



STRIVE FOR EXCELLENCE 2026, Las Vegas, NV

Innovations in Cal/OSHA Rulemaking: Protecting Firefighters During Wildland and WUI Operations



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The views expressed in this presentation do not necessarily reflect those of the Department of Industrial Relations or the Labor and Workforce Development Agency.



Photo by Mike Wilson



Enforcement: Inspections, citations, abatement of hazards

Consultation: Outreach, technical support for small businesses

Research and Standards: Drafts new and revised standards

CA OSH Standards Board: Adopts new or revised standards.



AB 2146 (Skinner) (2014): DIR must assess whether Cal/OSHA's firefighter safety regulations reflect current NFPA standards. NFPA 1984 pertains to wildland/WUI respiratory protection.



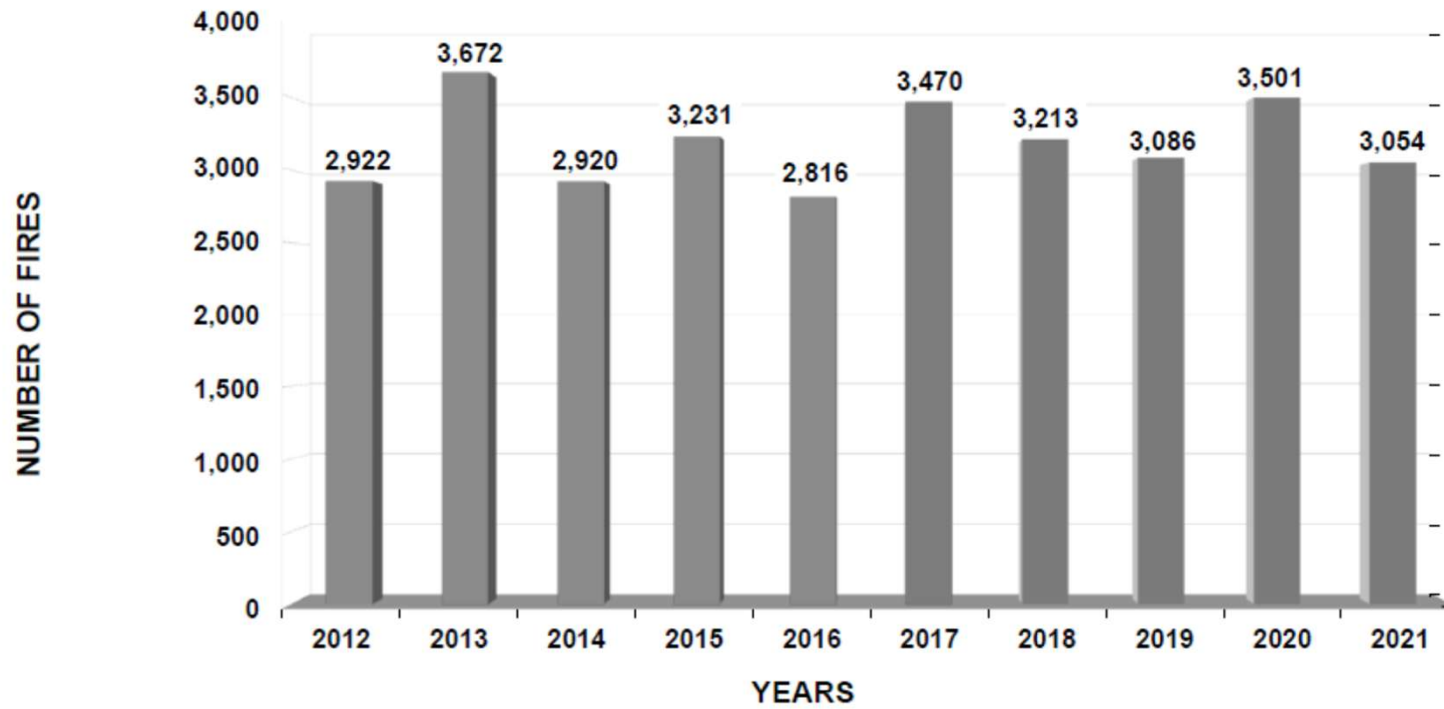
Innovations in Cal/OSHA Rulemaking: Protecting Firefighters During Wildland and WUI Operations

- Firefighters and W/WUI fires.
- Firefighter inhalation hazards during W/WUI deployments.
- Cal/OSHA's rulemaking on W/WUI inhalation exposures
- Cal/OSHA's Collaboration with LA County Fire, Cal/FIRE and USFS
- Current status of rulemaking

Innovations in Cal/OSHA Rulemaking: Protecting Firefighters During Wildland and WUI Operations

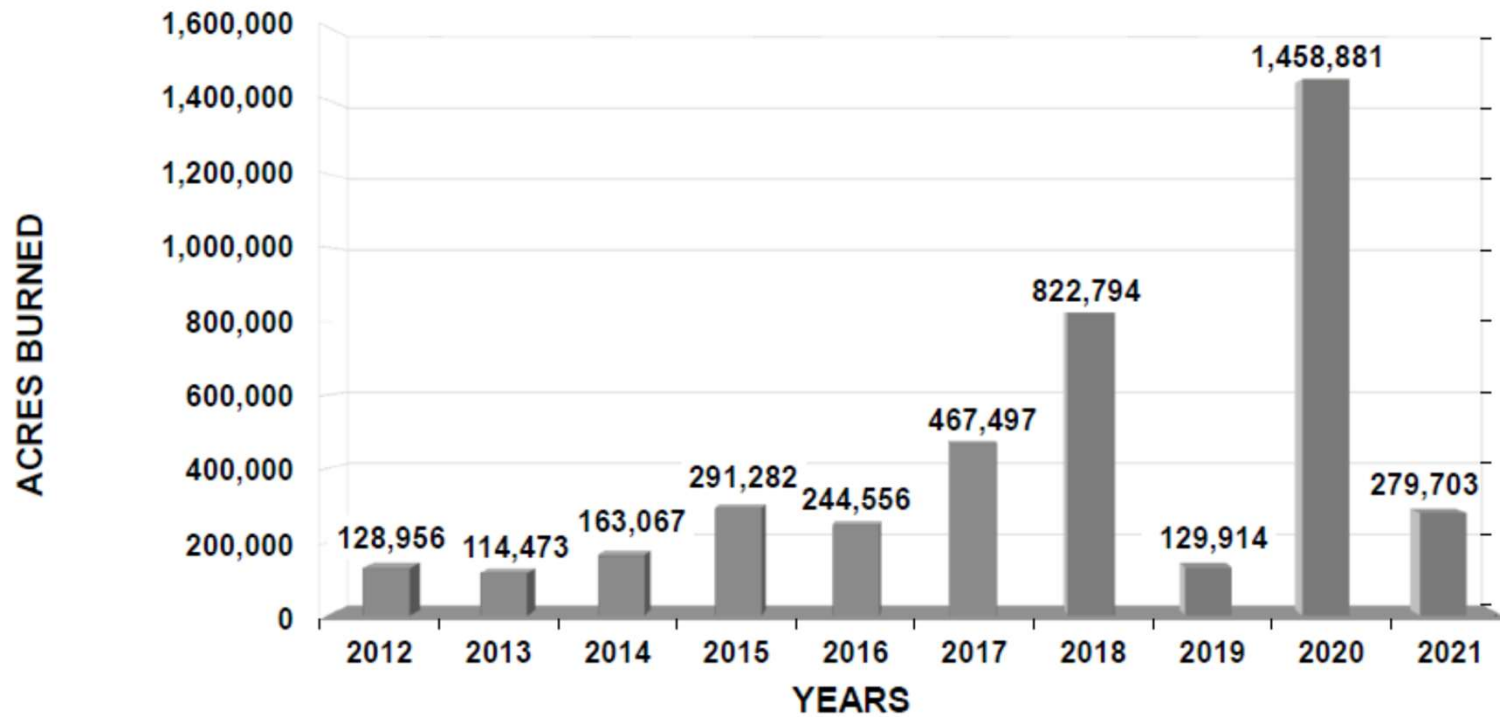
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NUMBER OF FIRES 2012-2021

