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 Cal/OSHA, DIR or the Labor and Workforce Development Agency.


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.
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- 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

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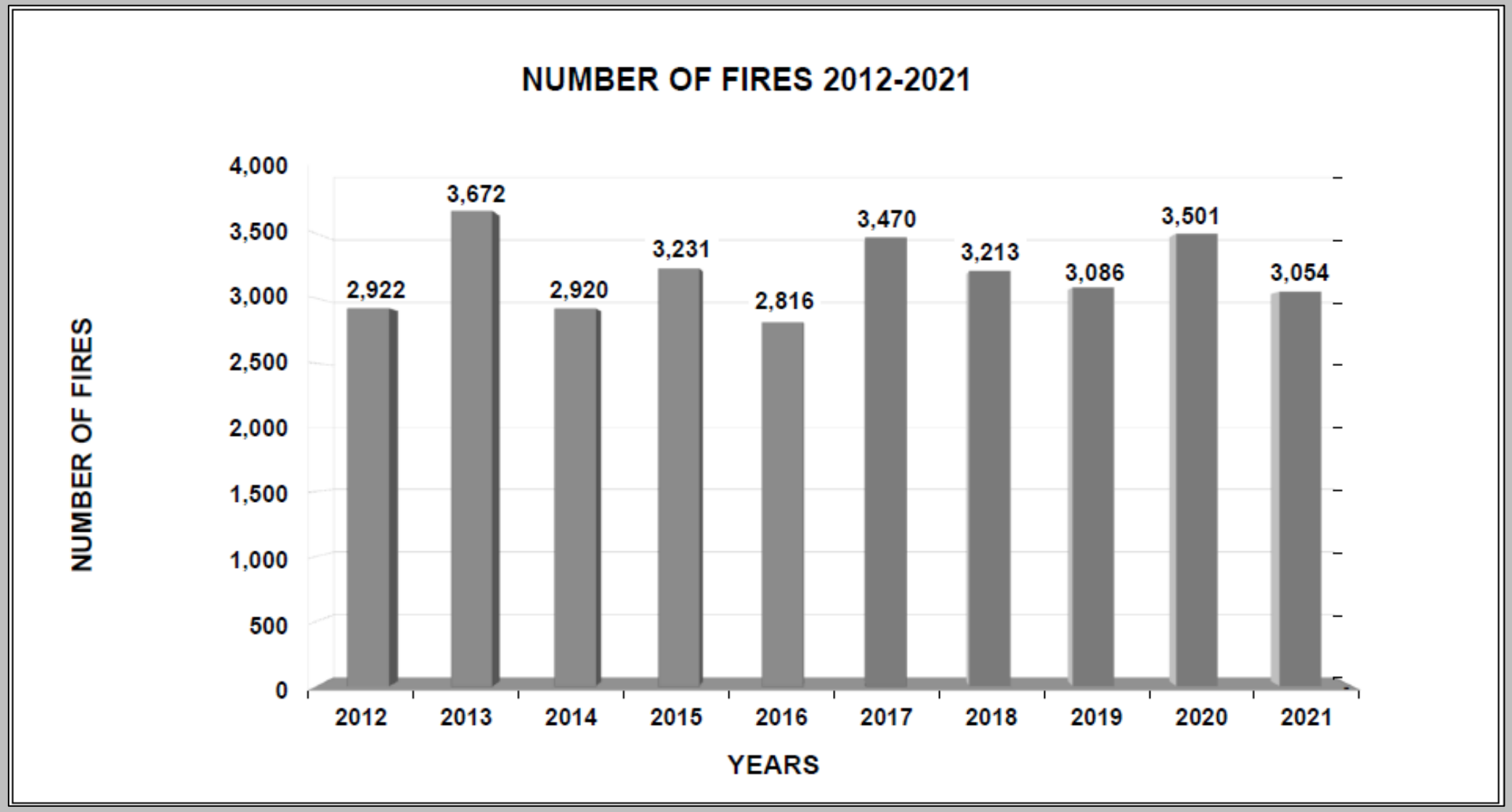
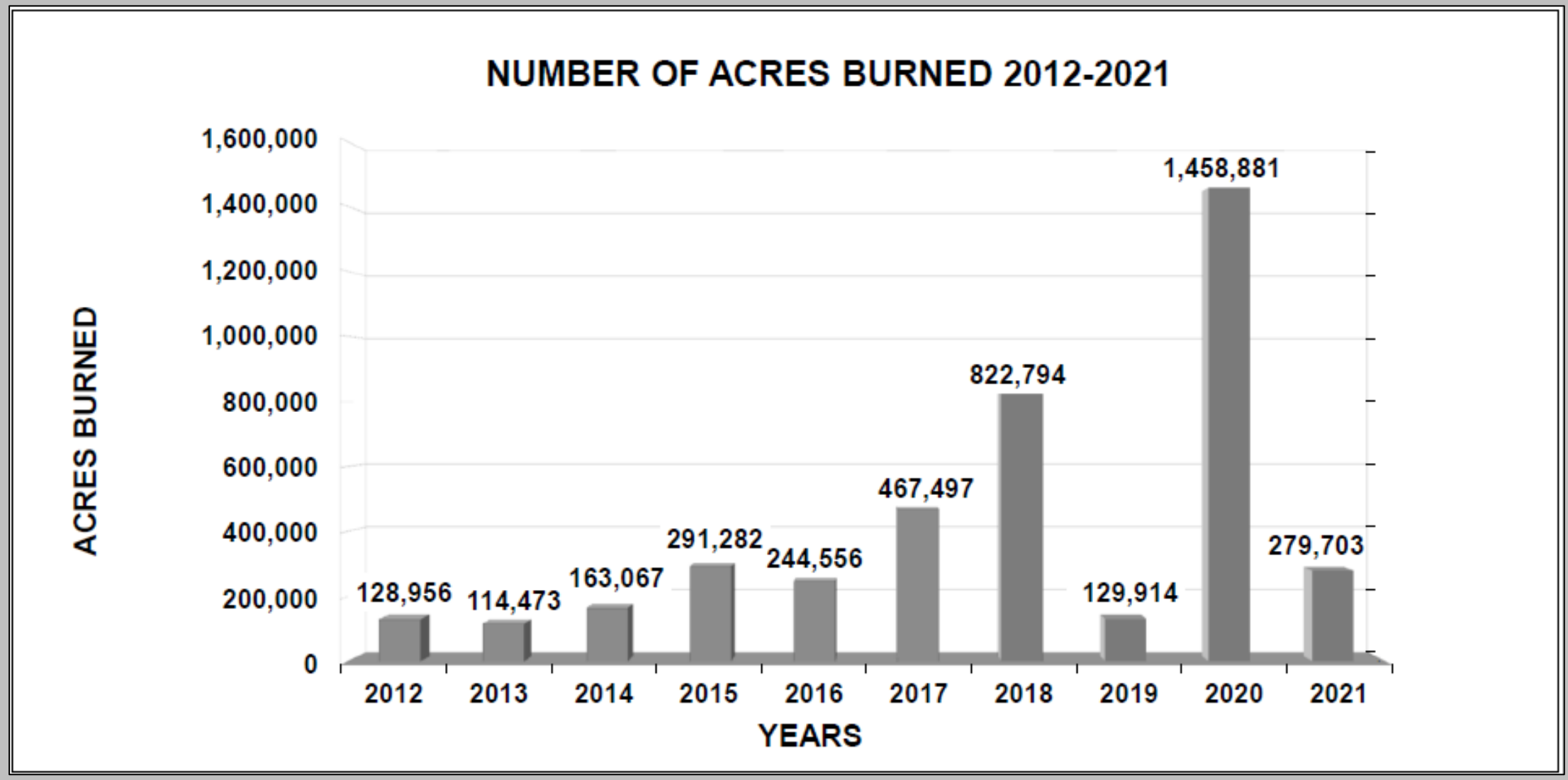


