http://akfireconsortium.uaf.edu

ALASKA FIRE SCIENCE CONSORTIUM

Mission: *Better collaboration between fire science and fire management*

JOINT FIRE SCIENCE PROGRAM

Photo by Rob Allen

Health Effects of Wildfire Smoke: new findings?

Randi Jandt, Fire Ecologist, UAF

Stacy Cooper >>

Health Effects of Wood Smoke

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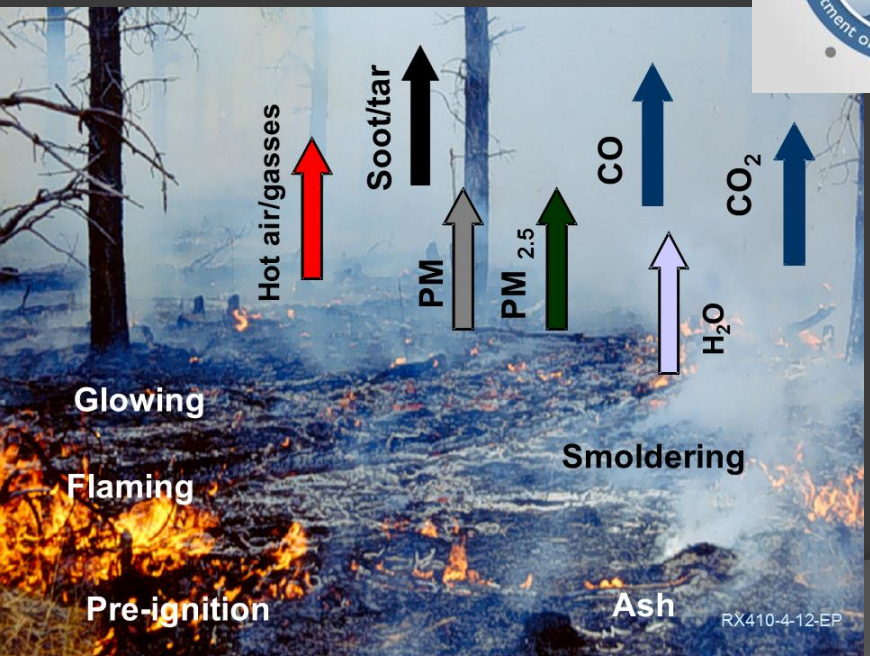


<< Roger Ottmar, USFS-PNW at RX410

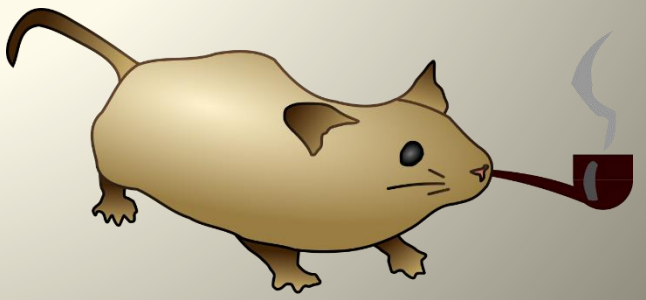
Health Effects

Short Term

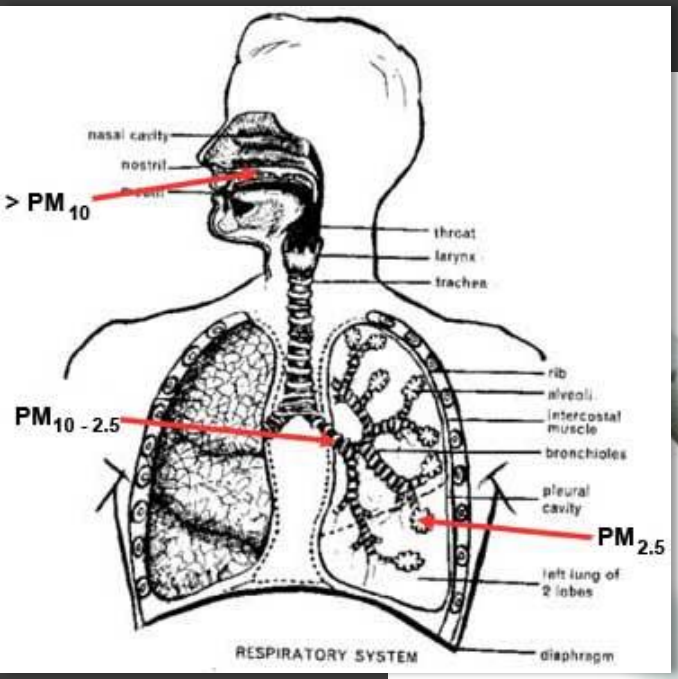
- Irritated eyes, nose, throat
- Headache
- Acute bronchitis
- *Exacerbate asthma*
- *Irregular heart beat*
- *Stroke, heart attack*

