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Western Center
for Agricultural Health
and Safety

Wildfire Smoke and Health

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**ENVIRONMENTAL HEALTH
SCIENCES CENTER**





Photo credit: Pixabay



Source: California EDD

2018 CAL FIRE Incidents

Agricultural Workers and Occupational Exposure to Wildfire Smoke



Photo: Stephanie Rodriguez, CAUSE



Outline of Presentation

- Health effects
- Reproductive implications (a perfect storm)
- Benefits and limitations of using a respirator
- Emergency Wildfire Regulation: Title 8, Section 5141.1

Health Effects

Air

- A mixture of many gases and particles



Air Pollution

- When harmful substances are added to the air:
 - Organic and inorganic *particles*



Particles

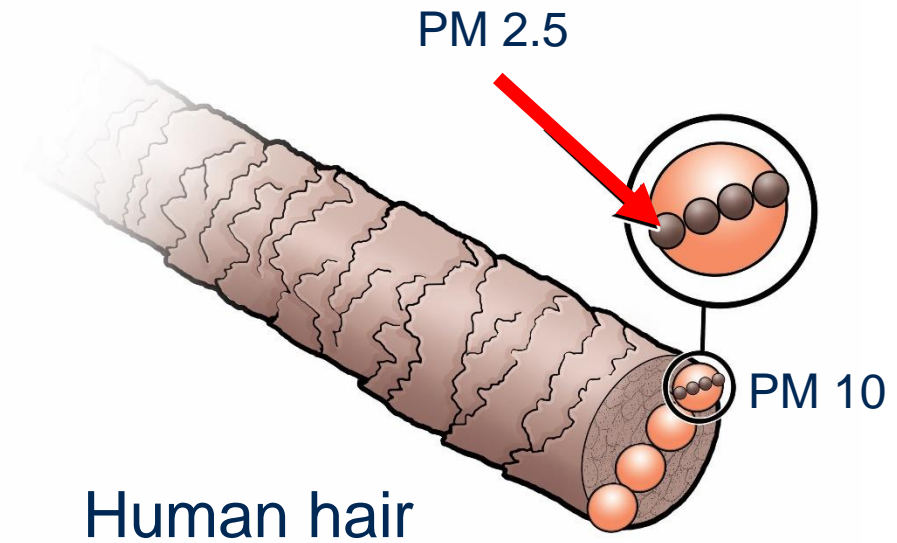
- Some can be seen with the naked eye:
- Some can be seen only with a microscope



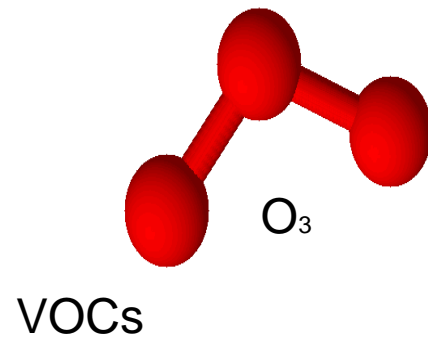
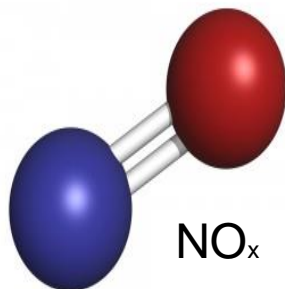
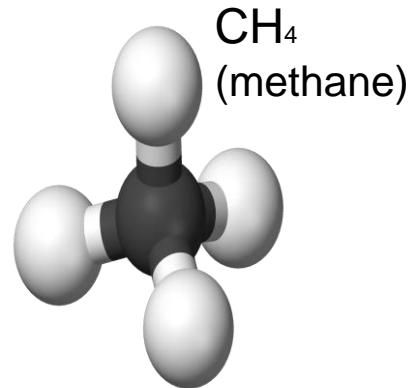
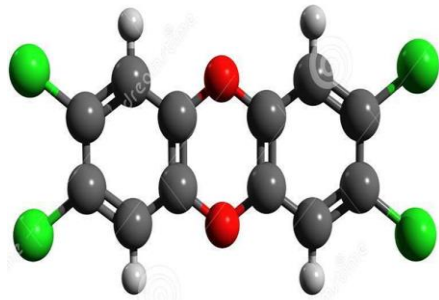
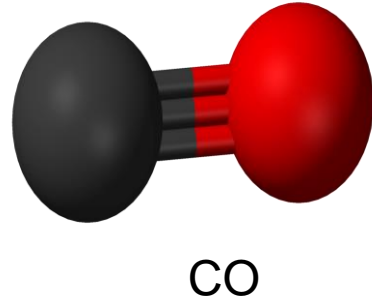
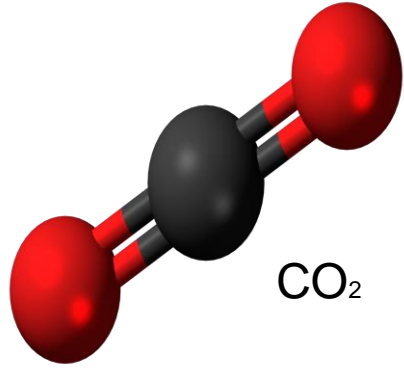
Particles

