



Health Effects from Wildfire Smoke

Office of Environmental Health



Leadership for a Healthy Arizona

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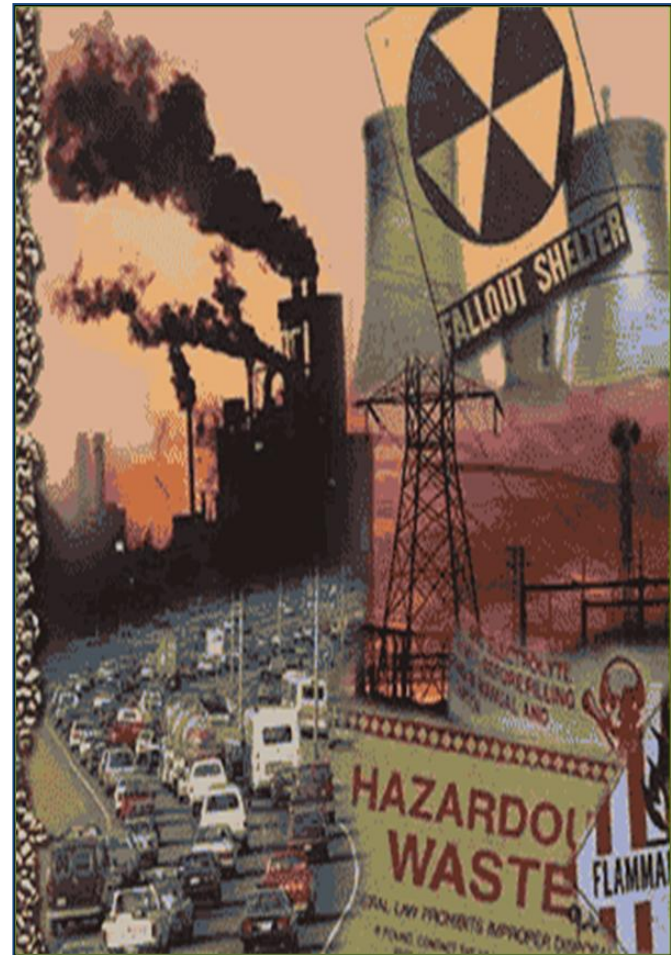
ENVIRONMENTAL TOXICOLOGY PROGRAM

Leadership for a Healthy Arizona



Risk Assessment

- Mathematical modeling process
 - Yields estimates of risks
 - Helps define safe and unsafe chemical concentrations
 - Used to predict potential health effects
- Four Parts
 - Contaminant identification
 - Toxicity assessment
 - Exposure assessment
 - Risk characterization



Wildfire Smoke and Your Health

- What makes up wildfire smoke?
 - Small particles
 - Large particles
 - CO₂, CO, NO_x
 - Hydrocarbons and other organic compounds
 - Water vapor



Wildfire Smoke and Your Health

- The major health concern is particulate matter (PM)
 - Large particles
 - Small particles



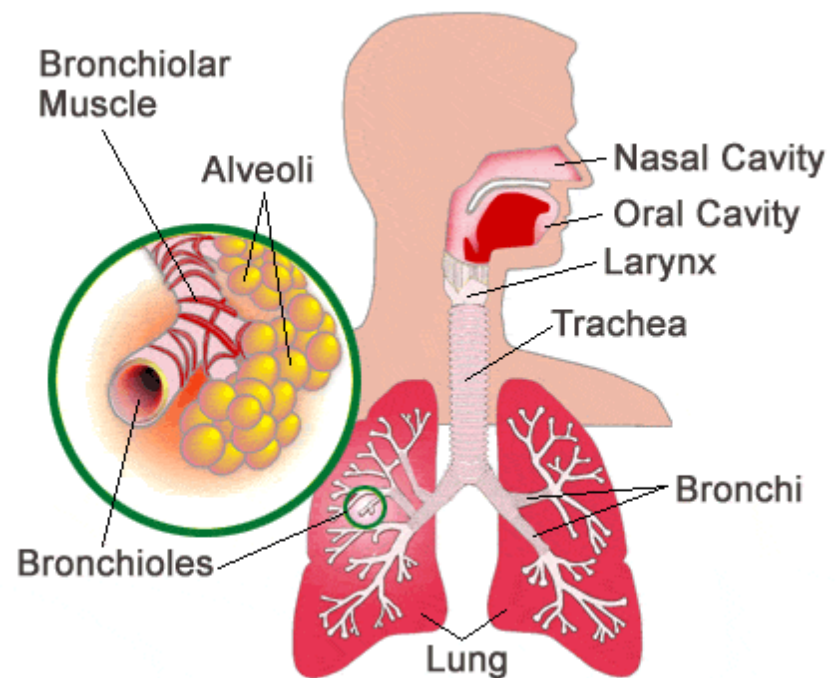
Wildfire Smoke and Your Health

- Health affects from large particles...
 - Burning eyes
 - Runny nose
 - Scratchy throat
 - Headaches



Wildfire Smoke and Your Health

- Health affects from small particles...
 - Collect in alveoli
 - Illness (e.g. bronchitis)
 - Aggravates chronic heart and lung disease (e.g. asthma)



http://www.medicinenet.com/smokers_lung_pathology_photo_essay/article.htm



Health affects of smoke by group

- **Children** – more susceptible because...
 - Lungs are still developing
 - Greater activity levels
 - Breathe about 50% more air per pound of body weight than adults
 - Increased respiratory illness; symptoms include lower respiratory infections and bronchitis



Health affects of smoke by group

- **Elderly** – more susceptible because...
 - Pre-existing lung and heart diseases
 - Loss of important respiratory defense mechanisms with age
 - More difficulty clearing particles from lungs
 - PM can compromise the immune system
 - Bacterial or viral respiratory infections
 - Pneumonia and other respiratory complications



Health affects of smoke by group

- Asthma and other respiratory diseases – more susceptible because ...