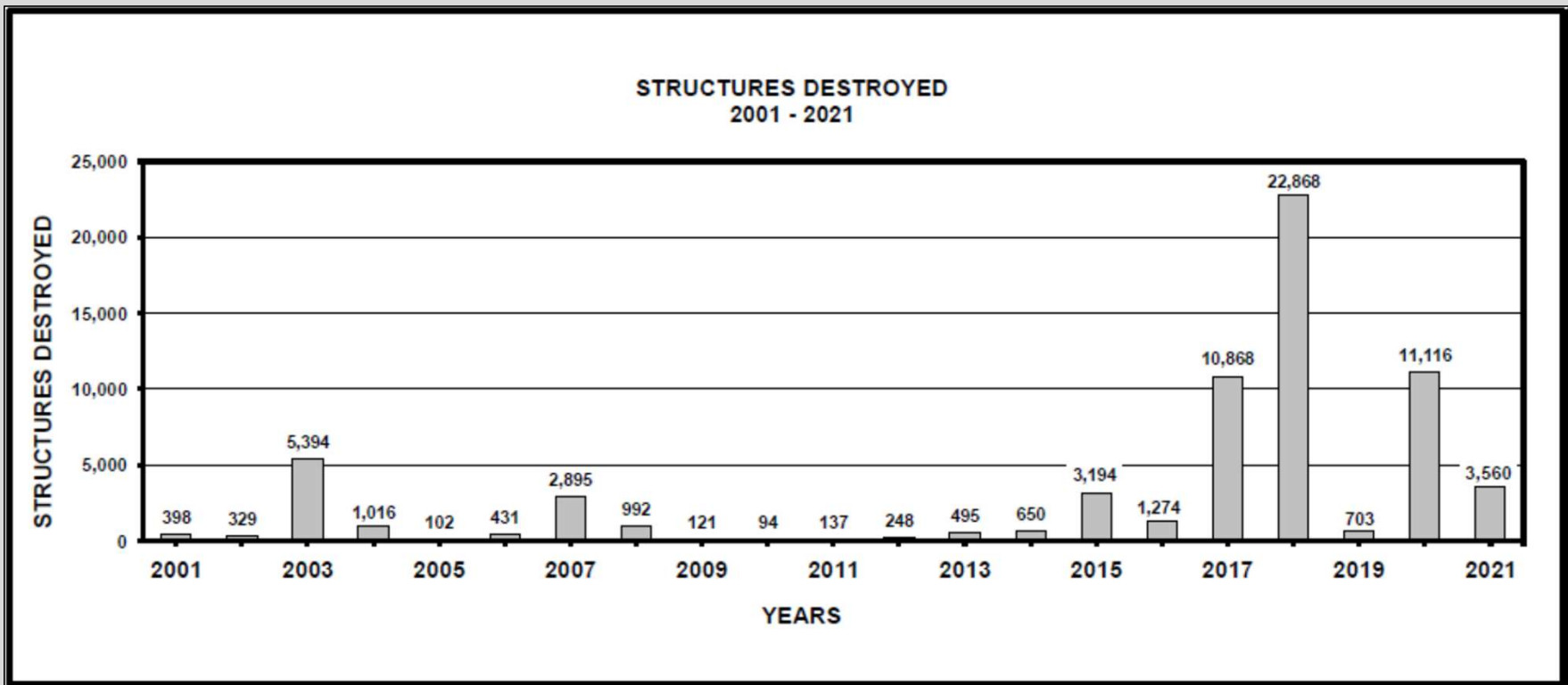


Source: Cal/FIRE. Wildfire Activity Statistics, 2021 (Red Book)

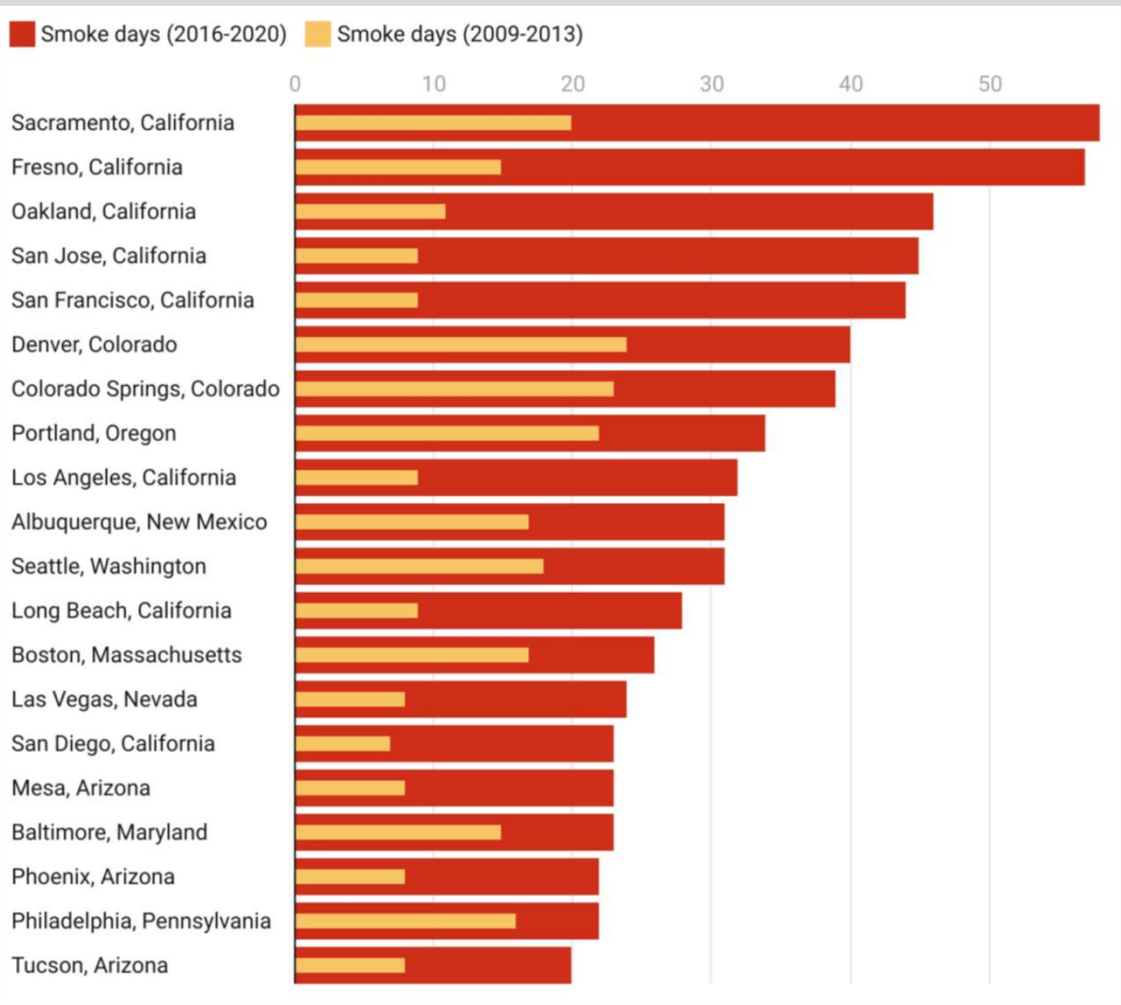
NUMBER OF ACRES BURNED 2012-2021



Source: Cal/FIRE. Wildfire Activity Statistics, 2021 (Red Book)