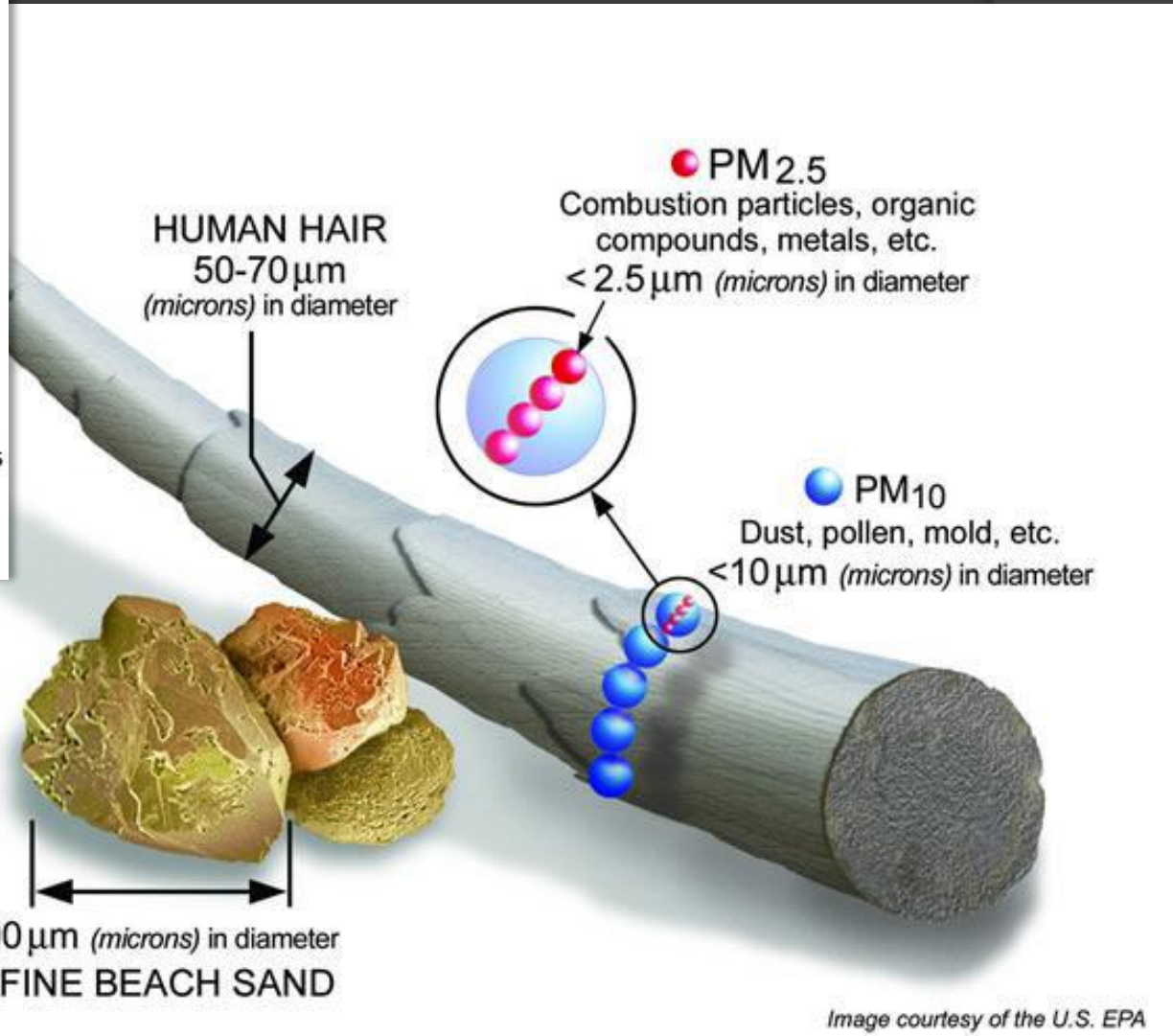
Long Term

- Reduced lung function
- Chronic bronchitis
- *Lung cancer*
- *Heart disease*
- *Premature death*