- Some particles can remain in the air for days to weeks.

- 10 μm
- 2.5 μm
- 0.1 μm



Components of wildfire smoke



Particulate Matter is of specific importance.



Image courtesy of the U.S. EPA

For those who are not very close to the fire, the particles in the air are the main hazard



Camp Fire – November 2018

Paradise, California





Bay Bridge, 170 miles from Paradise, CA

Wildfire Smoke and Pregnancy Outcomes



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Center
(UCDMC)

Objective

- Does exposure to elevated levels of ambient fine particulate matter (PM 2.5) after the Camp Fire wildfire effect conception and/or live birth rates in the non-human primates that reside outdoors at the nearby California National Primate Research Center (CNPRC)?

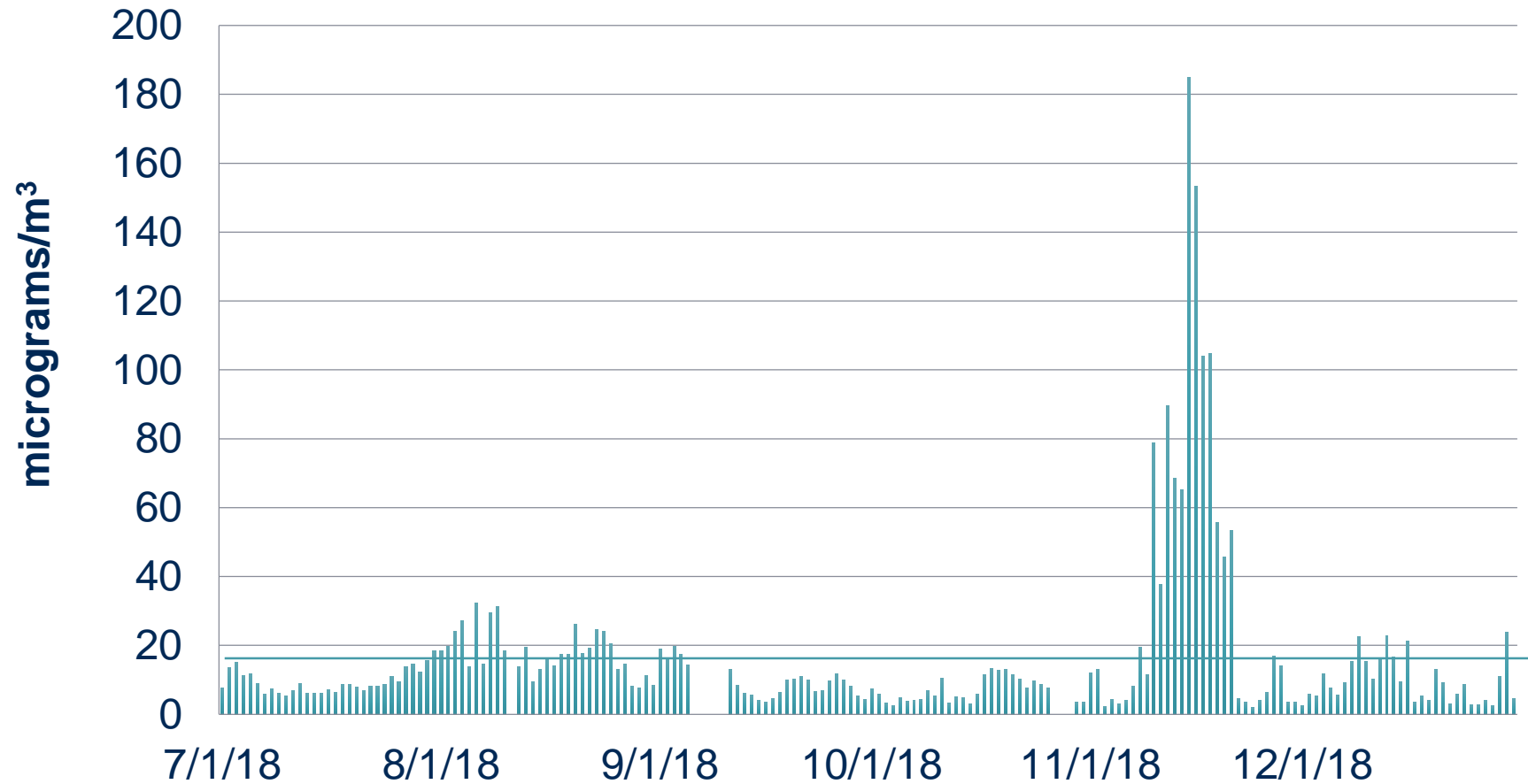


California National Primate Research Center



Photo by Kathy West, California National Primate Research Center

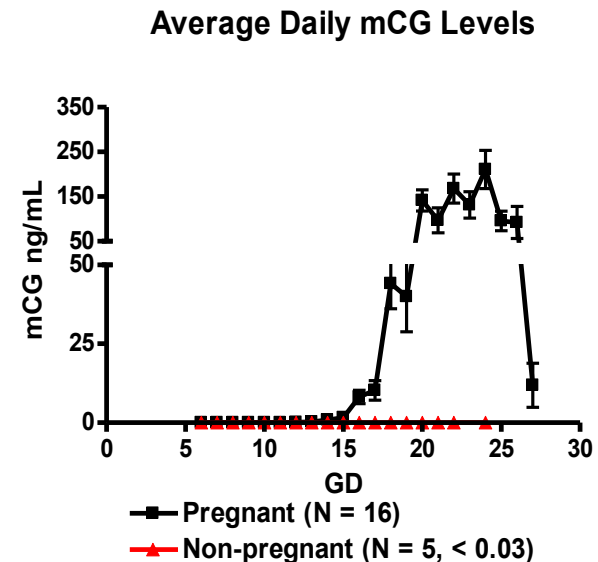
UC Davis Site: Ambient Fine Particulate Matter (PM_{2.5})



California Air Resource Board (CARB) 2018

M. mullata Reproduction

- Breed in seasons
 - Conceive in fall/winter -> deliver in spring/summer
- Novel assay - macaque chorionic gonadotropin (mCG)
 - present GA 14-30d
- Average gestation 166.5 days