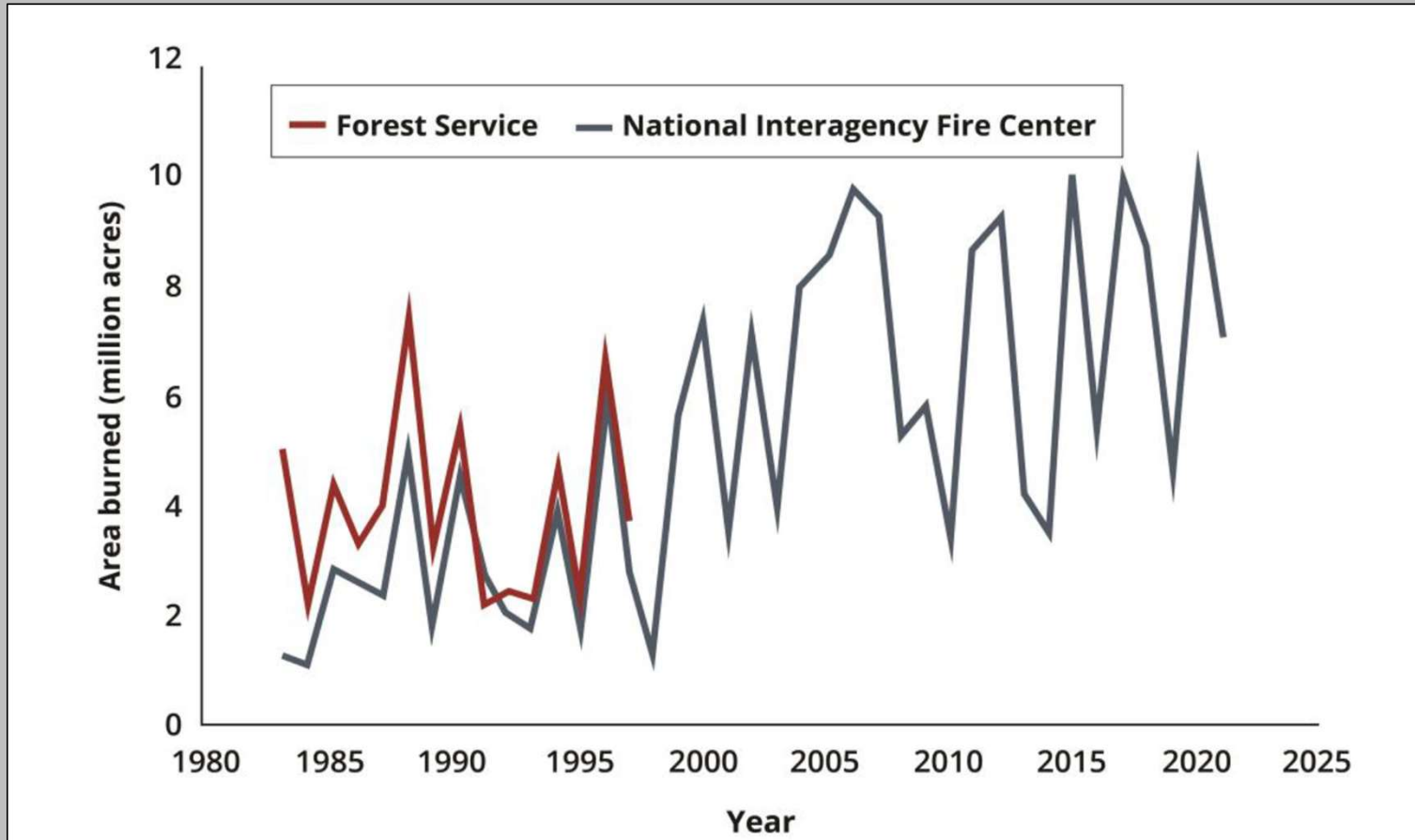
Source: Cal/FIRE. Wildfire Activity Statistics, 2021 (Red Book)



Annual smoke days in major U.S. cities, 2009-2013 compared to 2016-2020.



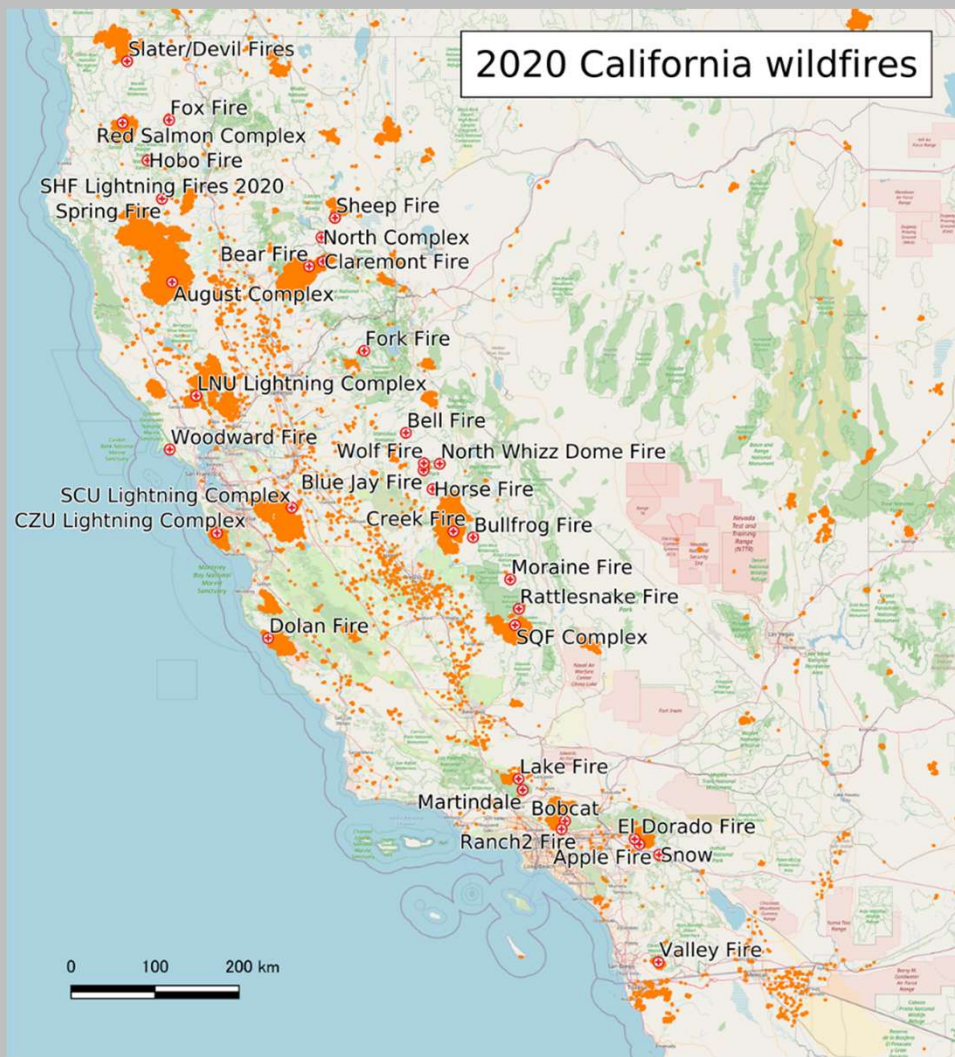
Source: Alison Saldanha, Dangerous Air: As California Burns, America Breathes Toxic Smoke. Sept 28, 2021. <https://www.kvpr.org/news/2021-09-28/dangerous-air-as-california-burns-america-breathes-toxic-smoke>



Area Burned by Wildfires in the United States, 1983-2021



Source: NIOSH (Dec 2024) *Wildfire Smoke Exposure Among Farmworkers and Other Outdoor Workers*. External Review Draft



Source: Wikimedia Commons.
https://commons.wikimedia.org/wiki/File:2020_California_wildfires.png

Each year, thousands of Cal/FIRE and municipal firefighters are deployed in strike teams to fight large wildland and wildland-urban interface (WUI) fires.



Photo: LA County Fire Dept.