SMOKE: Particle Size Matters



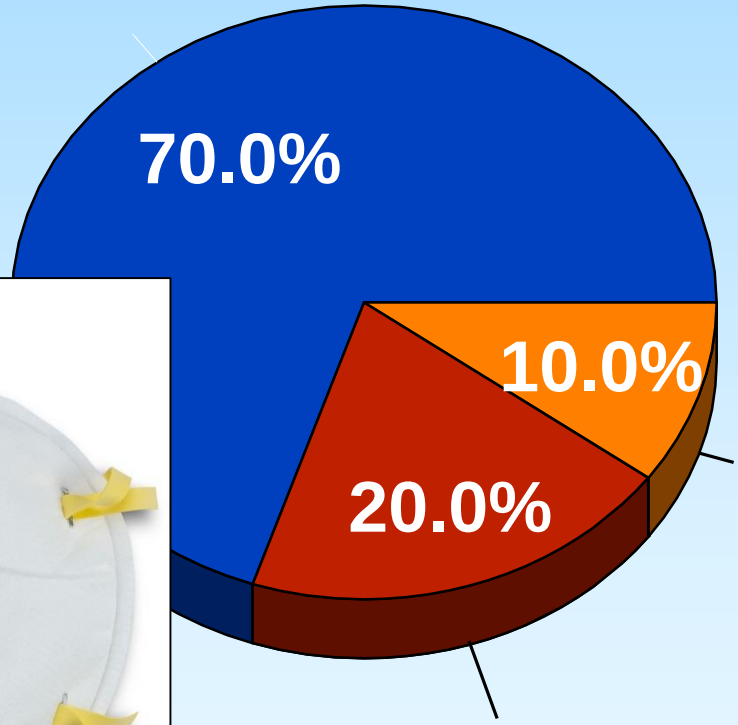


Particulate Matter

Smoke particles from wood are relatively small

< PM 2.5 microns

Virus: 0.3 microns



> PM 10 microns

PM 2.5-10 microns

Roger Ottmar:
RX410-4-5-EP

Are Respiratory Masks Effective?

- Effect of protective filters on fire fighter respiratory health: field validation during prescribed burns (DeVos, 2008)
- Effective vs. particles,

  VOC's, irritants

- **None filter CO!!!**
- **Thus, alerts on masks**

What's the big deal about carbon monoxide?