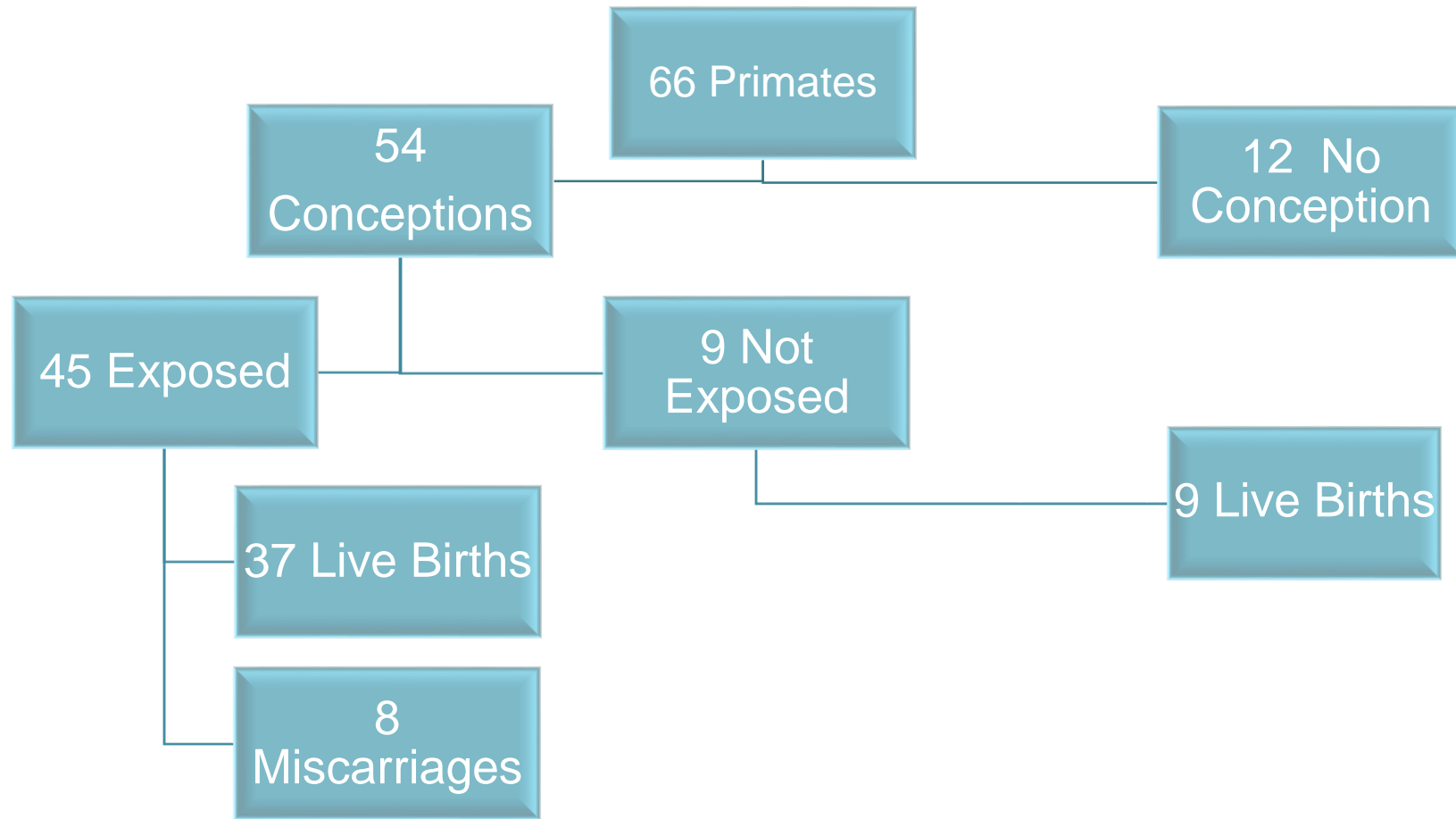


Gee et al. (2007). *Journal of Medical Primatology*, 36(3), pp.164-169.

Materials and Methods

- 66 blood (serum) samples
 - December 4th, 6th, and 11th 2018
 - Reproductive age female primates, outdoor colony
 - Estimation of conception date
 - mCG assay, palpation, average gestational length
- Demographics
 - Maternal age, G/P, infant weight
- Control: preceding 9 breeding seasons
 - 2009-2018