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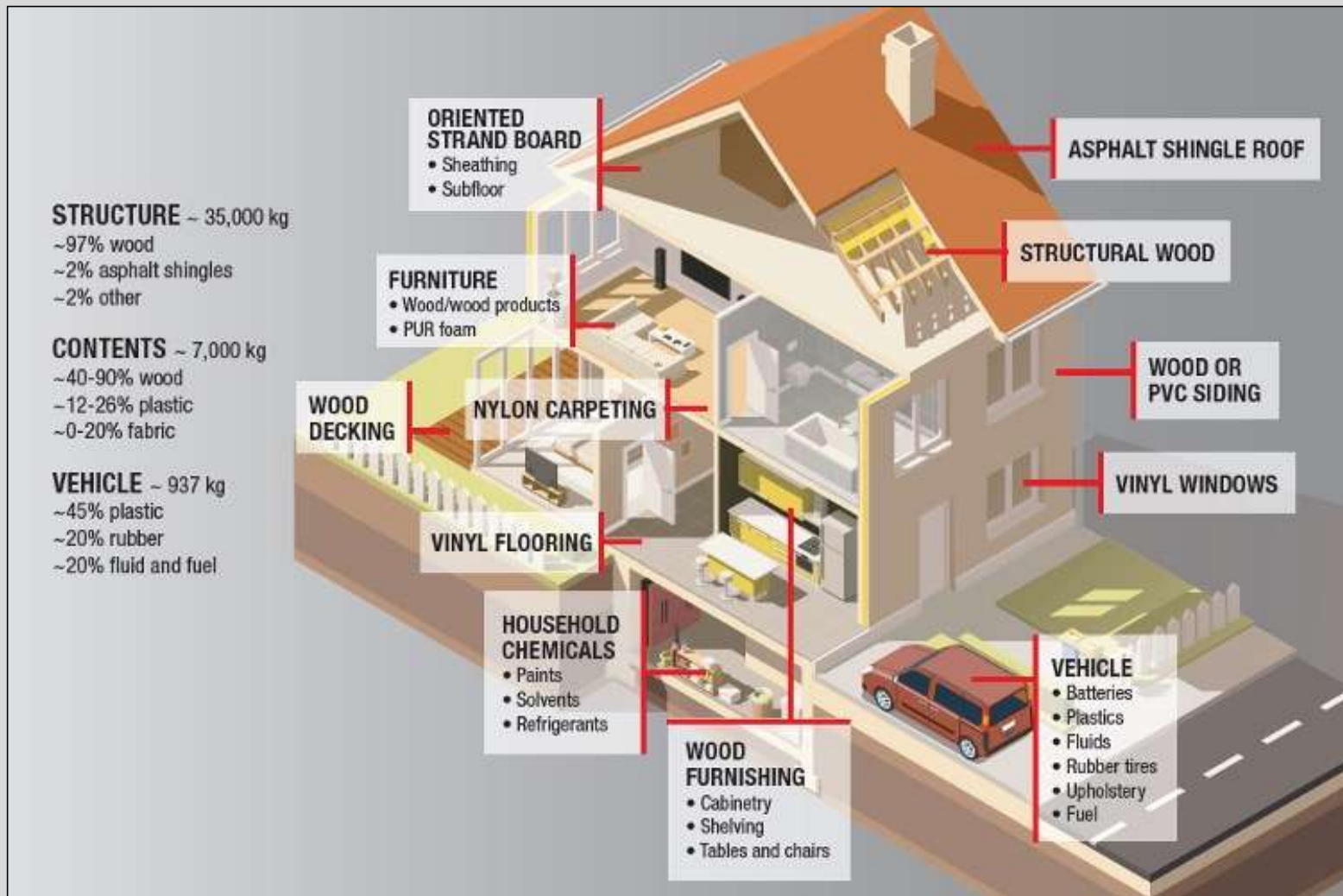
Shockey Fire, San Diego. Wildland Urban Interface (WUI) operations result in exposures to structure fire smoke, without the protection of an SCBA.



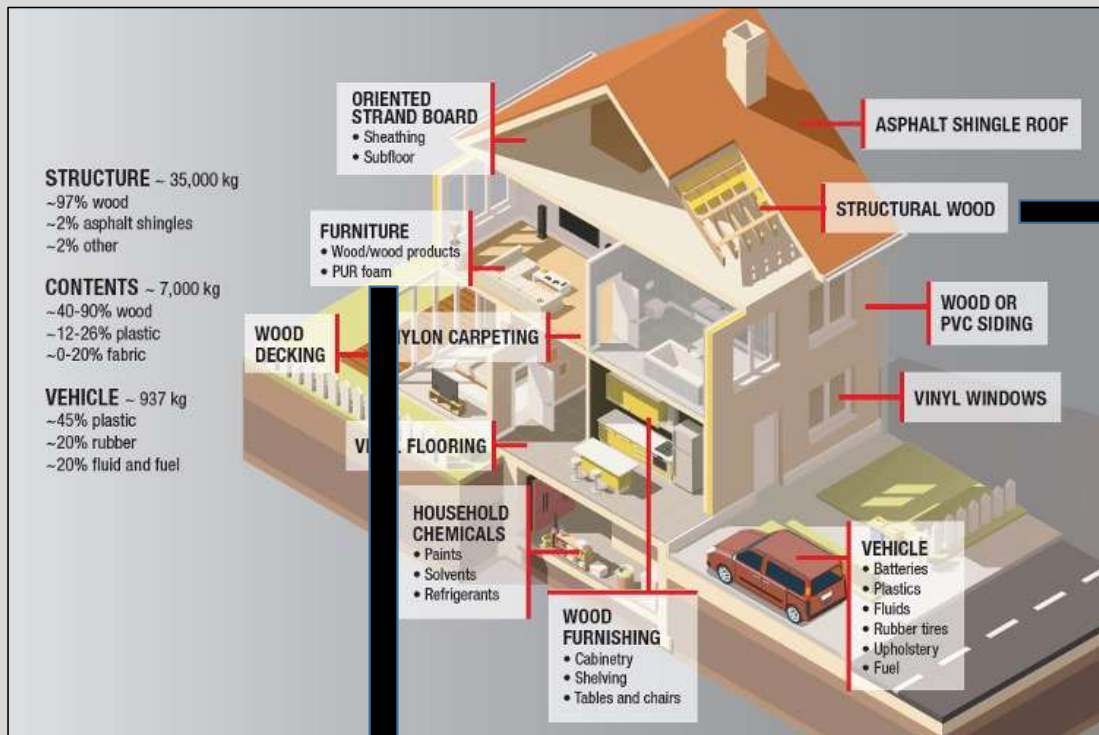
Photo: DHS Science and Technology Directorate



Pacific Palisades and Eaton Fires, January 2025:
28 deaths, more than 16,000 structures destroyed



Source: National Academy of Sciences (2022) *The Chemistry of Fires at the Wildland-Urban Interface*.



Oriented strand board (OSB)

HCN, CO, NO₂, HCl, acrolein, formaldehyde, PM, PAHs, VOCs, SVOCs, isocyanates

- Acrylic clothing
 - Residential furniture
- HCN, CO, NO, NO₂, NH₃, PM, PAHs, VOCs, SVOCs, isocyanates, benzene, toluene, formaldehyde, organophosphate flame retardants



Source: National Academy of Sciences (2022) *The Chemistry of Fires at the Wildland-Urban Interface*.

International Agency
for Research on Cancer



World Health
Organization

2022: Occupation of Firefighting Classified as a Group 1 Carcinogen

“Occupational exposure as a firefighter causes cancer. There was sufficient evidence for cancer in humans for mesothelioma and bladder cancer.

There was limited evidence for cancer in humans for colon cancer, prostate cancer, testicular cancer, melanoma of the skin, and non-Hodgkin lymphoma.”



Source: IARC Monographs (July 1, 2022) <https://www.iarc.who.int/news-events/iarc-monographs-evaluate-the-carcinogenicity-of-occupational-exposure-as-a-firefighter/>







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The logo for the Los Angeles Times, featuring the words "Los Angeles Times" in a stylized, gothic-style font on a black background.

By Marla Cone
Dec 8, 1992

New respirators hold promise for crews who have fought wildfires with just bandannas to protect their lungs.

“For decades, firefighters have battled wildfires with nothing but a red bandanna to shield them from lung-scarring, poisonous smoke. But the bandanna is about to be replaced by a new form of respirator that provides safe, lightweight protection.”

“When state forestry firefighters in Sunol...were equipped with full-face, air-purifying masks for part of a summer season, it not only eased the burden on their lungs but enhanced their firefighting ability. In all, 24 firefighters tried them during the last two summers.”

“Among firefighters who battled the 1991 Oakland blaze, those who didn’t don respirators were sick for days, while crews that did wear them were able to return to work immediately.”

“With that mask on, you weren’t worried about when you could take your next breath,” Gonzalez said. “You could breathe normally. There was a sense of being a lot more calm, and you could see clearly because your eyes weren’t watering and burning and your lungs weren’t burning.”