Source: Cal/FIRE. Wildfire Activity Statistics, 2021 (Red Book)



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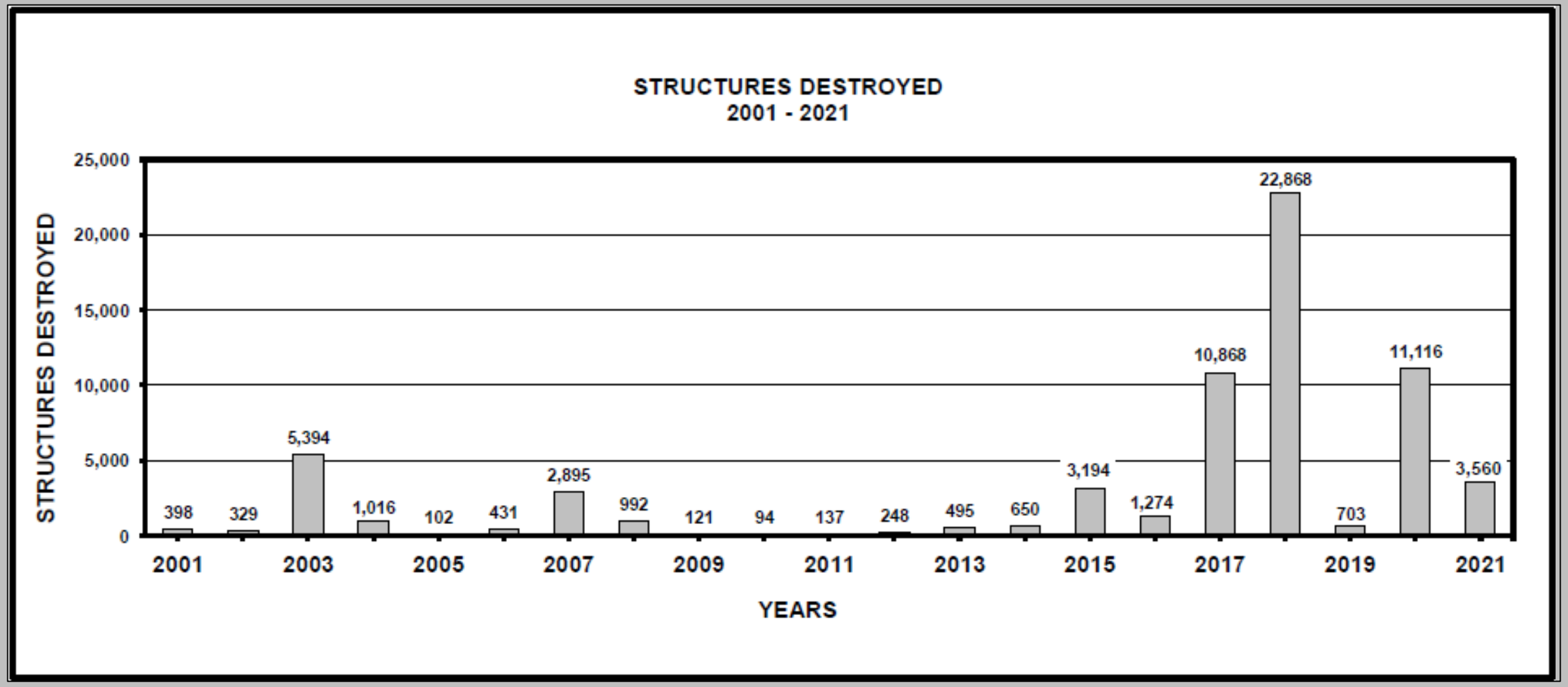