Results

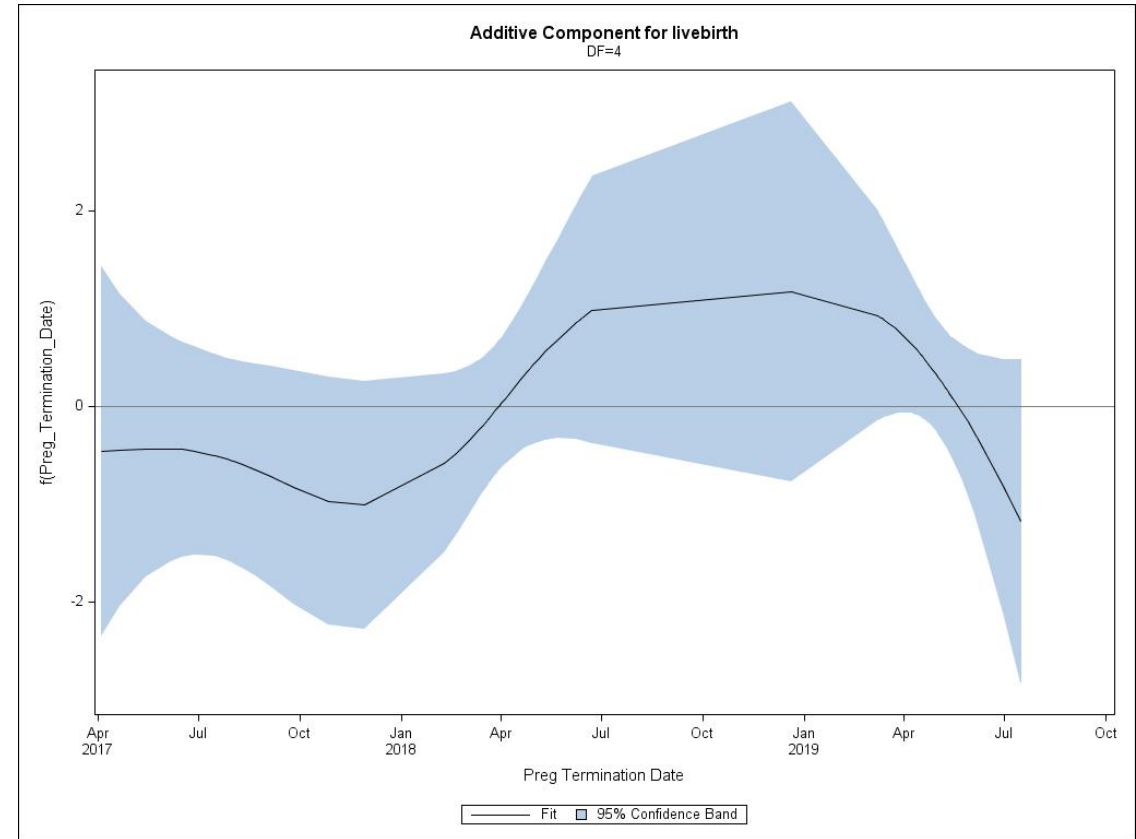


Results

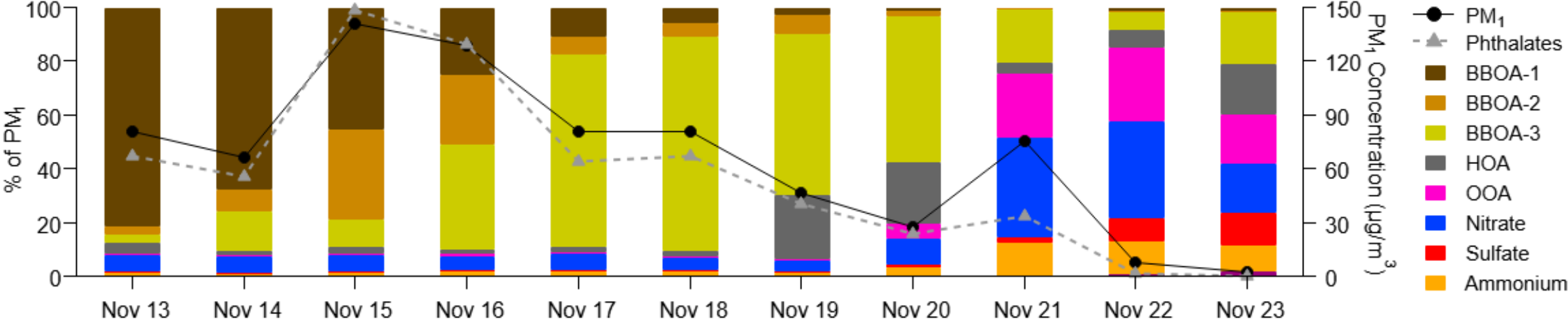
Breeding Season	n	Conceptions	Conception Rate	Live births	Live birth rate per conception
2009-2018	6668	5680	85%	5118	90%
2018-2019 Cohort	66	54	82%	46	85%
Exposed	-	45	-	37	82%
Unexposed	-	9	-	9	100%

Conclusions

- No effect on conception rate
- Statistically significant trend toward miscarriage
 - Additive model
 - $p < 0.05$ ($p = 0.035$)
 - Maternal age/parity
 - $P < 0.05$ ($p = 0.048$)



Chemical Composition of Wildfire Smoke in Davis Arising from the Paradise Camp Fire Event – November 2018