<https://www.latimes.com/archives/la-xpm-1992-12-08-mn-1859-story.html>



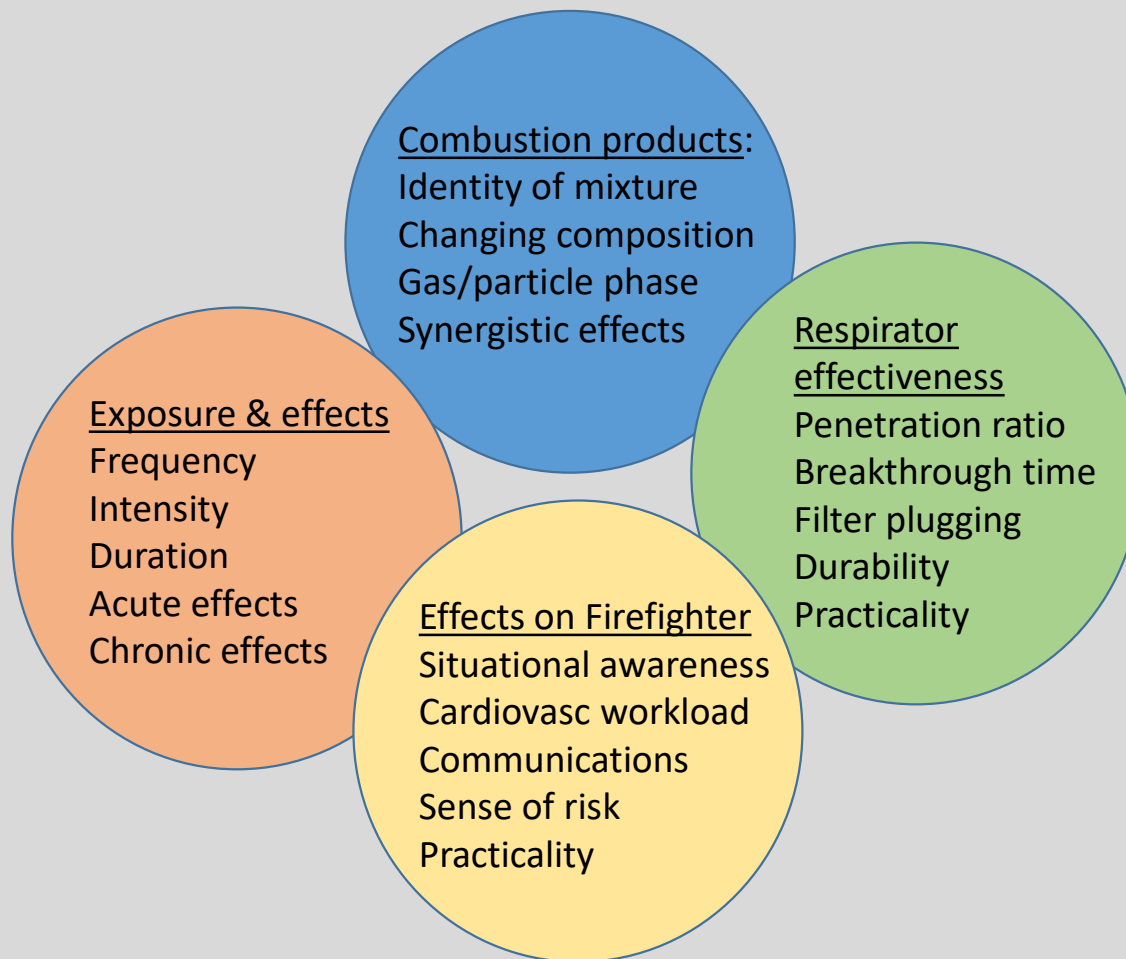


“To move forward in developing a compliant prototype respirator, manufacturers would need sufficient demand or a commitment from federal, state, and local wildland fire management agencies to purchase respirators.”

2026: 34 years later, no W/WUI respirator exists. A 2014 NIOSH report concluded that lack of demand has been the key barrier.



NIOSH (2014): Analysis of Barriers Affecting Implementation of the NFPA 1984 Standard on Respirators for Wildland Fire-fighting Operations 2011 Edition. Unpublished report.



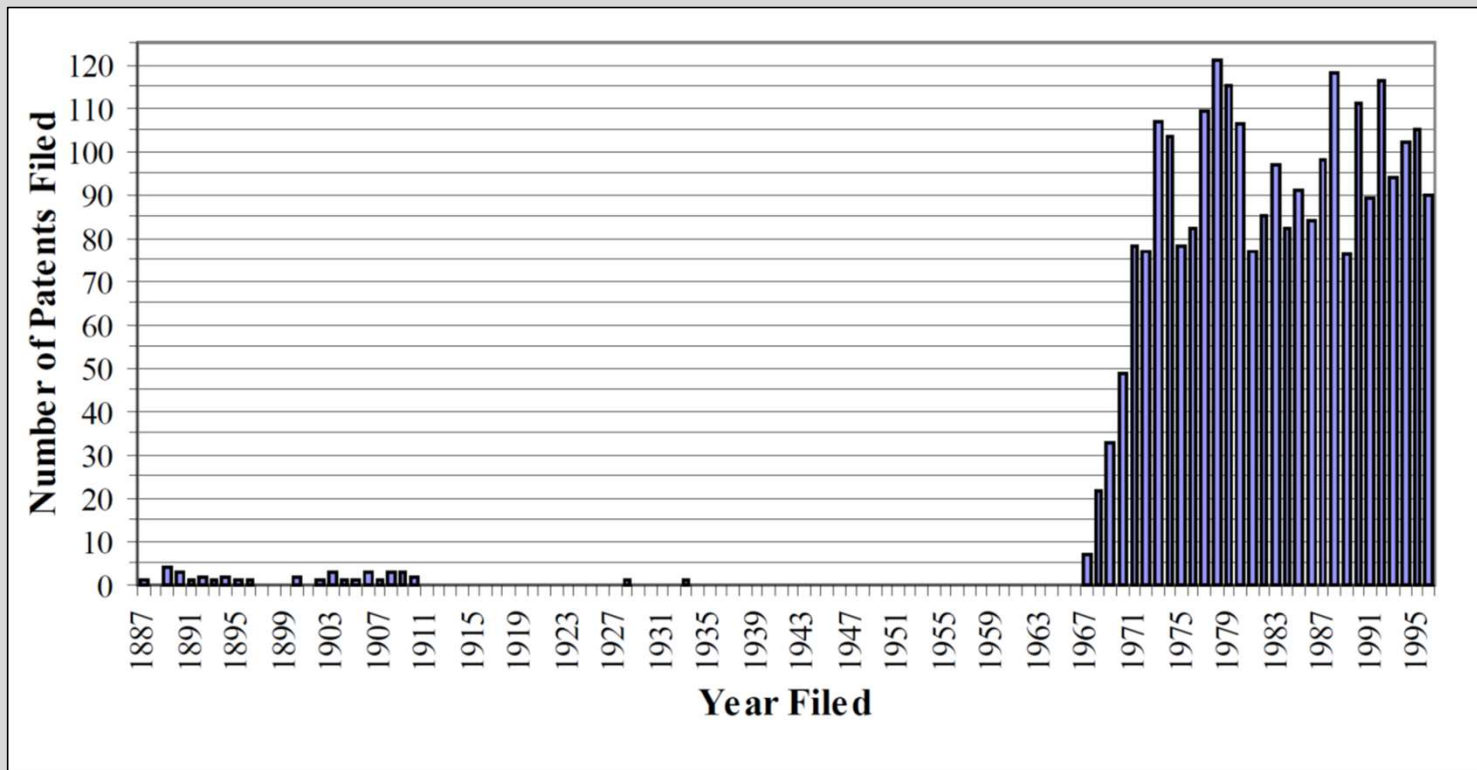
Data Gaps: Lack of demand, and lack of innovation by industry, stem from persistent W/WUI respiratory protection data gaps.



While doing this.



So firefighters should wear an SCBA...



Solution: Technology-forcing regulation. U.S. patents for SO₂ control technology, related to the Clean Air Act of 1970.

“A relatively high degree of [regulatory] stringency appears to be a necessary condition for inducing higher degrees of innovative activities.”



Taylor et al. (2001) The Effect of Government Actions on Technological Innovation for SO₂ Control. EPA/DOE/EPRI



CCR Title 8, § 5194.
Bloodborne Pathogens.

(d) Methods of Compliance.

(A) Needleless Systems, Needle Devices and non-Needle Sharps.

a. Market Availability. The engineering control is not required if it is not available in the marketplace.

Technology-forcing regulation: Cal/OSHA's Bloodborne Pathogens standard required safety engineered injection devices, *when they became available on the market.*



STATE OF CALIFORNIA

GAVIN NEWSOM, Governor

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DRAFT REGULATORY TEXT
CALIFORNIA CODE OF REGULATIONS, TITLE 8, SECTION 3410.2

**RESPIRATORY PROTECTION FOR WILDLAND FIREFIGHTING
AND WILDLAND URBAN INTERFACE OPERATIONS**

FOR CONSIDERATION BY THE CAL/OSHA RESPIRATORY PROTECTION
TECHNICAL ADVISORY COMMITTEE
FOR DISCUSSION PURPOSES ONLY

May 25, 2022

“Within two (2) years of the effective date of this section, or within two (2) years after they are made available on the market, the employer shall ensure that each employee deployed to incidents that may involve wildland firefighting or WUI operations is provided with a fully functional, full-face, NIOSH-certified, Class 3, powered air purifying respirator (PAPR) that meets the requirements of NFPA 1984, Standard on Respirators for Wildland Fire-Fighting and Wildland Urban Interface Operations (2022 version).”