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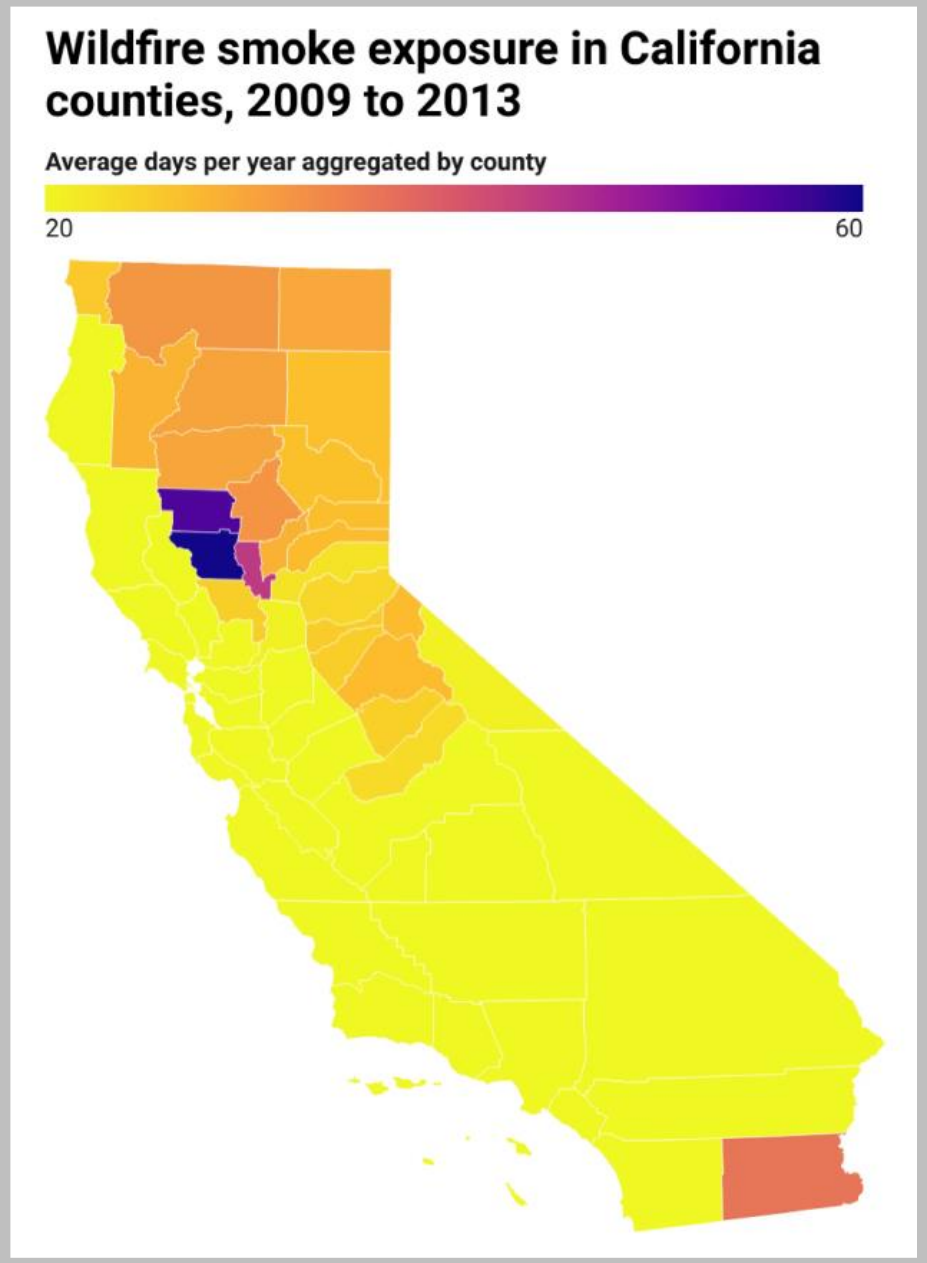
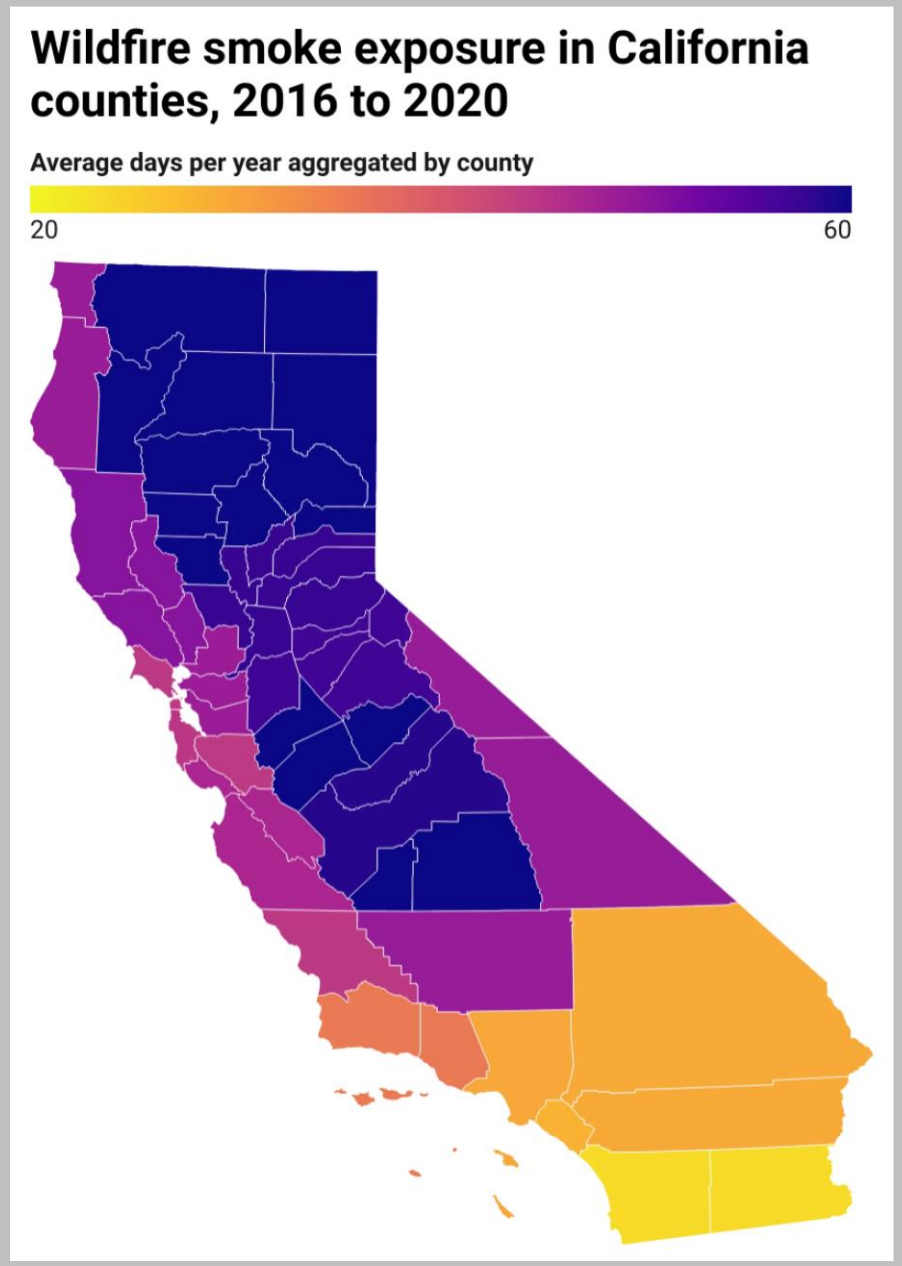
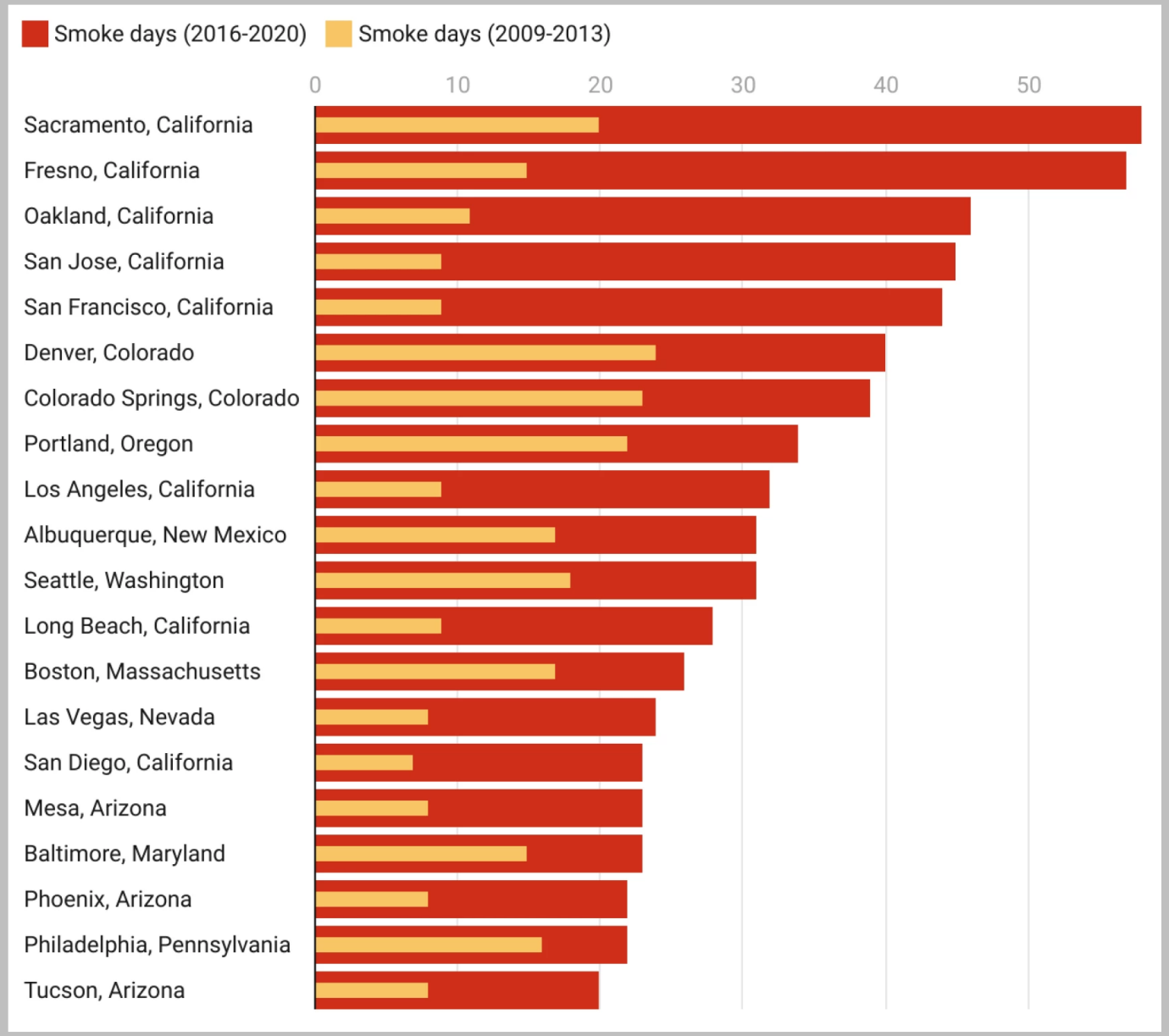


