td>
<td></td>
<td>Rubbery/chlorine/cleaning</td>
</tr>
<tr>
<td>E (b)</td>
<td></td>
<td></td>
<td></td>
<td>Chlorine/sweet/chemical/solvent</td>
</tr>
<tr>
<td>F (e)</td>
<td>Gasoline</td>
<td>Harsh</td>
<td>Irritating</td>
<td>Gasoline/toluene</td>
</tr>
<tr>
<td>G (c)</td>
<td>Solvent</td>
<td>Sour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H (n)</td>
<td>No odor detectable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Several of the testers noted **throat irritation and constriction** after smelling the test sample(s).”

State looked for some VOCs, found multiple present, not just benzene
Benzene only is a sufficient indicator for VOC contamination.
- No. Your own data and Tubbs Fire shows it’s not.

Benzene above 1 ppb (CA MCL) is a problem.
- No. For the Tubbs Fire you decided anything at or above 0.5 ppb benzene was a problem because pipes were actively leaching benzene. Butte County deserves same protection and safety factor.

Must test in homes. Kitchen sink cold water only. 12-48 hour stagnation required.
- Testing in homes is good, but you ignore hot water (which is in different pipes) and 72 hours was the Tubbs Fire approach. Multiple samples needed per home, not 1.
Butte County Health Officer Issues Water Quality Advisory for Residents in Burn Affected Areas

BUTTE COUNTY, CA. - The Butte County Health Officer issues a countywide warning and urges people not to drink or boil tap water.

Information from water authorities indicates that contamination may be present in home plumbing systems, and therefore, residents should not rely on home water filtrations systems as they may not be adequate to provide protection.

In addition, it is highly recommended that residents:

- Limit use of hot water
- Limit shower time (use lukewarm water and ventilate area)
- Use a dishwasher to wash dishes and use air dry setting
- Wash clothing in cold water
- Do not take baths
- Do not use hot tubs or swimming pools

Residents who use water from private wells or temporary water storage tanks may want to consult with well owners or contact their county health authority directly.

The Health Department does not have oversight over water authorities. If residents have concerns, they should contact their water authority directly.

March 19, 2019 Countywide warning

“…contamination may be present in home plumbing systems, and therefore, residents should not rely on home water filtrations systems as they may not be adequate to provide protection.”

“…residents should not use tap water for drinking, cooking, food preparation, brushing teeth, or similar activities.”
For a child: 26 ppb for 1 day’s worth of water poses health risk

Avg level in PID ~31 ppb, Max PID >2217 ppb, Max Del Oro 530 ppb

SWRCB then assumes 60% safety factor
Infrastructure and Contaminated Water Classification as Hazardous Waste

500 ppb benzene is RCRA TCLP Waste

<table>
<thead>
<tr>
<th>Initial measurement concentration (C_i)</th>
<th>Goal A (never above 0.5 ppb)</th>
<th>Goal B (only exceed 0.5 ppb after 72 hours of stagnation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous</td>
<td>Intermittent (once/72 hrs)</td>
</tr>
<tr>
<td>100 ppb</td>
<td>286</td>
<td>312</td>
</tr>
<tr>
<td>50 ppb</td>
<td>246</td>
<td>270</td>
</tr>
<tr>
<td>20 ppb</td>
<td>195</td>
<td>213</td>
</tr>
<tr>
<td>10 ppb</td>
<td>155</td>
<td>171</td>
</tr>
<tr>
<td>5 ppb</td>
<td>116</td>
<td>129</td>
</tr>
<tr>
<td>2 ppb</td>
<td>64</td>
<td>74</td>
</tr>
</tbody>
</table>

>286 days of flushing at 2 GPM
Purdue, USEPA, Manhattan College
**PEOPLE** should be the primary focus post-disaster.