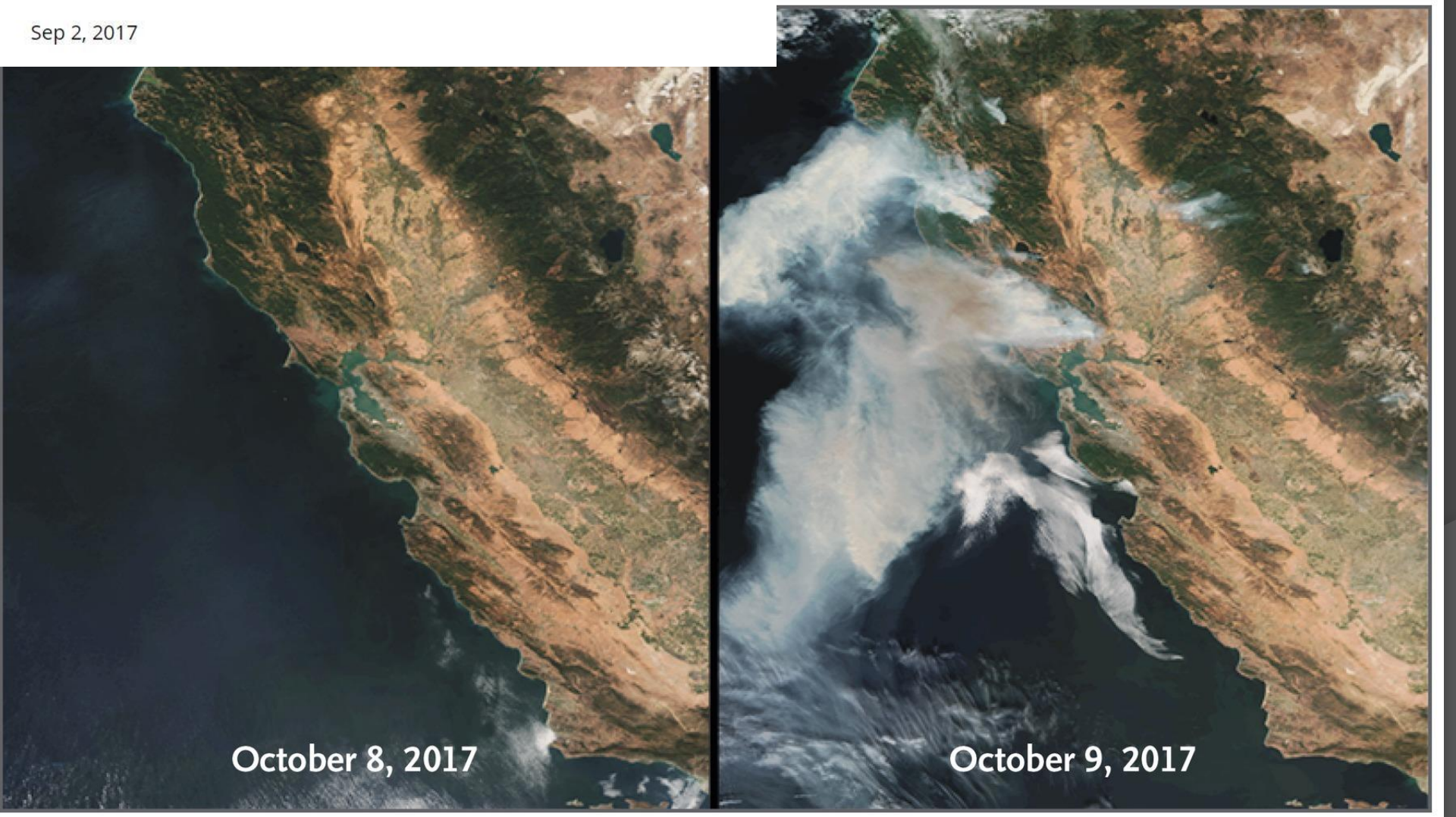
- CO attaches to hemoglobin in RBC's, robbing you of oxygen.
- Causes headache, dizziness, weakness, disorientation and impaired decision making (Raub, 1999; Raubet al., 2000).
- Elimination half-life of COHb is 4–5 hours without any intervention.

Headaches and raspy voices as wildfire smoke chokes US West

Air quality has been rated unhealthy across the region because of blazes that show no signs of abating, officials said

Sep 2, 2017

Recent large fire seasons spurred some interest in smoke research



Ft. McMurray fire set new smoke records

May 2016 Ft. McMurray Fire

Photo by Jonathen Hayward, The Canadian Press

New publications on Ft. MM indicate smoke was “off the chart” high for towns in its path

Recent review articles on smoke and public/firefighter health:

- ✓ Review-type articles analyze multiple studies and rate the quality of the study (*Reid et al 2016, Adetona et al 2016*).

- ✓ Links to increased pneumonia and bronchitis in general population well documented.

Increases in hospital visits . . .