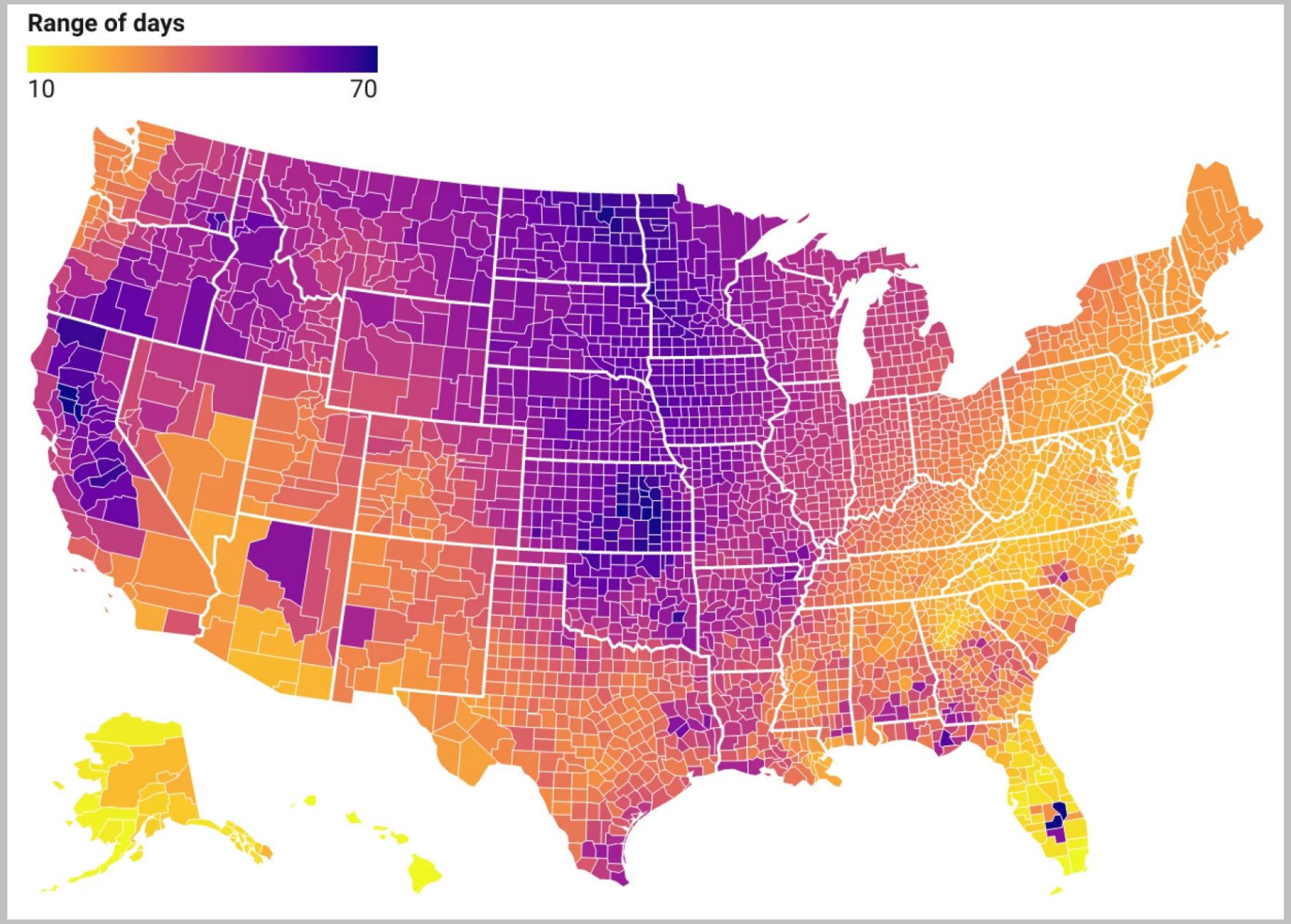


Source: NASA data and Stanford Environmental Change and Human Outcomes Lab, reported in Alison Saldanha, Dangerous Air: As California Burns, America Breathes Toxic Smoke. Sept 28, 2021. https://www.kvpr.org/news/2021-09-28/dangerous-air-as-california-burns-america-breathes-toxic-smoke



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



Annual smoke days in U.S. counties, 2016-2020.

Source: NASA data and Stanford Environmental Change and Human Outcomes Lab, reported in 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

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

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

Deployments last up to 10 days and require 12 hour shifts, or longer.

Photo: LA County Fire Dept.

Tubbs Fire—A Cal/FIRE firefighter works to protect a home in Coffey Park, Santa Rosa, Monday Oct 9, 2017. (Photo: Kent Porter, The Press Democrat).

The 2018 Camp Fire killed 85 people and burned nearly 19,000 structures in and around the town of Paradise.

Photo: Noah Berger, AP. The Guardian. June 15, 2019

Wildfire approaches community of Chino, CA Oct 27, 2020

Photo: David McNew, Getty Images.