[or water from a *private well*, (15% of US population)]

*Modified from Lee et al. (2013) Water Supply AQUA 64(2)*
‘Standing Home’ Public Health Implications

Citizens weren’t adequately protected from contaminated water
• SWRCB told people to SMELL water to determine if its safe
• 2 DOWC systems were contaminated, but no water advisory
• Some PID customers did not follow water use restrictions

Contaminated water was entering homes for 6+ months
• Benzene found in homes by residents, State said they have no knowledge (because they didn’t credibly sample!)
• Utilities were still trying to identify their contaminated assets
• Checkerboard recovery: Loss of pressure (main break, leak) could move contaminated water into a standing home service line

Plumbing has received 6+ months of contaminated water
Cold and hot water systems [Now declared nonpotable]
Trunk-and-branch vs. homerun designs
In-home treatment devices
Paying for water testing, results not representative
External water tank maintenance and microbiological growth
Some have no economic capacity to purchase bottled water, devices

Insurance companies make decisions about in-home treatment

Butte County Private Well Information
Post-fire well safety and testing guidelines.

Recommended for private wells
Bacteria, heavy metals, PAHs, VOCs
72 hr stagnation on well
More Standing Home Inhabitant Challenges

Want to sample their plumbing... but being told to follow lab directions that flush out their plumbing BEFORE sampling.

Commercial Laboratory: “When sampling from a tap, open the tap and allow the system to flush until the water temperature has stabilized (usually about 10 minutes).”

Want to sample their plumbing... but being told by SWRCB to only look for benzene at the cold water kitchen sink (no stagnation needed).

This ignores hot water systems, along with basics of plumbing design, operation, chemical desorption, and more.

Many unaware the SWRCB recommended any damaged property have the customer-side service line replaced to Butte County

Estimated $1,000-$7,000 cost per home. Insurance may or may not pay.
Right Before we Arrived to Deliver Our Community Health Survey Presentation and Plumbing Safety Education Workshop in Butte County, CA the SWRCB Issued their Deficient Plumbing Testing Guidance

<table>
<thead>
<tr>
<th>Topic</th>
<th>SWRCB Guidance to the Public</th>
<th>Guidance from Plumbing and Water Experts from 5 Universities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>November 2018-June</td>
<td>7 months after the fire</td>
</tr>
<tr>
<td>Exposure Pathways Included</td>
<td>Ingestion only</td>
<td>Ingestion only</td>
</tr>
<tr>
<td>Number of Indoor Locations</td>
<td>1, kitchen sink cold water</td>
<td>1, kitchen sink cold water</td>
</tr>
<tr>
<td>Systems to Test</td>
<td>Cold water only</td>
<td>Cold water only</td>
</tr>
<tr>
<td>Stagnation Period Required</td>
<td>None</td>
<td>At least 8 hour</td>
</tr>
<tr>
<td></td>
<td>At least 8 hour</td>
<td>72 hour</td>
</tr>
<tr>
<td>VOCs to Look For</td>
<td>Benzene only</td>
<td>Benzene only</td>
</tr>
<tr>
<td></td>
<td>All VOCs detected post-fire</td>
<td></td>
</tr>
</tbody>
</table>

Ingestion, inhalation, and skin contact
All exposure locations
Cold and hot water
All VOCs detected post-fire
Survey: To provide the community and officials insight into how the fire has impacted the attitudes and experiences related to drinking water of people living in or who own standing homes.

Post-disaster plumbing education

⇒ 4,000+ people reached

Grant from the Paradise Rotary Foundation
Survey: A Look at the First 6 Months of the Recovery