- PM → severe inflammation & constriction of airways (→ obstruction of children's airways)
- Aggravates asthma, emphysema & bronchitis
- Triggers headaches & allergies
- Irritates eyes

Health affects of smoke by group

- Individuals with cardiovascular disease– more susceptible because...
 - Particulate matter pollution causes...
 - Increased heart attacks and symptoms
 - Respiratory symptoms
 - Changes in lung function
 - Alteration of mucociliary clearance
 - Leading to increased permeability of the lungs and accumulation of fluid in the lungs



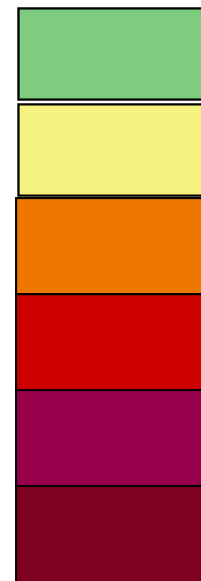
Health affects of smoke by group

- Smokers – more susceptible because...
 - Compromised lung function
 - PM exposure leads to...
 - Chest pain
 - Trouble breathing
 - Other respiratory symptoms
 - Adverse health affects occur more quickly than in non-smokers



Protecting Your Health

- Pay attention to local air quality reports
- Use common sense
 - Limit outdoor and strenuous activities in smoky conditions
- Use visibility guides to
 - Determine air quality conditions
 - Identify health effects
 - Determine the exertion levels based on the visibility range



Visibility (Miles)	Air Quality Index	Health Category	Health Effects
10 +	0- 50	Good	None
5- 10	51- 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
3- 5	101- 150	Unhealthy-Sensitive Groups	People w/ heart or lung disease, older adults, & children should limit prolonged/heavy exertion.
1.5- 3	151- 200	Unhealthy	People with heart or lung disease, older adults, & children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
1- 1.5	201- 300	Very Unhealthy	People with heart or lung disease, older adults, & children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
1 or less	301- 500	Hazardous	Everyone should avoid all physical outdoor activity; people with heart or lung disease, older adults, & children remain indoors and inactive.

Protecting Your Health



- If advised to stay indoors:

- Keep windows and doors closed



- Run the air conditioner with the air intake closed and a clean filter in place

- If available, use a device with a High Efficiency Particulate Air (HEPA) filter

- DON'T use devices that generate ozone, which pollutes even more

Protecting Your Health

- Don't add to the air pollution – refrain from:
 - Using anything that burns, e.g. candles
 - Vacuuming
 - Smoking
 - Dust masks aren't enough
 - HEPA masks filter out small particles, but are not suitable for people with lung diseases
- **People with lung diseases should follow their regular respiratory management plan and call a doctor if symptoms worsen**



Long Term Effects

- Residents – Short duration exposure
 - Not expected to have long term effects
- Firefighters – Long duration / occupational exposure
 - Concern for long term effects not well supported in a recent risk assessment

Health Risk Assessment

- A Screening-Level Assessment of the Health Risks of Chronic Smoke Exposure for Wildland Firefighters by T F Booze, T E Reinhardt, S J Quiring, and R D Ottmar; Journal of Occupational and Environmental Hygiene, May 2004
- Exposure – 2 groups (based on estimates)
 - Type I: 64 days/yr at wildfires; 5 days/yr of prescribed burns [95th percentile: 97 days at wildfires and 17 days prescribed burns]
 - Type II: 10 days/yr at wildfires; 3 days/yr of prescribed burns [95th percentile: 46 days at wildfires and 22 days prescribed burns]

Health Risk Assessment

- 15 substances of potential concern
 - Aldehydes (including formaldehyde)
 - Polycyclic aromatic hydrocarbons
 - Carbon monoxide
 - Benzene
 - Respirable particulate matter (PM)

Health Risk Assessment

- Only 2 substances posed cancer risk & only for worse case scenarios
 - Benzene
 - Formaldehyde
- Only 2 substances posed a non-cancer long term risk (both mean and worse case scenarios)
 - Acrolein
 - Respirable particulate matter (PM3.5)

Health Risk Assessment

- Two other research papers by the Forest Service noted:
 - 5-10% of exposures exceeded the respiratory irritant mixture Threshold Limit Value for formaldehyde, acrolein, and PM3.5
 - 5-10% of exposures exceeded the CO Threshold Limit Value

Conclusions

- The majority of health problems will be seen during and soon after the fire/smoke events.
- The general public is not expected to have long term effects

Conclusions

- Firefighters may have increased risk if at the high end of exposure rates
- Surveillance of health effects would be useful to determine with more certainty the risks of health effects to firefighters and sensitive populations.