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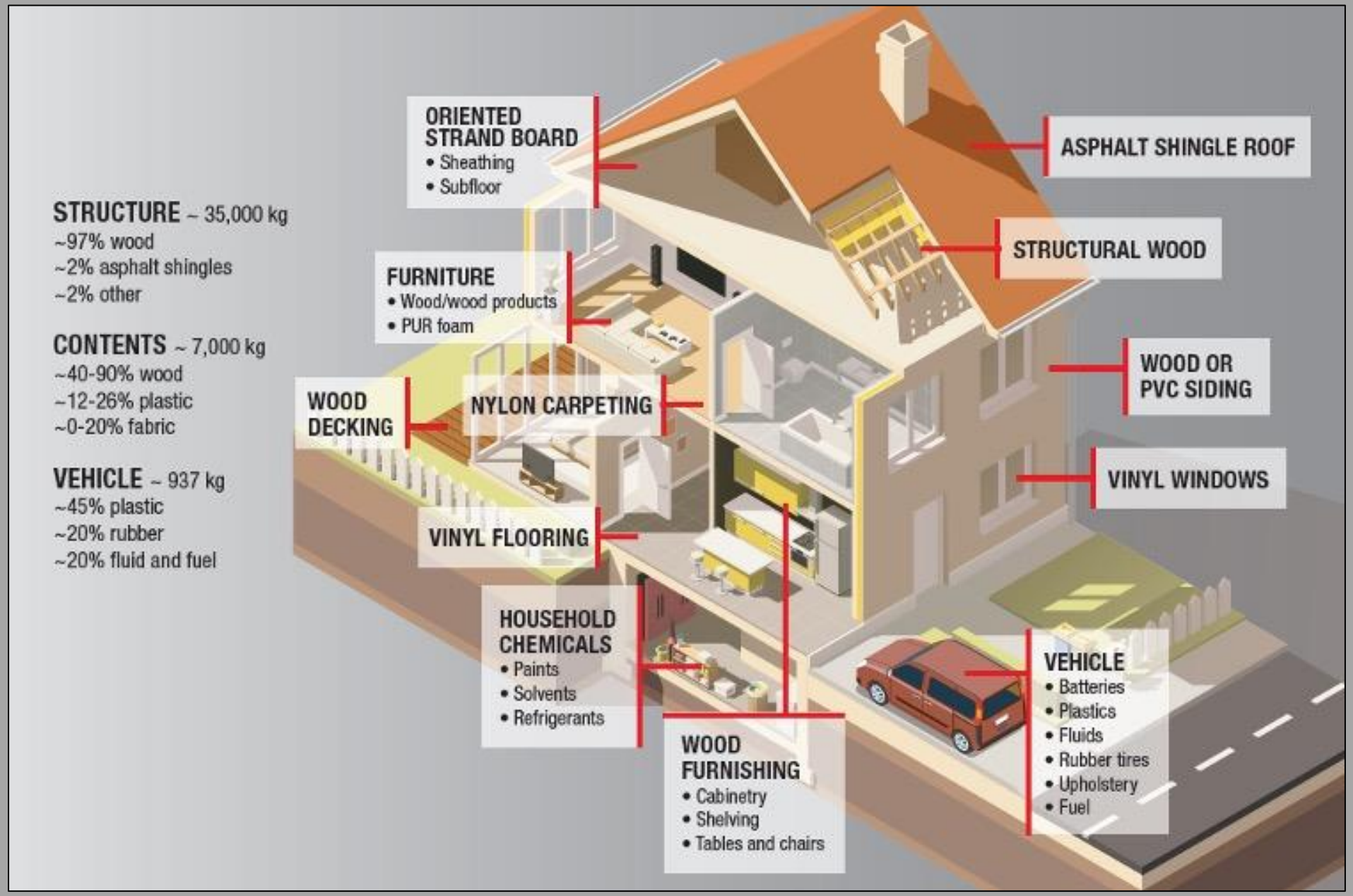
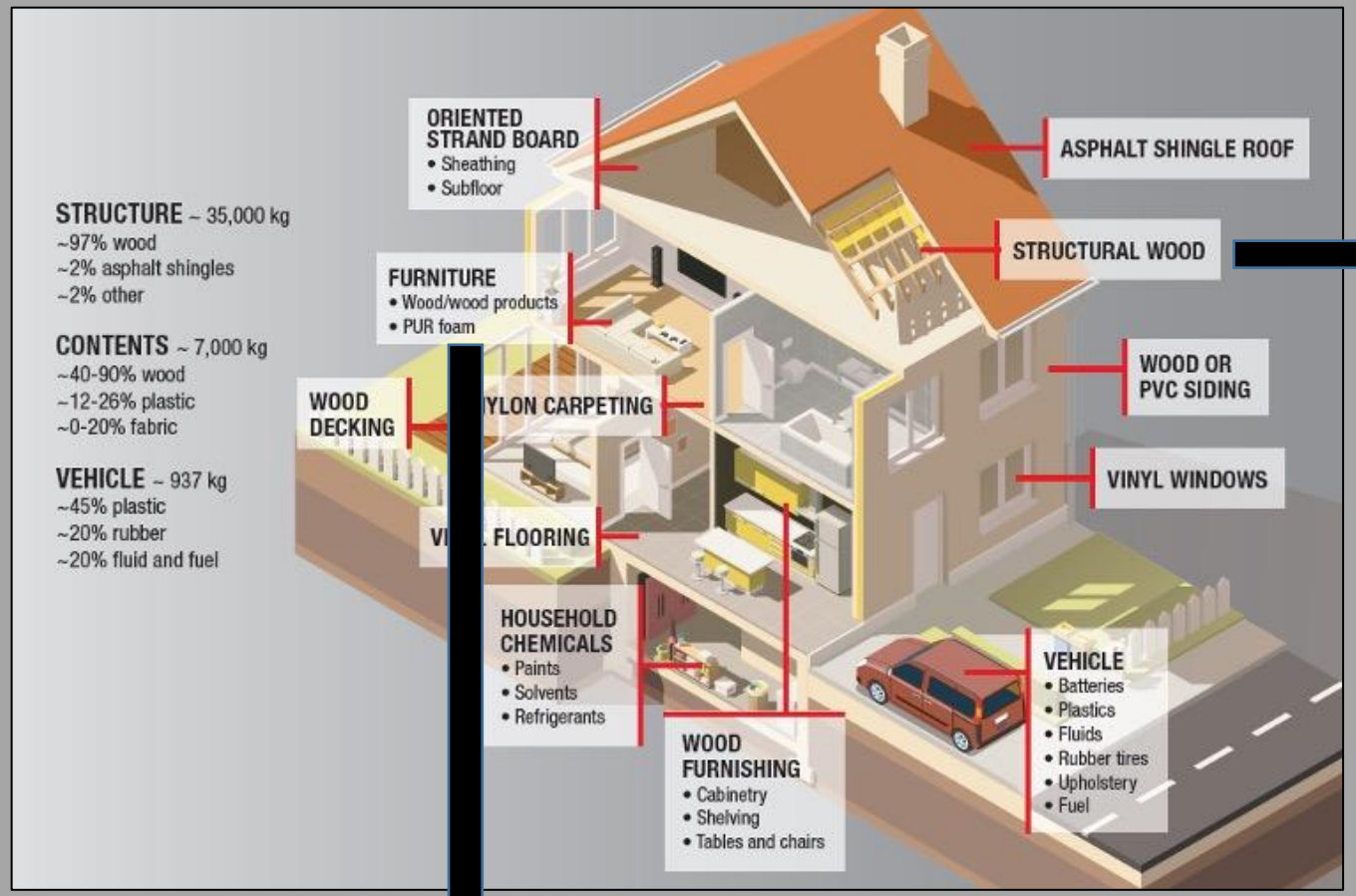
Sept 2012 Shockey fire near San Diego. Interface operations often result in exposures to structure fire smoke, without the protection of an SCBA.

Photo: DHS Science and Technology Directorate



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



Oriented strand board (OSB) — HCN, CO, NO_2, HCl, acrolein, formaldehyde, PM, PAHs, VOCs, SVOCs, isocyanates

- Acrylic clothing
- Residential furniture

HCN, CO, NO, NO_2, NH_3, 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

In 2022, IARC classified occupational exposure as a firefighter as *carcinogenic to humans* (Group 1), on the basis of *sufficient evidence* for cancer in humans.

Evidence for cancer in humans

"Occupational exposure as a firefighter causes cancer. There was *sufficient evidence* for cancer in humans for the following cancer types: mesothelioma and bladder cancer.

There was *limited evidence* for cancer in humans for the following cancer types: colon cancer, prostate cancer, testicular cancer, melanoma of the skin, and non-Hodgkin lymphoma."

Strong mechanistic evidence

"There was *strong* mechanistic evidence in exposed humans that occupational exposure as a firefighter exhibits 5 of the 10 key characteristics (KCs) of carcinogens: "is genotoxic" (KC2), "induces epigenetic alterations"(KC4), "induces oxidative stress" (KC5), "induces chronic inflammation" (KC6), and "modulates receptor mediated effects" (KC8)."

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

Cal/FIRE firefighters at the Fairview Fire base camp, Nov 2022. Lacking effective alternatives, bandannas and flame retardant neck gaiters are the most common type of protection used by firefighters.

Photo: Mike Wilson, Cal/OSHA

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Photo: Dept of Homeland Security, Science and Technology Directorate

Wildland/WUI respiratory protection is complicated.

The SCBA is impractical in the WUI.

Toxic substances released during thermal decomposition are highly variable.

A Wildland/WUI Respirator Must:

- Filter fine PM (≤1 µm), fire gases, VOCs, BTX, PAHs
- Reduce the work of breathing
- Be highly durable, lightweight, compact
- Meet NFPA 1984 standards
- Be NIOSH-certified
- Must find a way to deal with CO

Respirator	Useable in the WUI	Work of Breathing	Weight	Effective Filtration	Durable	Compact	Does it exist?	APF
SCBA								10,000 (Pos pr)
N95								10
APR/CBRN								10 (Half-mask) 50 (full-face)
PAPR/CBRN								50 (half-mask) 1000 (full-face)

A lightweight, durable, compact, fire-rated PAPR would deliver low work of breathing and effective filtration in the WUI…if one existed.

National Institute for Occupational Safety and Health NIOSH®

"Based on information provided by manufacturers, the primary reason for not developing a NFPA 1984 Standard-Rev compliant respirator is the lack of demand or negligible purchasing commitment from the federal wildland fire fighting community."

"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."

Problem: No suitable respirator exists. A 2014 NIOSH report concluded that lack of demand has been the key barrier.