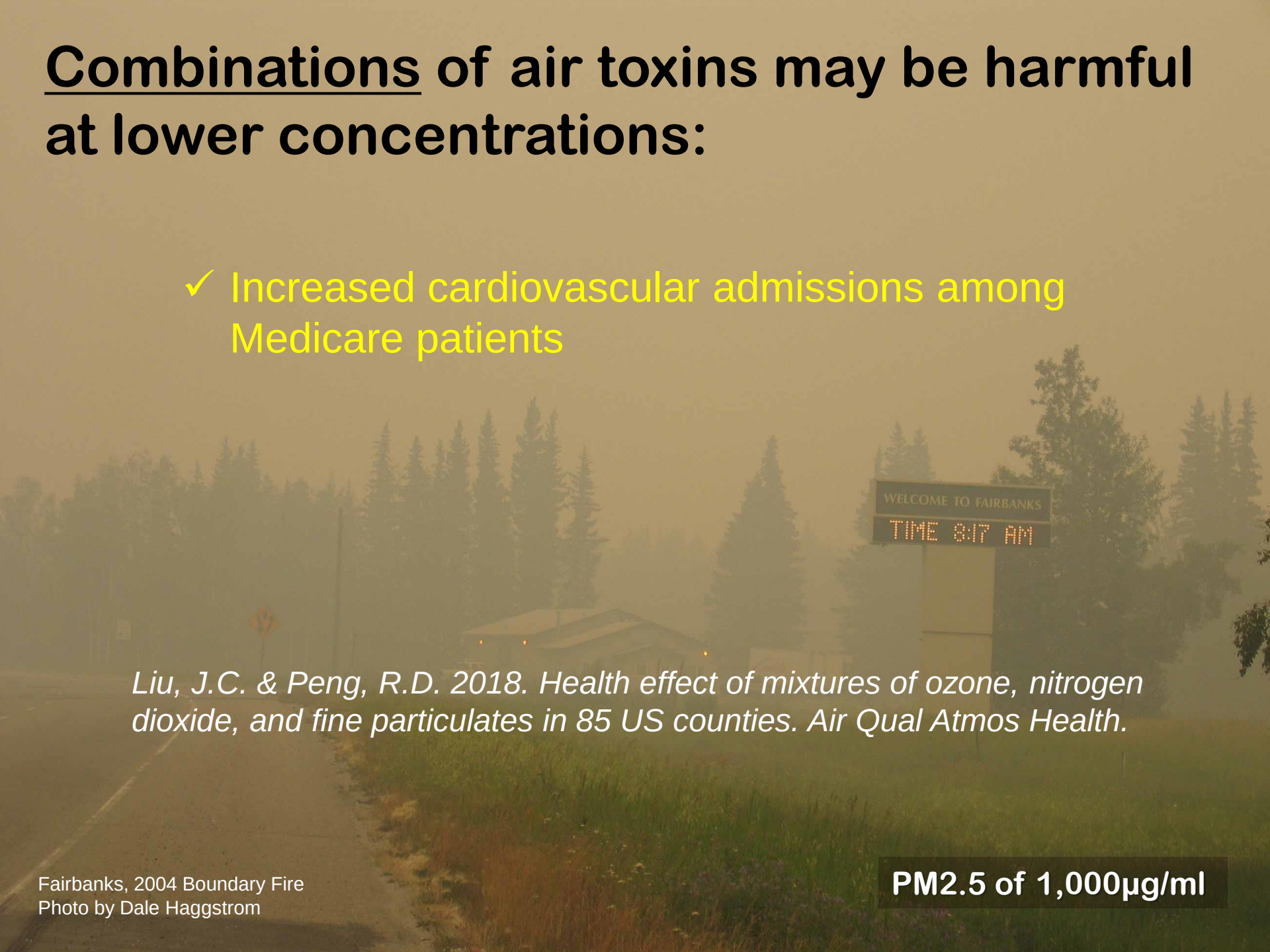
. . . were documented just after wildfires in California, Greece, Australia, *etc*.

Hospital admissions increased with ambient air PM2.5 concentration suggesting acute respiratory effects of wildfire smoke exposure.

Combinations of air toxins may be harmful at lower concentrations:

- ✓ Increased cardiovascular admissions among Medicare patients

Liu, J.C. & Peng, R.D. 2018. Health effect of mixtures of ozone, nitrogen dioxide, and fine particulates in 85 US counties. Air Qual Atmos Health.



Fairbanks, 2004 Boundary Fire
Photo by Dale Haggstrom

PM2.5 of 1,000µg/ml

Documented adverse effects on wildland firefighters?