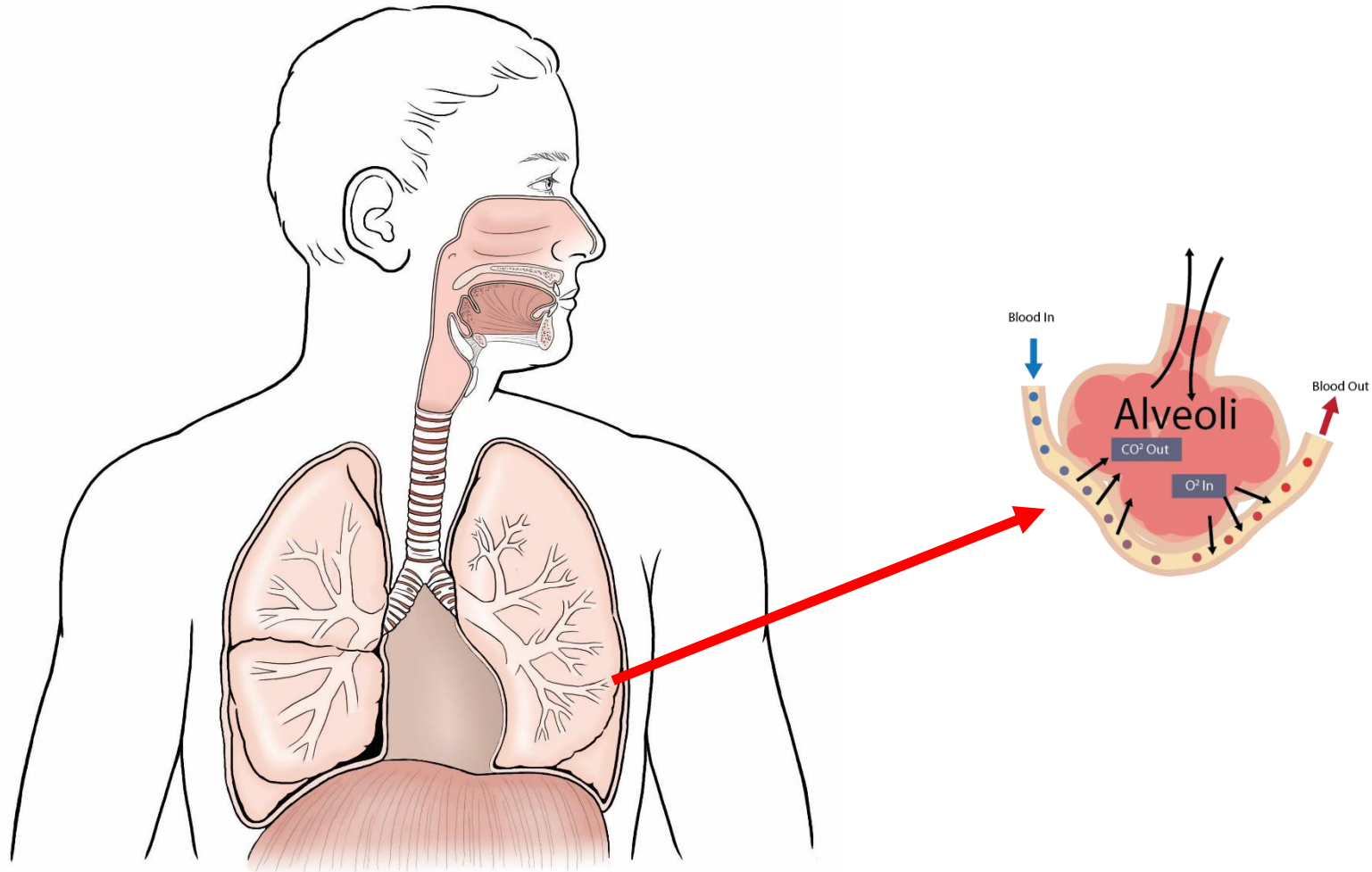


Air Quality Index

Air Quality Index - Particulate Matter

301 – 500	Hazardous
201 – 300	Very Unhealthy
151 – 200	Unhealthy
101 – 150	Unhealthy for Sensitive Groups
51 – 100	Moderate
0 – 50	Good

Health Effects



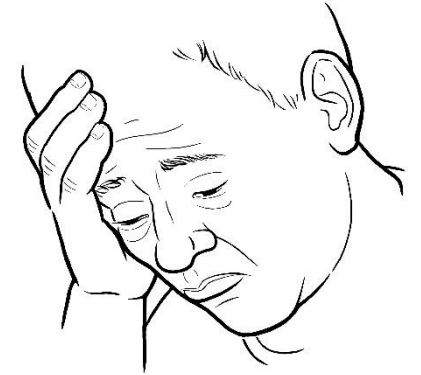
Who Has Higher Risk

- People working outdoors
- People with lung or heart disease
- People with diabetes
- Older adults
- Children
- Pregnant women



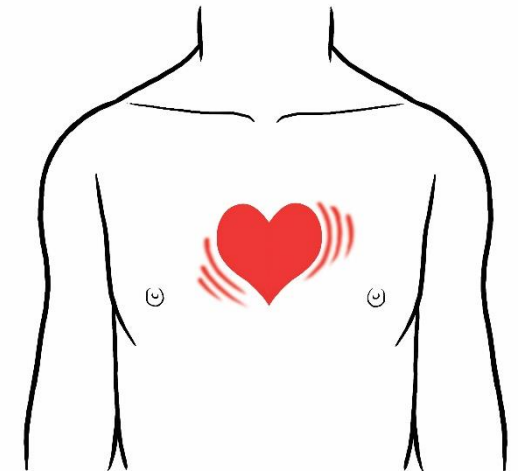
Health Effects

- Headache
- Burning eyes
- Running nose
- Coughing
- Phlegm
- Wheezing
- Dizziness
- Fatigue