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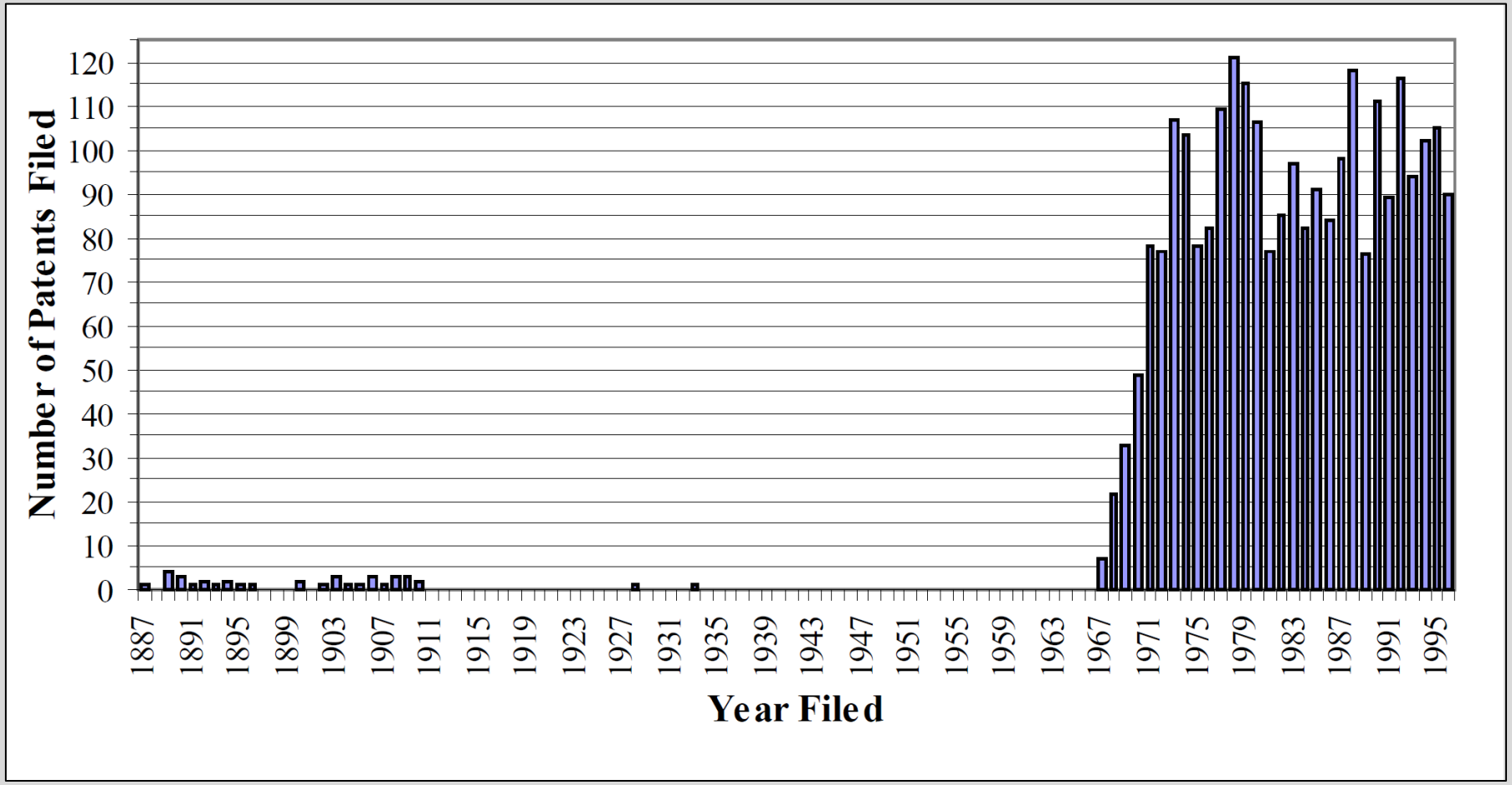
NIOSH (2014): Analysis of Barriers Affecting Implementation of the NFPA 1984 Standard on Respirators for Wildland Fire-fighting Operations 2011 Edition. Unpublished report.



Solution: Technology-forcing regulation. U.S. patents for SO_2 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 SO_2 Control. EPA/DOE/EPRI

CCR Title 8, § 5194. Bloodborne Pathogens.

(a) Scope and Application. This section applies to all occupational exposures to blood or other potentially infectious materials as defined by subsection (b) of this section

(d) Methods of Compliance.

(3) Engineering and Work Practice Controls -Specific Requirements.

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

(4) Exceptions. The following exceptions apply to the engineering controls required by subsections (d)(3)(A)1-3:
a. Market Availability. <u>The engineering control is not required if it is not available in the marketplace.</u>

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

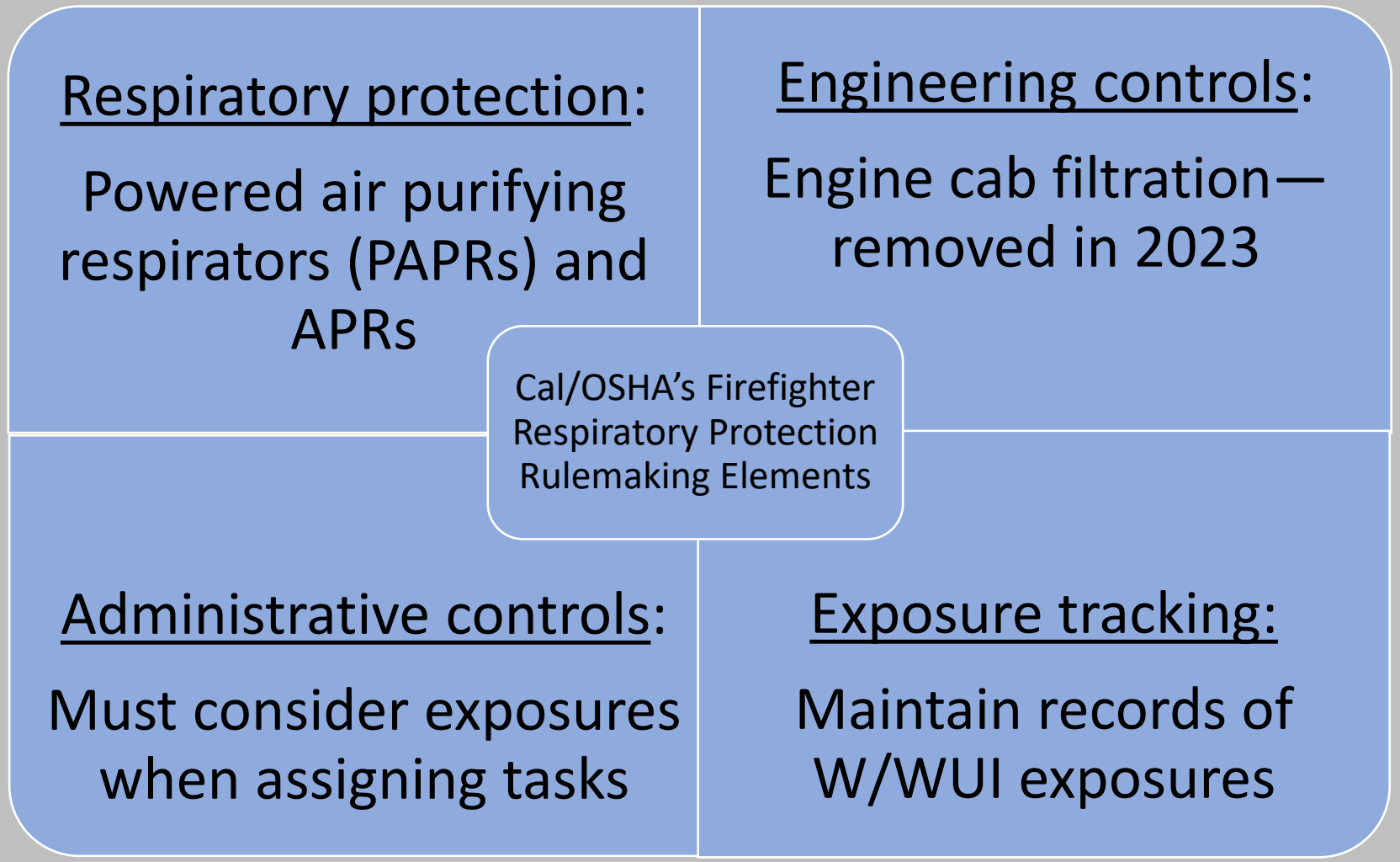
RESPIRATORY PROTECTION FOR WILDLAND FIREFIGHTING AND WILDLAND URBAN INTERFACE OPERATIONS

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


Respiratory protection:
Powered air purifying respirators (PAPRs) and APRs
Engineering controls:
Engine cab filtration—removed in 2023
Cal/OSHA's Firefighter Respiratory Protection Rulemaking Elements
Administrative controls:
Must consider exposures when assigning tasks
Exposure tracking:
Maintain records of W/WUI exposures

Technical Advisory Committee: Structure protection is likely a good application for a powered air-purifying respirator (PAPR).