Cal/OSHA issues draft regulation on May 25, 2022



Rulemaking Based on the Model of Community-based Participatory Research



A partnership of firefighters, department and union leadership, researchers, fire service organizations, and regulators.

Partners contribute expertise and share decision-making.

Firefighters are collaborators (co-designers, co-producers) from start to finish, in recognition of their expertise and lived experience.



Adapted from National Cancer Institute (Sept 2018). April Oh, Design Thinking and Community-Based Participatory Research for Implementation Science

<https://cancercontrol.cancer.gov/is/blog/dispatches-from-is-at-nci-blog-september-2018>



Adopted Resolution No. 17 of the IAFF 2024 Convention: *Bill of Rights for Firefighters Participating in Research as Human Subjects*



Photo by Mike Wilson, Cal/OSHA

“CBPR is a collaborative approach to research where scientists and firefighters collaborate as equal partners on all aspects of a research project...”

Principles are “founded on respect for persons, beneficence, and justice.”

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In 2022-23, Cal/OSHA collaborated with LA County FD, Cal/FIRE and the U.S. Forest Service to conduct Operational Field Assessments of five wildland/WUI respirators.

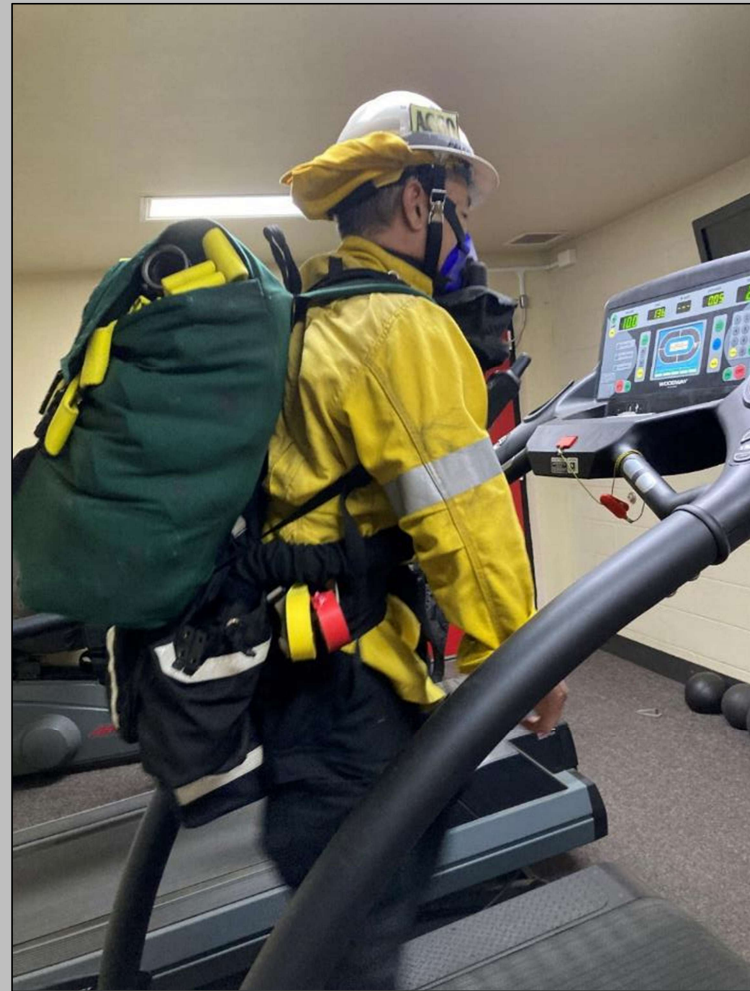




Photos: Mike Wilson, Cal/OSHA



LA County Fire, Cal/FIRE, USFS, Cal/OSHA Operational Field Assessment, Castaic, Aug 30, 2023:
3M PAPR, MSA PAPR, Sundstrom PAPR and APR, TDA/Drager PAPR, Ventus APR



Weight and cardiovascular workload are key considerations. The TDA/Dräger P APR responds to increases in tidal volume by increasing the air flow rate.

Photo: Mike Wilson,
Cal/OSHA



Cutting line while wearing respiratory protection (PAPR and APR) at the OFA, LA County Training Center, Castaic, CA Aug 30, 2023.

Photos: Mike Wilson,
Cal/OSHA





Cal/FIRE
firefighters
wearing
TDA/Drager
PAPR, MSA PAPR
and Sundstrom
APR.

Cal/FIRE, USFS,
Cal/OSHA OFA,
Redding CA.
Sept 12, 2023

Photos: Mike Wilson, Cal/OSHA



Photos: Mike Wilson,
Cal/OSHA

TDA/Drager PAPR with USFS webgear
Cal/FIRE Operational Field Assessment, Redding, Sept 12, 2023.

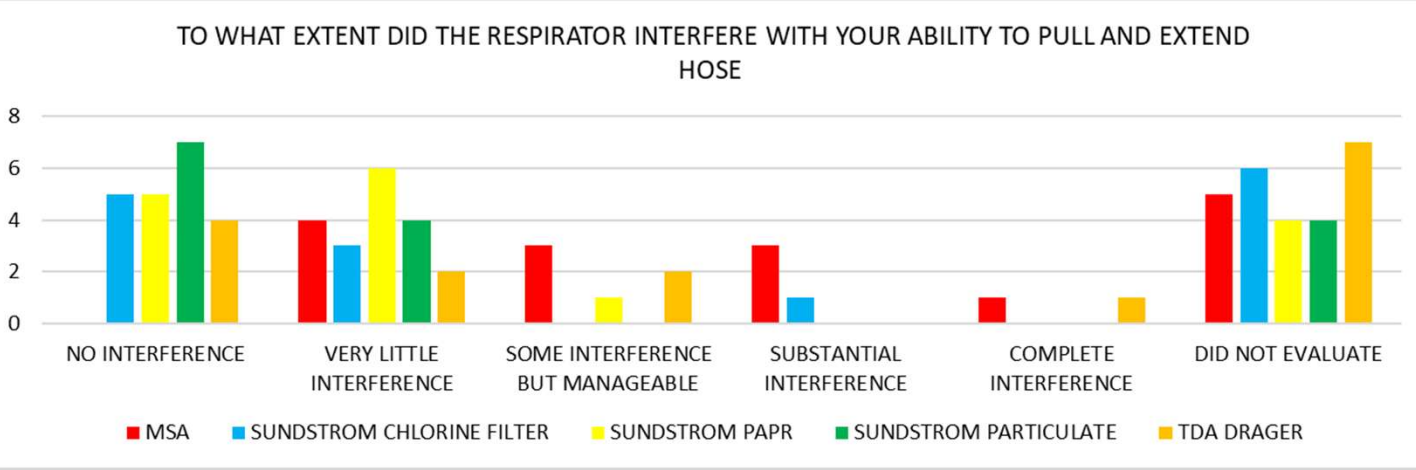
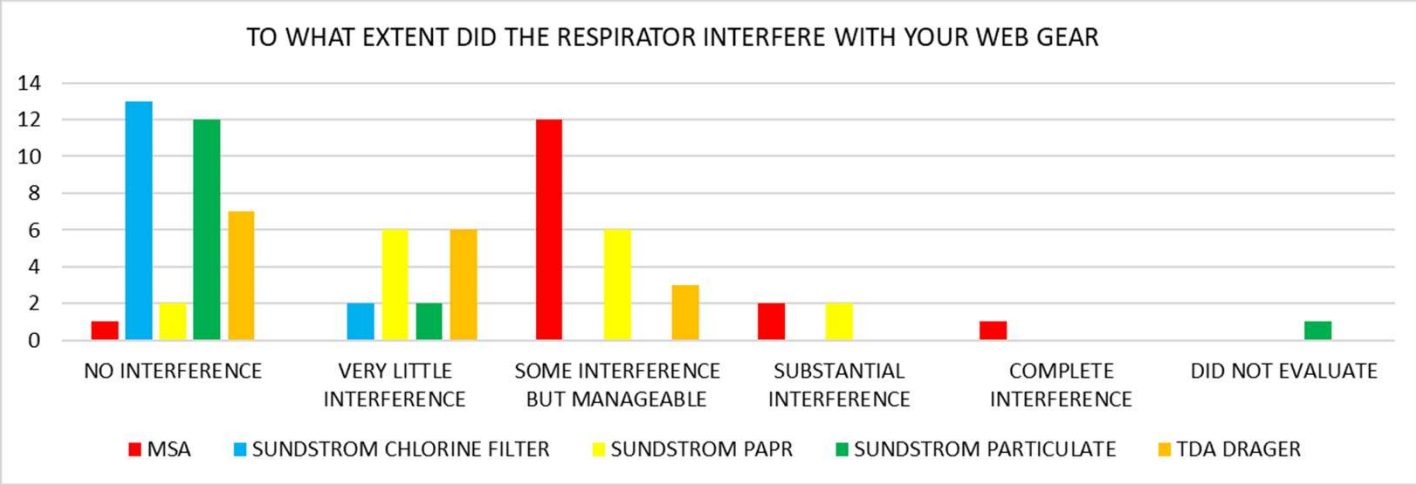




Cal/FIRE
firefighters
wearing
respiratory
protection while
conducting an
extended
wildland hoselay.