Health Effects

- Difficulty breathing
- Bronchitis
- Worsening of asthma
- Rapid heartbeat
- Chest pain
- Reduce lung function
- Heart failure
- Premature death



Monitoring AQI

www.AirNow.gov

<https://wildfiresmoke.net>

California Air Resources Board

Local air pollution control district

Direct reading

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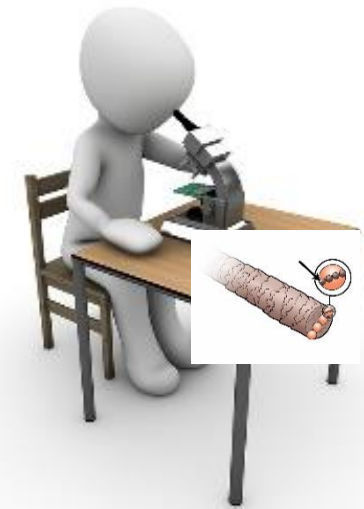


Using a Respirator



Respirators

- Filters = Porous devise for removing particles or impurities
- Their primary objective is to reduce exposure to harmful gases, vapors, or particular matter in the air



Respirators?



NO



Samples

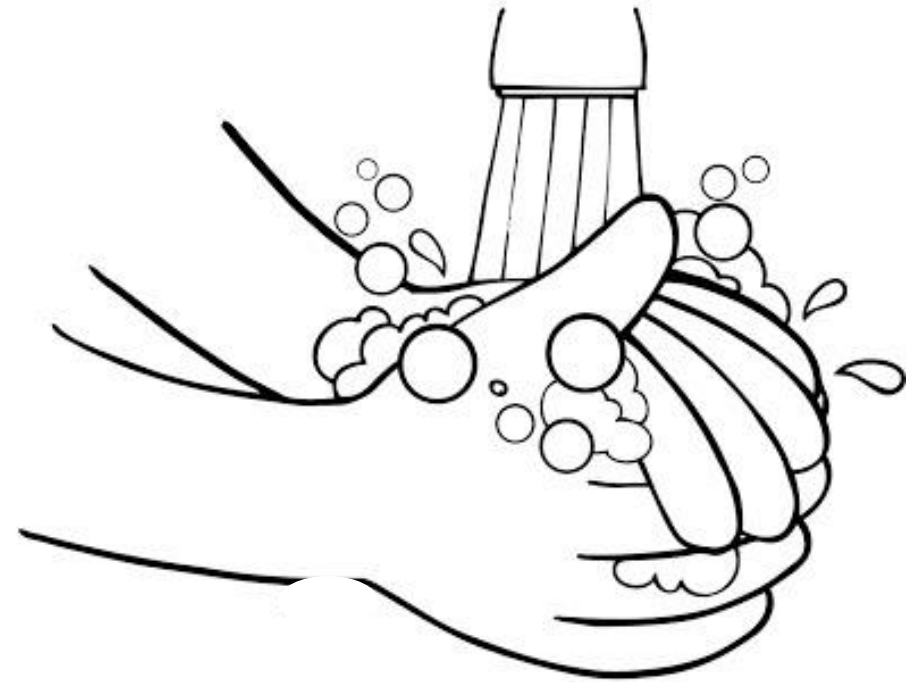
- An N95 respirator is the minimum level of protection for wildfire smoke.





Respirators – Proper use

- Clean hands (with soap and water) before and after touching/adjusting respirator.



Wearing a Respirator



- Place it over the nose and under the chin.
- Pull the bottom strap over your head and place it below your ears.
- Pull the top strap over your head and rest it on the crown of your head.

Wearing a Respirator

- Using both hands, mold the metal nose clip around your nose to secure seal.
- To check the seal
 - Place both hands over the respirator and exhale.
 - The respirator should bulge slightly.
 - If air leaks, reposition respirator and adjust nose piece.