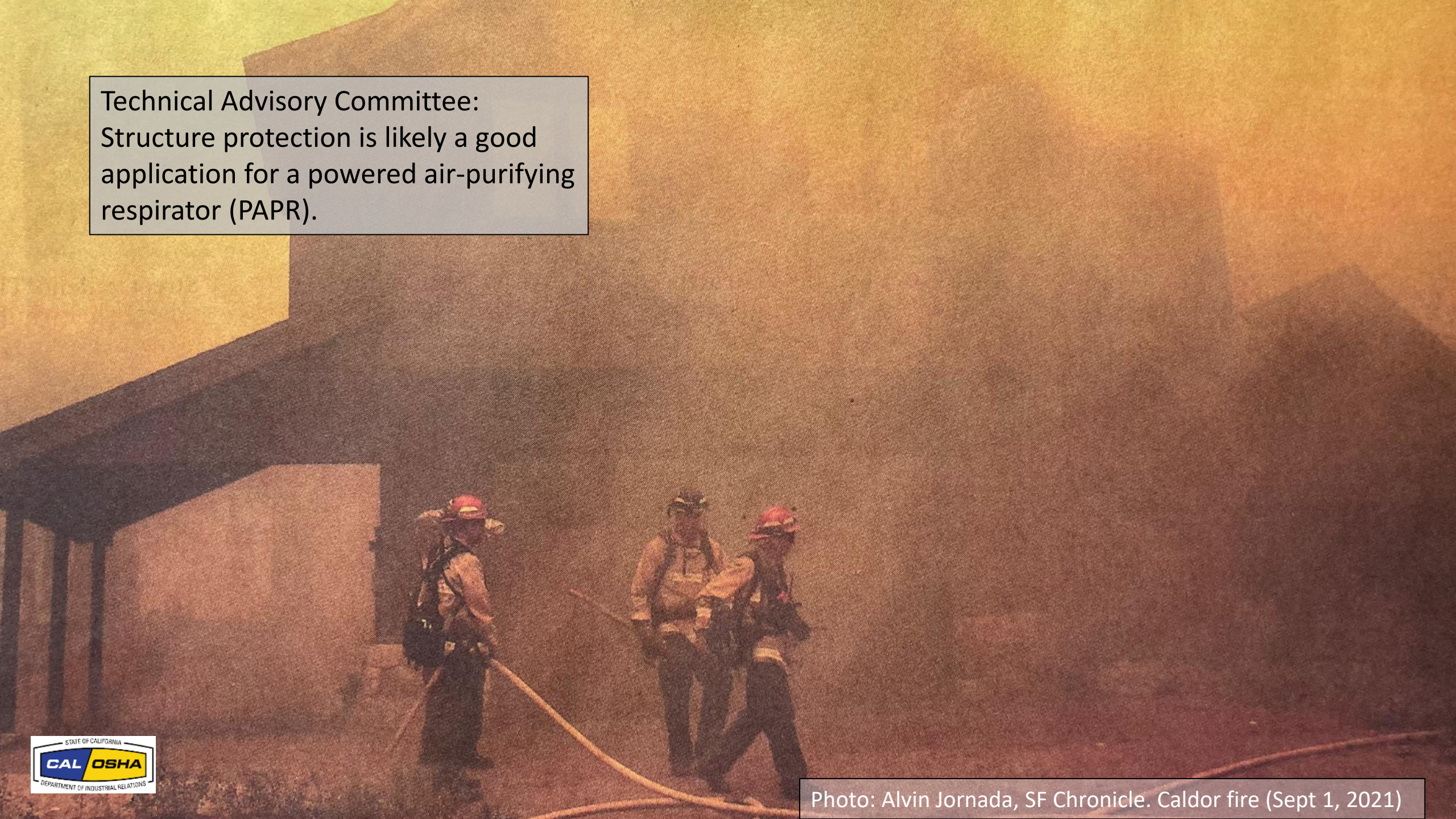


Photo: Alvin Jornada, SF Chronicle. Caldor fire (Sept 1, 2021)

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

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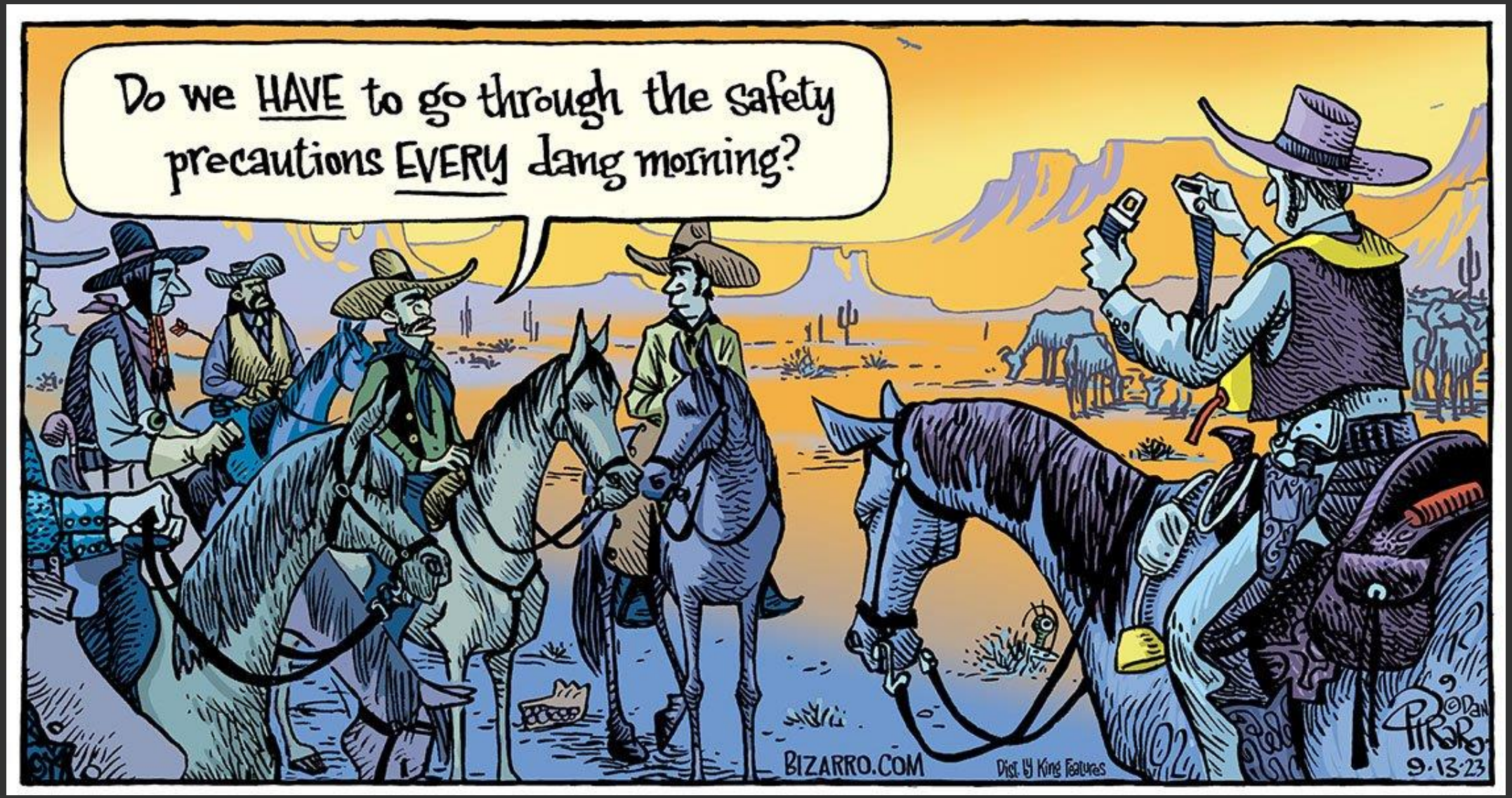

Thanks to Dan Piraro, creator of the Bizarro comic

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Goal: Rules that require practical and effective respiratory protection.