OFA, Redding CA.
Sept 12, 2023

Photos: Mike Wilson, Cal/OSHA



20 Firefighter participants in the Redding OFA.

MSA: PAPR with G-1 full facepiece

Sundstrom: PAPR with full facepiece

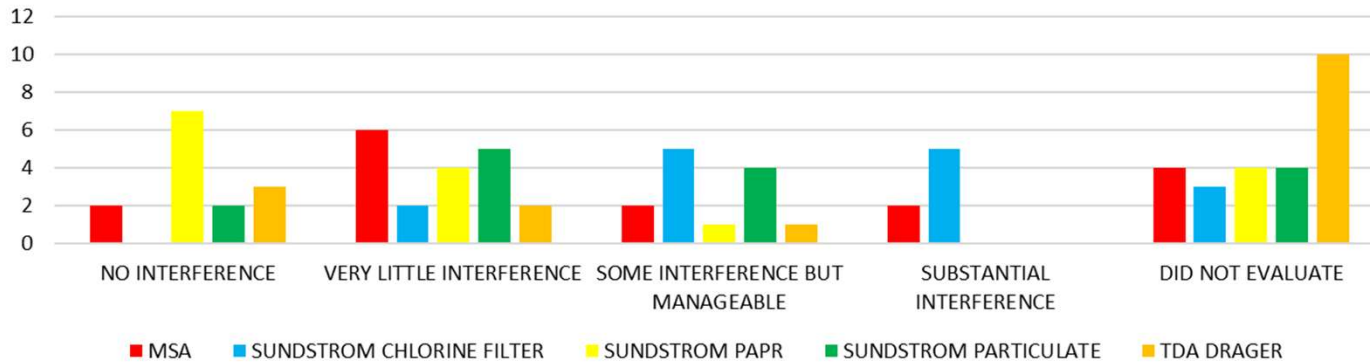
Sundstrom: APR with PM filter

Sundstrom: APR with PM and chlorine filter

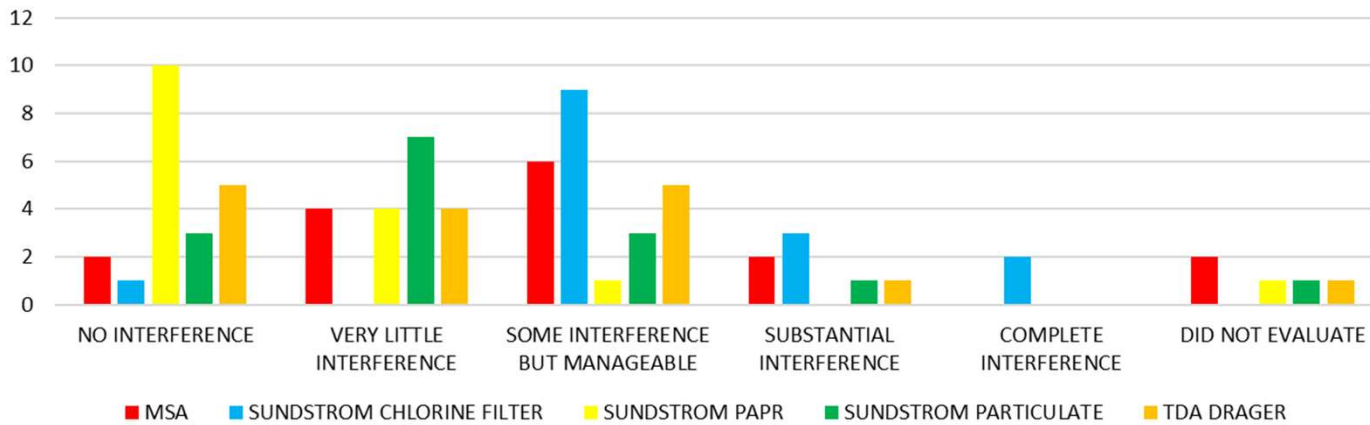
TDA Drager: PAPR with half-face mask



TO WHAT EXTENT DID THE RESPIRATOR INTERFERE WITH YOUR ABILITY TO BREATHE WHILE WALKING QUICKLY UPHILL



TO WHAT EXTENT DID THE RESPIRATOR INTERFERE WITH YOUR ABILITY TO BREATHE WHILE WORKING STRENUOUSLY



20 Firefighter participants in the Redding OFA.

MSA: PAPR with G-1 full facepiece

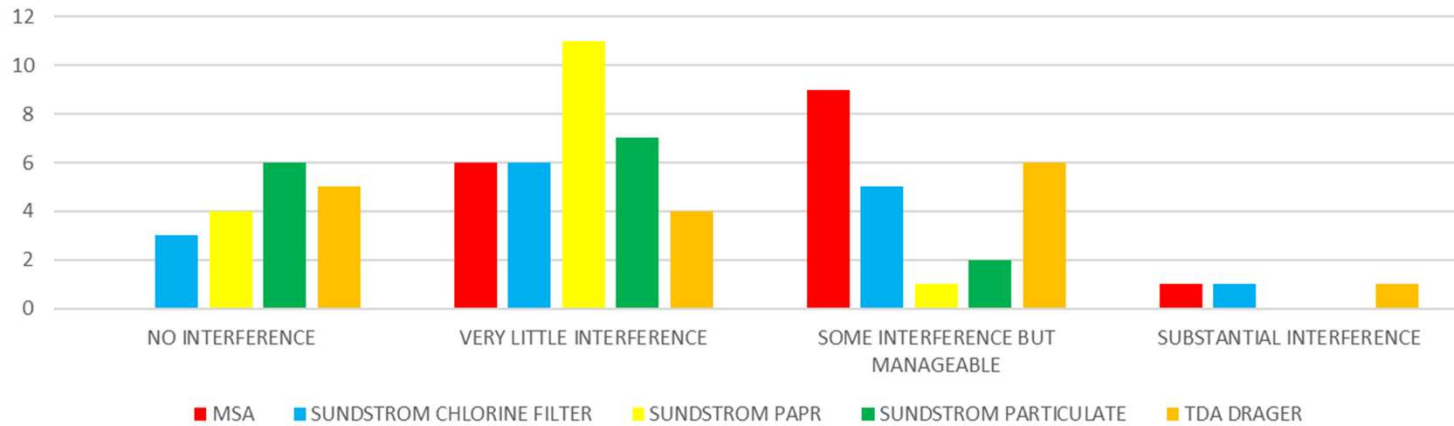
Sundstrom: PAPR with full facepiece

Sundstrom: APR with PM filter

Sundstrom: APR with PM and chlorine filter

TDA: PAPR with half-face mask

TO WHAT EXTENT DID THE RESPIRATOR INTERFERE WITH YOUR ABILITY TO PERFORM YOUR ASSIGNMENTS DURING THE EVOLUTION



20 Firefighter participants in the Redding OFA.

MSA: PAPR with G-1 full facepiece

Sundstrom: PAPR with full facepiece

Sundstrom: APR with PM filter

Sundstrom: APR with PM and chlorine filter

TDA: PAPR with half-face mask

Structure protection is likely a good application for a PAPR with CBRN filtration.