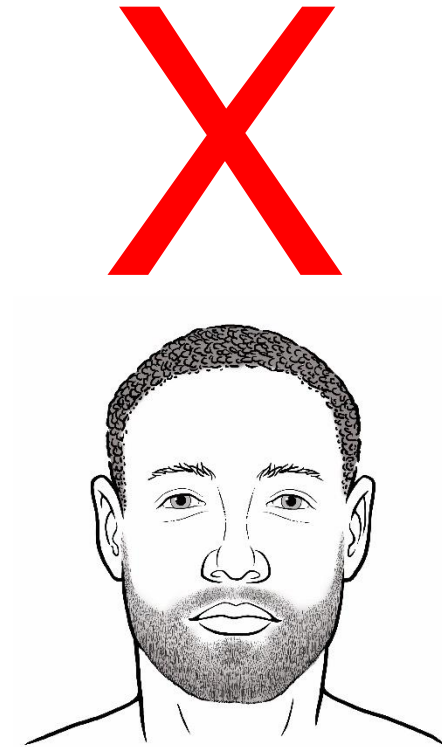


Wearing a Respirator

- If there is not proper seal **it is not protecting you.**
- If you adjust the respirator and still does not fit properly, it may be the wrong size respirator for you face.

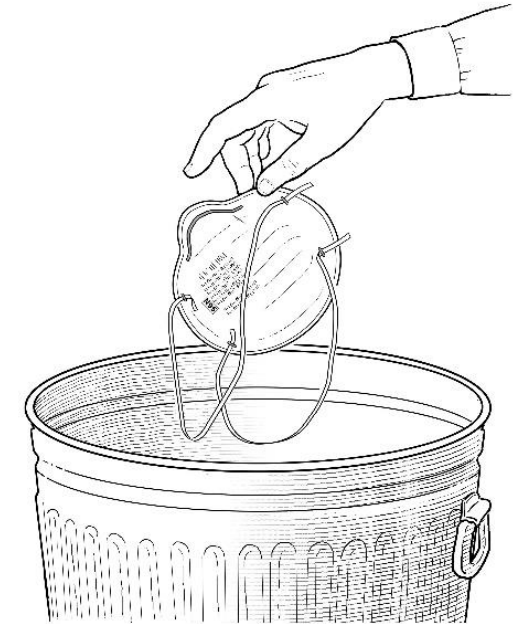
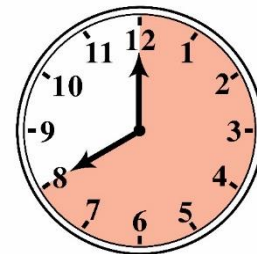
Respirators – Proper use

- No facial hair (mustache ok).



Respirators

- With valve breathing resistance is reduced
- Recommended for single use
 - Discard after each use
 - Do not recommend to re-use, even when used briefly.



California Wildfire Emergency Regulation

Title 8, Section 5141.1



Photo credit: Hector Amezcua, College of Agricultural and Environmental Sciences, UC Davis



Training and Instruction

- Effective
- Include:
 - Health effects
 - Harmful effects of particulate matter
 - The right to obtain medical treatment
 - How to obtain the current AQI
 - Communication system
 - Methods to protect workers
 - Importance and limitations of using a respirator



Control of Harmful Exposures

- In Emergencies:
 - Rescue and evacuation
- Engineering Controls:
 - Enclosed buildings, structures or vehicles



Control of Harmful Exposures

- Administrative control:
 - Relocating work to a location where AQI for PM_{2.5} is less than 151
 - Changing schedules
 - Reducing work intensity
 - Providing additional rest periods

Control by Protective Equipment

- When AQI for PM_{2.5} is equal to or greater than 151, but do not exceed 500.
 - The employer shall provide respirators for voluntary use.
 - Encourage their use.

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Monitor Air Quality

- Employer is required to find out the current AQI applicable to their worksite.
- Check it periodically during the shift
- They can do it visiting:
 - www.AirNow.gov
 - <https://tools.airfire.org>
 - www.arb.ca.gov/capcoa/dismap.htm.
 - www.enviroflash.info

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If you have symptoms

- Notify your supervisor.
- Do not remove respirator until you are in a safe area.
- Stop working and move to a safe area.
- Get **medical assistance as soon as possible**, if you are suffering a serious condition.
- Workers have the right to get medical treatment without fear of retaliation.



On July 29, the emergency
wildfire smoke regulation was
adopted in California







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UC Davis Environmental Health Sciences Center

aghealth.ucdavis.edu
environmentalhealth.ucdavis.edu

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