- ✓ Decline in lung capacity over a workshift (which seemed to return to normal after seasonal rest).
- ✓ Links to oxidative (stress) indicators in blood/urine mostly inconclusive or subtle effects.
- ✓ Body ramps up repair mechanisms (like smokers)

Photo credit: Tom McCabe

The good news:

- **Mixed, mostly negative, results evaluating whether smoke contributed to or exacerbated asthma.**

- **Mixed results relating smoke exposure to angina, arrhythmias, and heart attack.** *(Reid et al 2016, Adetona et al 2016).*

- **Scant evidence, to date, tying smoke exposure to hypertension.**

Photo: PNW, King Ck Fire 2004,

Pike & Alpine Hotshot crews

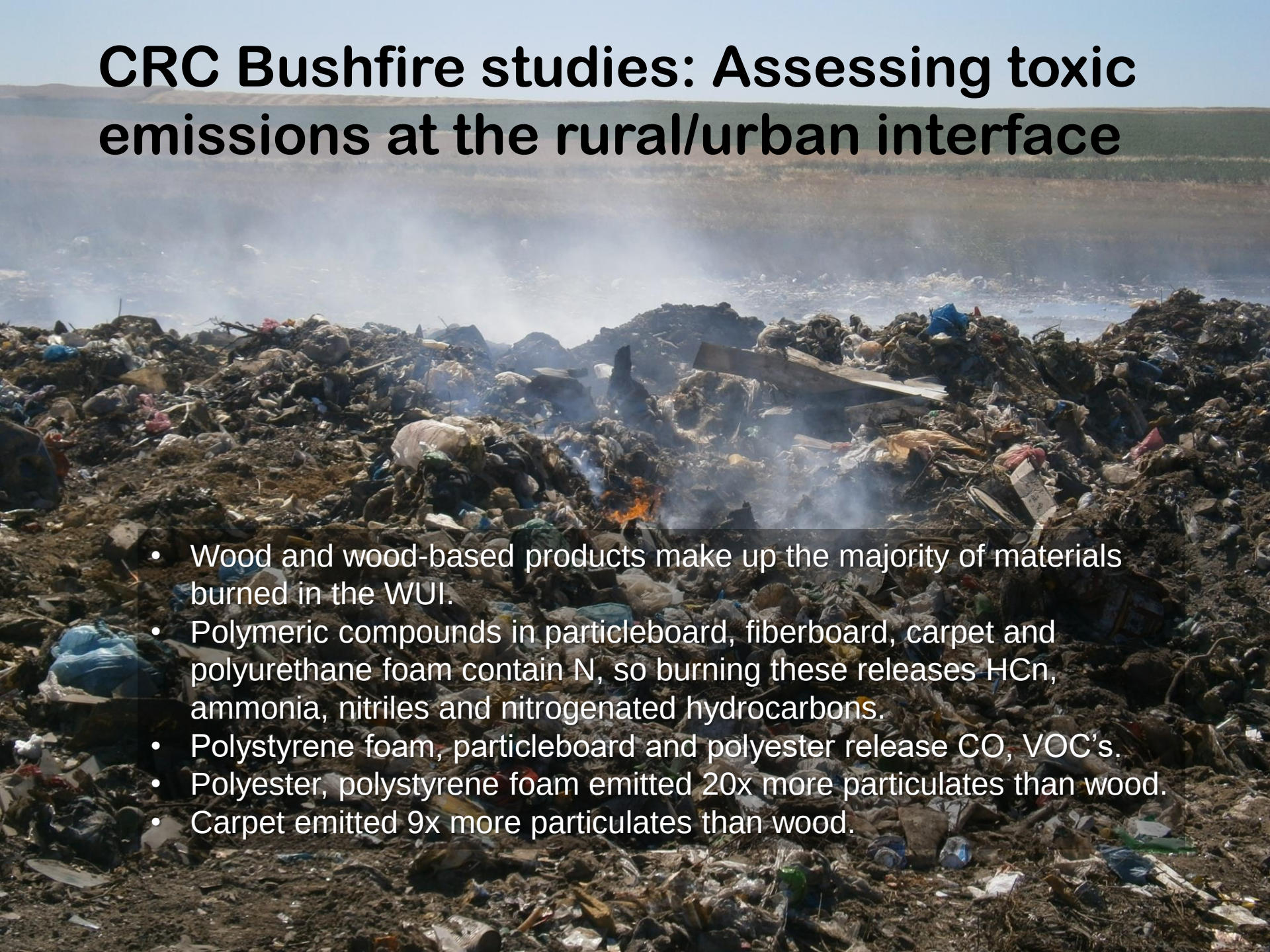
Did smoke exposure influence an index of arterial stiffness that has been linked to increased risk of cardiac events? Gaughan et al. 2014

Photo credit: NPS

Producing a clearer picture of smoke toxins

Kay Ansell quotes CRC Bushfire (Reisen et al.)
“In general, burning wood-based and polymeric materials released volatile organic compounds at higher concentrations than pine”.
“This means that the combustion of these products in fires at the rural/urban interface is likely to be a greater health risk than forest bushfires.”