At least 605 people represented

Type of Home
- 85.8% House
- 9.0% Manufactured Home
- 1.3% Apartment
- 1.3% RV

Location of Home
- 70.8% Paradise
- 22.7% Magalia
- 2.6% Outside Town Limits
- 2.6% Yankee Hill
- 0.4% Butte Creek Canyon
- 0.9% Concow
11% to 88% of households chose to **STOP** certain water use activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>COLD Water Use</th>
<th></th>
<th>HOT Water Use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PID n = 159</td>
<td>DOWC n = 57</td>
<td>Well n = 17</td>
<td>PID n = 159</td>
</tr>
<tr>
<td>Drinking</td>
<td>81%</td>
<td>42.0%</td>
<td>53.3%</td>
<td>88.1%</td>
</tr>
<tr>
<td>Handwashing</td>
<td>49%</td>
<td>11.8%</td>
<td>43.8%</td>
<td>56.8%</td>
</tr>
<tr>
<td>Teeth Brushing</td>
<td>78%</td>
<td>29.6%</td>
<td>42.9%</td>
<td>77.8%</td>
</tr>
<tr>
<td>Washing Clothes</td>
<td>43%</td>
<td>11.3%</td>
<td>37.5%</td>
<td>65.2%</td>
</tr>
<tr>
<td>Bathing</td>
<td>77%</td>
<td>25.6%</td>
<td>54.5%</td>
<td>70.8%</td>
</tr>
<tr>
<td>Showering</td>
<td>59%</td>
<td>25.6%</td>
<td>41.7%</td>
<td>65.5%</td>
</tr>
</tbody>
</table>

PID customers had greatest reduction in water use activities
>58% DOWC customers didn’t stop water use (they were told it was safe)
75.4% of homes that continued drinking the water used filtration
In the first 6 months, has anyone **CHEMICALLY** tested the drinking water inside the standing home? (n = 233)

<table>
<thead>
<tr>
<th>PID</th>
<th>DOWC</th>
<th>Private Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homes that did in-home testing</td>
<td>40.3%</td>
<td>15.8%</td>
</tr>
<tr>
<td>Belief in cold water chemical contamination?</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>
Outcomes

- anxiety, stress, and depression
- unknown if water and plumbing systems are contaminated
- not perceived as clear, helpful, or trustworthy
- high financial and logistical cost
- Invested estimated $7M in home water treatment and storage technologies

Recommended Actions

- Addressing drinking water concerns should reduce these symptoms
- The state should develop and field validate evidence based plumbing testing procedures that can identify contaminated plumbing; Also identify who will conduct testing and who will pay for it
- Organizations should provide greater transparency with decisions and data so that the public can access it
- Insurance companies should clarify coverage plans. State should consider insurance gaps.
- Due to public health implications, formal independent oversight is needed for technology selection, maintenance, and operation

Full survey results here: www.PlumbingSafety.org
Our multi-university team stepped in with plumbing safety help

Station 1: The Plumbing Zoo
Many survivors as well as contractors, journalists, local, county, and state officials did not understand plumbing. This direct engagement improved their knowledge.
Ask the Experts

The Plumbing Zoo

Water Sampling 101

Ask the Experts
Then, SWRCB’s July 2019 Public Presentation

Our Response

Opinion: Amid a Water Crisis, California Officials Fan Flames of Confusion

Since the 2018 Camp Fire, carcinogens have lingered at dangerously high levels in the region’s drinking water supply.
SWRCB: Repeatedly told us it was “unfair” PID could get FEMA funds and DOWC could not.

Butte County and PID: Issued water use restrictions to protect the population

SWRCB and DOWC: Said DOWC water was safe [It wasn’t]. Both ignored County’s advice.

USEPA Region 9: Refused to force the SWRCB and DOWC to protect DOWC customers.

CalOES: Direct line to governor, but when confronted with evidence, did not stop SWRCB from harming the water systems response or recovery.

A Few More Lessons

- SWRCB and DOWC claimed if water doesn’t have an odor, it is safe [WRONG]
- SWRCB found lab reproducibility issue: + 287% benzene difference in their own duplicates. Then chose NOT to run duplicates “because it would raise questions”.
- Plumbing testing guidance bungled by SWRCB, at least 1 Commercial Lab, some Home Water Treatment Companies, at least 1 Insurance Company
- Insurance companies hired “experts”. 1 said they didn’t believe in or use stagnation
One Year Later
Paradise and Beyond

- **Population:** Less than 3,000 of 26,000 pre-fire (now certified as rural)
- **Homes rebuilt:** 11 of the 11,000+ homes that were destroyed
- **Debris removed:** 7.3 billion pounds of ash, debris, metal, concrete, and contaminated soil (2x WTC center)
- **PID water:**
  - 150 of 172 miles of water main cleared free of contamination
  - 47% of meter/service lines ‘standing structures’ cleared of contamination; Service lines to destroyed structures still need testing, maybe contaminated
- **Home owners:**
  - Responsible for testing THEIR service line and THEIR plumbing.
  - Insurance only sometimes covered plumbing testing.
  - Many exclusively rely on in-home treatment systems, some on water tanks.
  - Some stayed, some returned, others left, others uncertain.
In-home testing was conducted 11 months after the fire