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

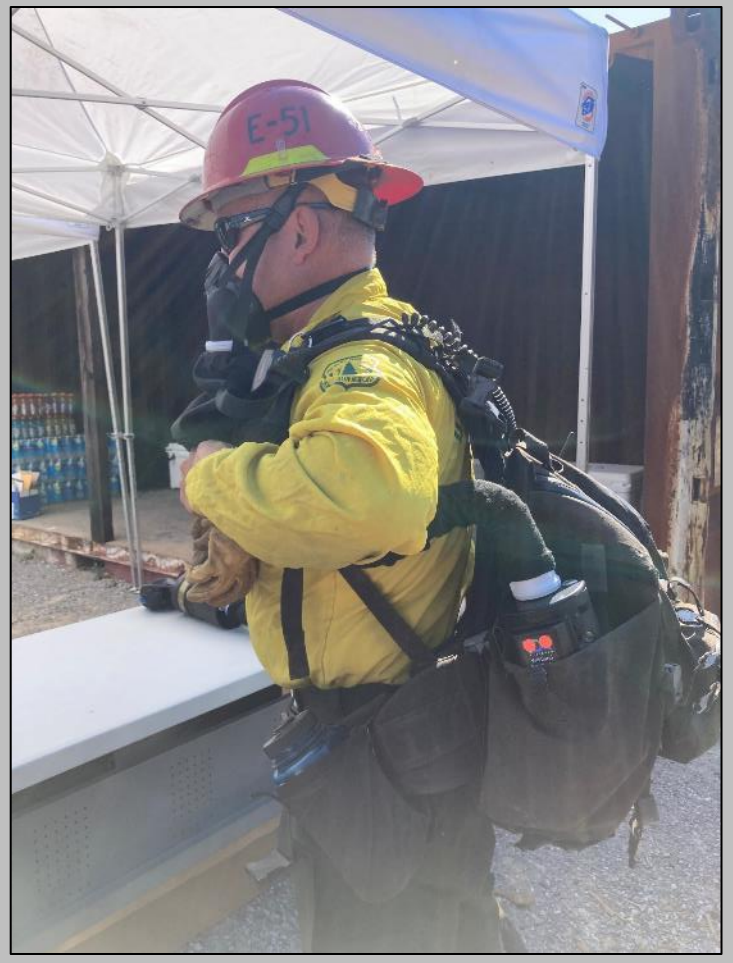
In 2022-23, Cal/OSHA collaborated with LA County FD, Cal/FIRE and the U.S. Forest Service to conduct Operational Field Assessments of five wildland/WUI respirators.

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/Draeger PAPR responds to increases in tidal volume by increasing the air flow rate.

Photo: Mike Wilson, Cal/OSHA



Photos: Mike Wilson, Cal/OSHA

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

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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

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MSA G1 PAPR

Sundstrom PAPR

Sundstrom APR

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

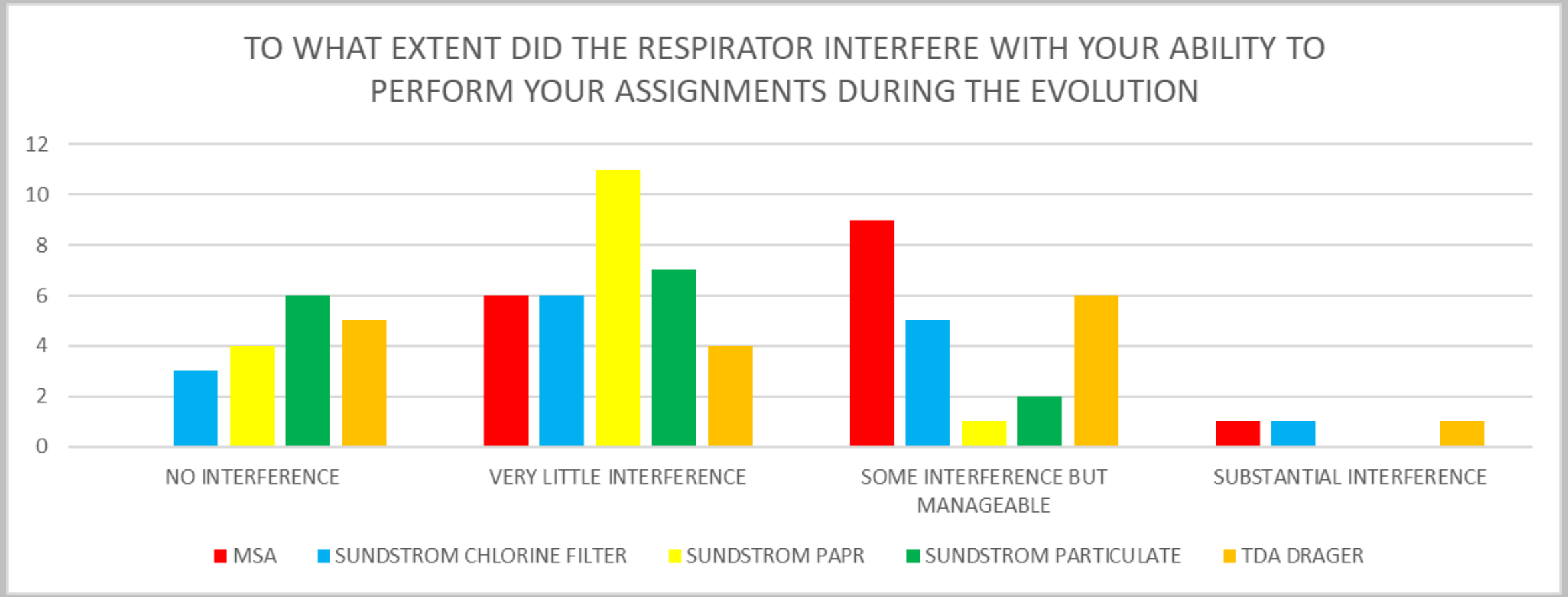
Cal/FIRE, USFS, Cal/OSHA OFA, Redding CA. Sept 12, 2023

Photos: Mike Wilson, Cal/OSHA

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

OFA, Redding CA. Sept 12, 2023

Photos: Mike Wilson, Cal/OSHA



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

Photos: Mike Wilson, Cal/OSHA

Photo: Mike Wilson, Cal/OSHA

Next Steps:

- Redesign PAPRs and APRs based on Aug and Sept field assessments; pursue NIOSH approval;
- Conduct lab and field-based smoke challenges of PAPR and APR cartridges;
- Design physiological workload studies and conduct pack tests;
- Characterize WUI products of combustion.
- Draft Cal/OSHA rulemaking documents.

Goal: Practical and effective respiratory protection.

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