CRC Bushfire studies: Assessing toxic emissions at the rural/urban interface



- Wood and wood-based products make up the majority of materials burned in the WUI.
- Polymeric compounds in particleboard, fiberboard, carpet and polyurethane foam contain N, so burning these releases HCn, ammonia, nitriles and nitrogenated hydrocarbons.
- Polystyrene foam, particleboard and polyester release CO, VOC's.
- Polyester, polystyrene foam emitted 20x more particulates than wood.
- Carpet emitted 9x more particulates than wood.

What is a safe distance?

- Results -- within 150 ft of a burning house, average toxin levels constantly exceed both peak and short-term exposure limits and there is no safe approach without protection.
- At 300 ft, exposures are still exceeding peak limits, but average concentrations are within safe exposure limits.
- At 450 ft, peak concentrations can still be close to their respective limits, primarily at high wind speeds.

Cancer among firefighters

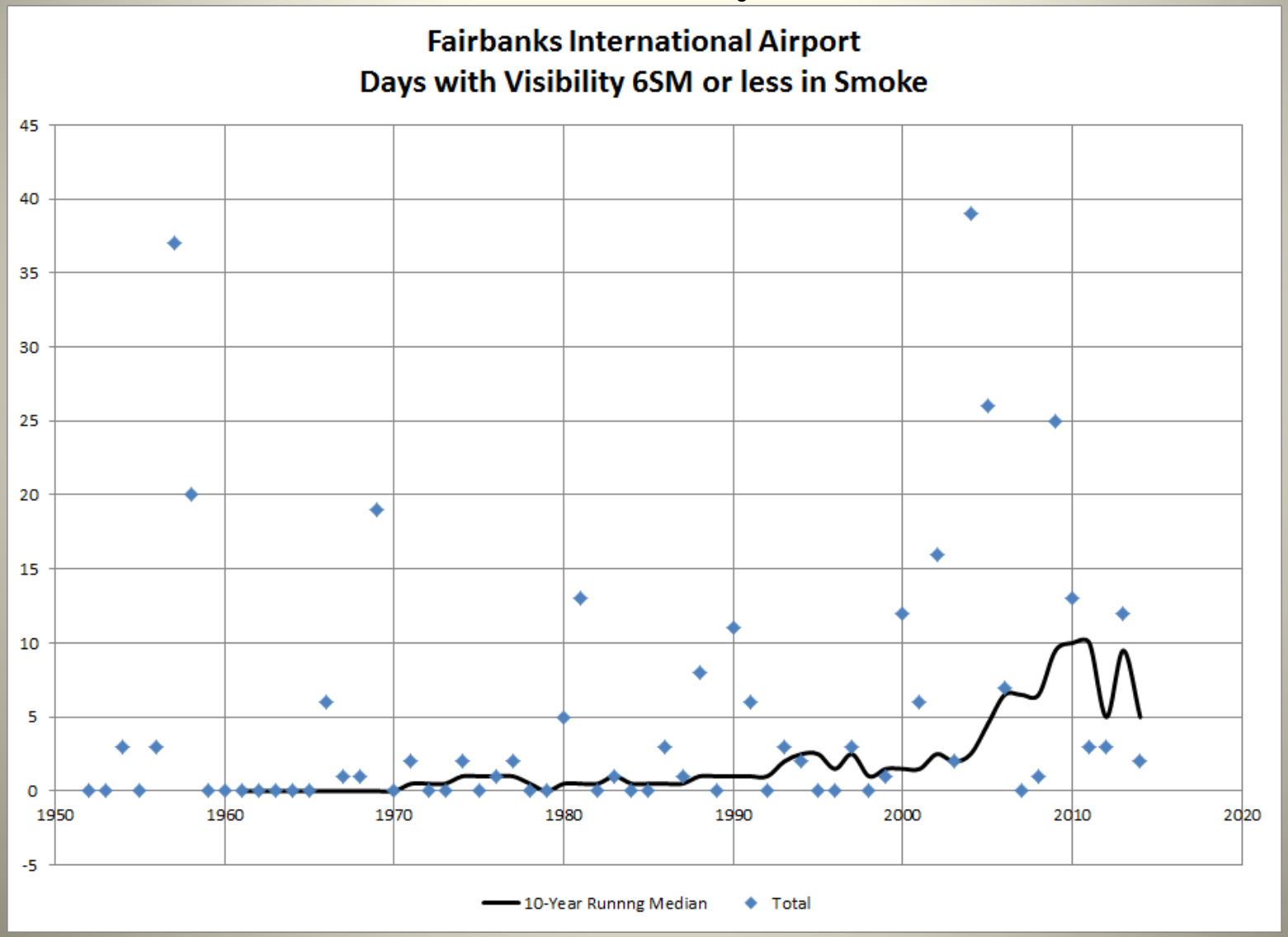
U.S. Fire Administration
Working for a fire-safe America
(FEMA)