125 homes: PID (101), Del Oro (24)
First draw, kitchen sink cold water only, 12+ hr stagnation.
Looked for more than benzene

- 2 homes: benzene found, but less than 1 ppb CA MCL
- 4 homes: methylene chloride exceeded USEPA 5 ppb MCL (max. 9.2 ppb)
- THF found above other state limits (no CA or federal limit)
- Unclear home location or plumbing system type (plastic vs. metal)
- Not statistically representative, homeowner service lines not tested
- Hot water systems are separate, where inhalation exposure occurs, but were not tested
- In-home testing we recommended to CalOES 8 months prior was never initiated
Disasters continue to expose a critical lack of knowledge when it comes to drinking water infrastructure

Water sampling and analysis for unknown contaminants
Water use advisories based on quantitatively predicted exposure
Lack of effective valid infrastructure decontamination methods
Waste handling policy for hazardous infrastructure and water
An understanding of how plumbing is designed, operated, and tested
Long-term population support when water is not safe
And more …
Case study: the crude MCHM chemical spill investigation and recovery in West Virginia, USA.

1. People want to make good decisions.
2. Call for external water contamination help early. Test correctly.
3. Survivors need help – *in their homes* – while the system is fixed.
4. Don’t expect the federal government to provide the technical help you need. They don’t have it. Get help outside the echo chamber.
5. Butte County will recover. It will take time. Despite adversity and difficulties projected by government agencies, the community is recovering.
Thank you.
Comments from survey takers:

“I work in Magalia and will live in Paradise. I have been in a trailer on our friend's property in Chico for 6 months. This does not work for my family”

PlumbingSafety.org • awhelton@purdue.edu
Comments from survey takers:

“"I’m completely stressed and worried about what our inside plumbing and water heater might contain therefore for now we will continue to live in Chico until I’m assured water is completely safe!"
Comments from survey takers:

“The reason I graded the organizations as C's for communications about the water, is because there are so many unanswered questions (especially the timeline for repairs) delaying our rebuilding decisions.”
Comments from survey takers:

“The process of trying to move back home has become quite complex and overwhelming a mystery if you will. We don’t know when to test our plumbing, if it’ll be reliable, or what to do if the tests are positive or negative.”

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Comments from survey takers:

“I'm still stressed and fearful of having my family, especially my 7, 6, 5 and 4 year old grandsons come and stay at our house and play in the newly cleaned and filled pool.”
Comments from survey takers:

“Lots of folks up here in Yankee Hill are wondering about their water wells. We need help testing them…. We just don't know about our water--that's the problem, and we don't have the funds to test it.”
Comments from survey takers:

“There are too many competing agencies and too much worry about liability. We have to live in our home which survived the fire. We need to know actual information, not what could happen.”
Comments from survey takers:

“This is a TRUST ISSUE. Right now, not sure who to trust. VERY SAD.”
Comments from survey takers:

“I would feel safer if someone could provide me a tank and pump. With clean water. I hate feeling like a test subject.”
Comments from survey takers:

“As long as we can get by with bottled water, we want to be at home.”
Comments from survey takers:

“I returned to my home as soon as the evacuation was lifted. I didn't care what the circumstances were, I was going to return regardless.”
Comments from survey takers:

“I have purchased my home after the fire. I took a risk to invest here in Magalia, CA”
Comments from survey takers:

“We tested positive for Benzene from the kitchen sink.”
Comments from survey takers:

“Going to Chico for showers is a real pain!”
Comments from survey takers:

“I do feel strongly that frequent water testing in all standing homes should be conducted at no cost to homeowners.”
Comments from survey takers:

“Our insurance company covered what was damaged due to the fire and that's it, this is all standing homes we got no help, none.”
Comments from survey takers:

“There have been a few of us that have gotten ill.”