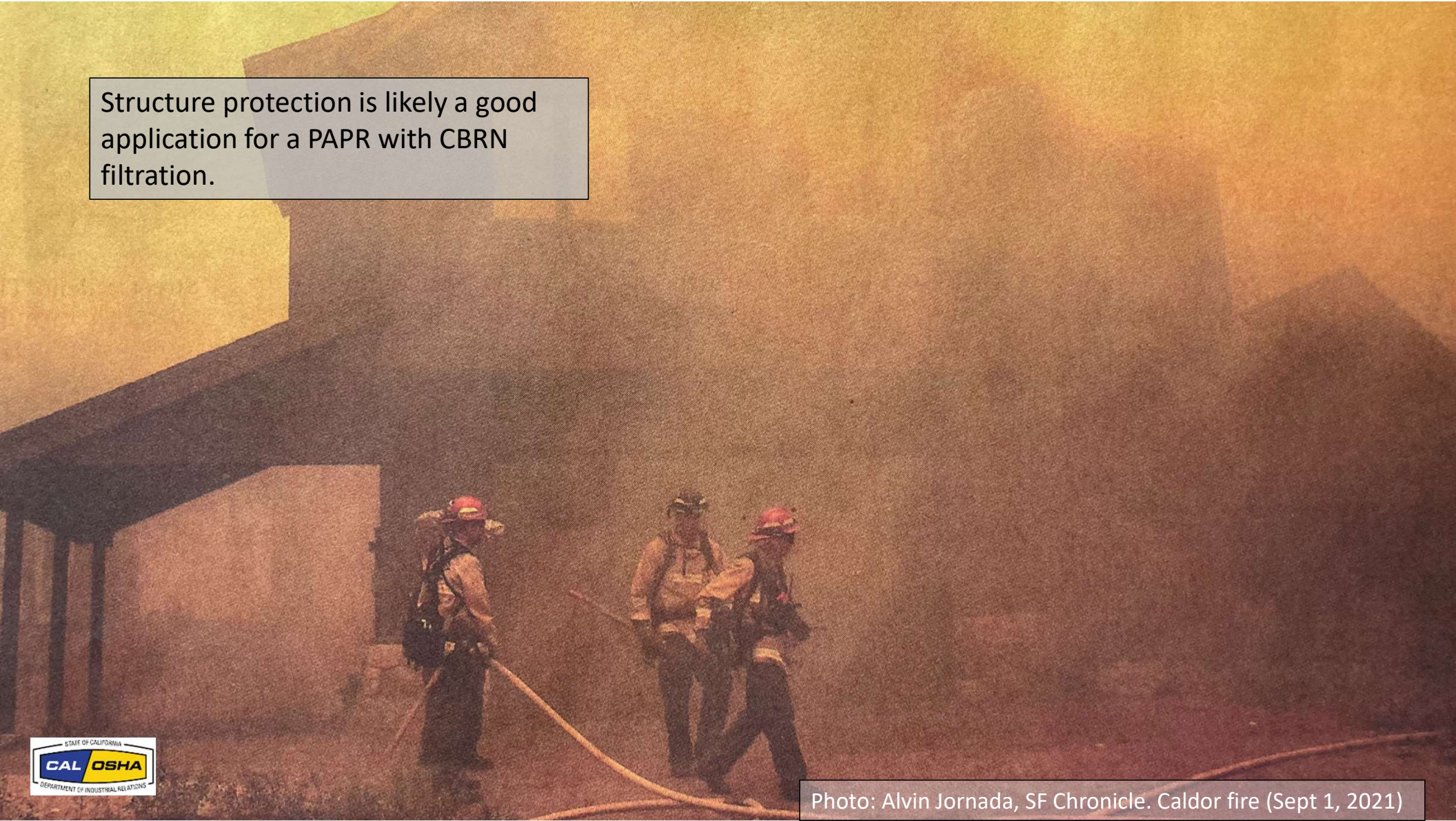


Photo: Alvin Jornada, SF Chronicle. Caldor fire (Sept 1, 2021)

Line crews need something lighter, most likely PM only.



Photo: National Interagency Fire Center. Government Accountability Office GAO-23-105517

Other scenarios are more complicated. Company officer will determine use.



Photo: DHS Science and Technology Directorate



Type I Engine

- Structure protection
- Powered Air-purifying Respirator (PAPR)
- CBRN canister (particulate, acid gas, organic vapor)



Type III Engine

- Progressive hoselays, perimeter control
- PAPR or Air-Purifying Respirator (APR)
- CBRN or multi-gas cartridge



Hand Crews

- Working from personnel carriers, handline work
- APR or PAPR
- Multi-gas or particulate filter only

Photos: Alvin Jornada, SF Chronicle
Arcata Fire District
Government Accountability Office GAO-23-105517



Other Potential Uses

- Overhaul: With limitations (CO, others)
- USAR: Extended ops
- EMS: Infectious respiratory diseases
- HazMat: Well-characterized, with limitations
- Fire Investigation

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Cal/OSHA baseline specifications under consideration:

- NIOSH-approved, personal issue PAPR and APR;
- NFPA 1984-certified, except chemical challenges;
- Cal/OSHA specific label



Photo: Mike Wilson, Cal/OSHA

“Performance elements” under consideration, evaluated and rated by Cal/OSHA, in collaboration with FIRESCOPE.

Effectiveness in smoke	Radio comms, Bluetooth enabled	Durability under W/WUI conditions	Minimizes work of breathing
Minimum battery life	Uses a pre-filter to prolong filter life	Particulate filter service indicator	Does not impede visibility
Battery life indicator	Operate controls with gloved hands	Minimum weight and bulk	Does not impede situational awareness
Max battery charging time	Works with wildland shroud	Does not impede tools, PPE, work	
Ease of battery swap-out	Works with load-carrying gear	Ease of donning & doffing	



Draft trigger under consideration:

- PAPRs and APRs required within two years after the rule goes into effect, even if not NFPA compliant,
- or when a PAPR or an APR enter the market that meets the baseline standards, whichever comes later, and
- that passes the evaluation of the “performance elements.”

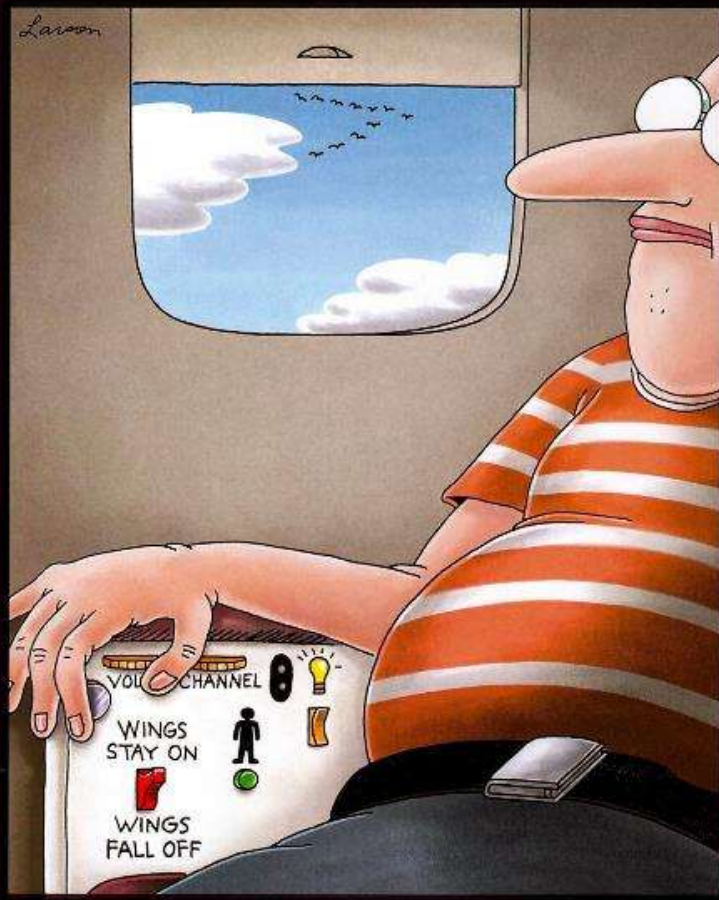
“Fumbling for his recline button, Ted unwittingly instigates a disaster.”

Goals:

- Motivate smart design, continuous improvement and innovation.
- Avoid impractical requirements.
- Avoid inappropriate designs.
- Avoid false starts.
- Build trust and cultural acceptance.

Strategies:

- Engage labor and management.
- Collaborate from the beginning.
- Draw on the lived experience of firefighters.
- Build a scientific foundation, but do not await exhaustive evidence of harm before acting.
- Advance a new rule based on the balance of the evidence.



Fumbling for his recline button, Ted unwittingly instigates a disaster.

Thanks to Gary Larson, creator of the Far Side.

Cal/OSHA Thanks Our Fire Service and Academic Partners



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With representatives of
California fire departments and
IAFF local unions.