National Institute for Occupational Safety and Health research project to clarify the relationship between firefighter occupational exposures and cancer.

Current study phase: 9% increased risk *vs.* general population

Examine health records of the approximately 30,000 firefighter study participants using an exposure surrogate metric . . .to increase the accuracy of cancer risk estimates. Examples of exposure metrics might include number of fire-runs and time at a fire. We also examine the relationship between occupational exposures and the specific causes of firefighter deaths from cancer.

Any evidence for increased smoke impacts?



State of Alaska myAlaska My Government Resident

Alaska Department of Environmental Conservation

Division of Air Quality

State of Alaska > DEC > Air Quality > AOS > Air Quality Summary > Air Quality Detail

Air Quality for FNSB NCORE

Predominant Pollutant (4/13/2017 10:23 AM)

42.5 $PM_{10}(\mu g/m^3)$

0 55 155 255 355

GOOD MOD UNHEALTHY

Serving Area

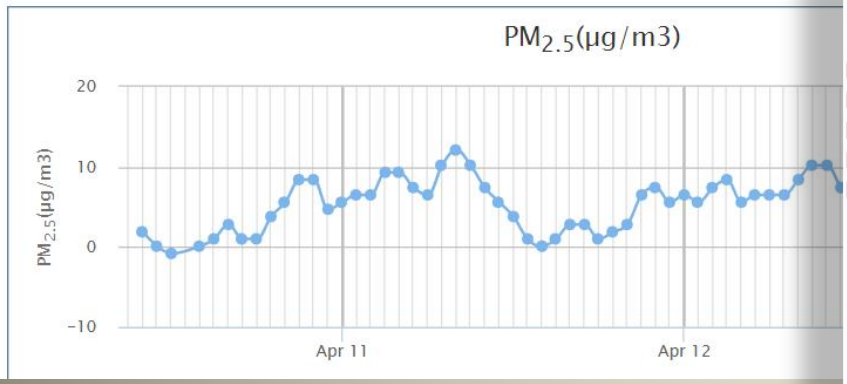
Click for Station Deta

Health Effect Categories

- Hazardous
- Very Unhealthy
- Unhealthy
- Unhealthy for Sensitive Groups
- Moderate
- Good
- No Data

Explanation of Categories

- ✓ **Also air quality alerts statewide**
- ✓ **Tips on mitigating exposure risk**



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UAFSMOKE

Wildfire Smoke Prediction for Alaska

Welcome to SMOKE.ALASKA.EDU!

The Weather Research and Forecasting model with inline Chemistry and fire plume rise dynamics (WRF/Chem) is used as core model to forecast the atmospheric dispersion of smoke downstream from Alaska wildfires. Forecasts for up to 72 hours are updated daily with current fire and weather information.

Note: Real time forecasts will be produced for the 2018 fire season beginning in May. Example forecasts from a previous fire season are available via the 'Forecasts' tab to the left.

UAFSMOKE is an initiative supported by the Geophysical Institute of the University of Alaska Fairbanks in cooperation with colleagues from NOAA's Global System Division, Brazil's Center for Weather Forecasting and Climate Studies (CPTEC/INPE), and the USFS Missoula Fire Sciences Lab.

Questions?

Photo: USFS PNW, Erickson Ck, 2003