

Risk Assessment of Air Contaminants



South Central Fresno Community Steering Committee Meeting May 8, 2019

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Office of Environmental Health Hazard Assessment

Air Resources Board

CalRecycle

Department of Pesticide Regulation

Department of Toxic Substances Control

State Water Resources Control Board



OEHHA Assessments Support CalEPA Environmental and Public Health Activities



CalEPA Mission:

To restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality.



OEHHA Mission:

To protect and enhance the health of Californians and our state's environment through scientific evaluations that inform, support and guide regulatory and other actions.

Outline

- Background: risk, toxicity, and exposure
- How OEHHA determines toxicity
- Factors that influence toxicity
- How OEHHA determines Health Guidance Values for use in estimating risk
- Health concerns associated with some of the chemicals being measured
- How risk is determined from air monitoring data
- How do improvements in air quality affect health?



Risk = Toxicity x Exposure How dangerous Does chemical contact is the chemical? or enter our body? **Health Guidance** Air monitoring data Values



What is Exposure?



How do we determine the toxicity of chemicals?

OEHHA develops benchmarks for toxicity called Health Guidance Values:

Noncancer: Reference Exposure Levels (RELs)

The amount of chemical in the air that is not likely to cause noncancer health effects (like asthma) even in sensitive populations like children and pregnant women

Cancer: Unit risks or cancer potency factors Describe increase in cancer risk per unit of exposure



What influences toxicity?

• Amount • •

• Length of exposure (time)



Sensitivity



https://www.meadindoor.com/for-physicians/



Health effects can become more serious as the amount someone is exposed to increases



https://science.education.nih.gov/supplements/webversions/Chemicals/guide/lesson3-1.html

Toxicity depends on the amount of time someone is exposed to a chemical

OEHHA develops Reference Exposure Levels for specific amounts of time

- Brief exposure (acute): occasional 1-hour exposures
- Moderate exposure: repeated 8-hour exposures over a significant fraction of a lifetime
- Constant exposure (chronic): continuous exposures from 1 year to a lifetime



https://accesspharmacy.mhmedical.com/content.aspx?bookid=2462§ionid=194918140



More people are affected as the amount of chemical they are exposed to increases

People differ – some are more sensitive than others (like children and pregnant women), while others are less sensitive (resistant)







http://www.ilocis.org/documents/chpt33e.htm



How are health guidance values developed?

Particulate Matter





https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

Health Concerns: PM_{2.5}

- Can reach deep into the lung
- Short- and long-term exposure: premature death, cardiovascular mortality and hospitalizations, respiratory and asthma hospitalizations
- Sensitive populations
 - > Elderly
 - Those with emphysema, asthma, chronic heart/lung disease
 - ➢ Infants/children (↑ childhood illnesses, ↓ lung function)
 - > Pregnant women (\downarrow birth weight, preterm birth)



https://www.masters.tw/wp-content/uploads/2015/07/pm2_52.jpg

Health Concerns: Diesel Exhaust

HEALTH HAZARD ASSESS

Noncancer

Respiratory irritation, cough, allergies, lung inflammation

 \uparrow hospitalizations, ER visits, asthma attacks, premature deaths

Sensitive populations

o Those with respiratory and cardiovascular conditions

o Children

Elderly

Cancer

Increased cancer risk

~70% of average Californian's cancer risk from air pollution (CARB)



https://commons.wikimedia.org/wiki/File:Diesel-smoke.jpg

Health Guidance Values for Diesel Exhaust

Non-cancer

Chronic REL: 5.0 μ g/m³ Effect: Changes in rat lung

Cancer

Unit risk: 0.0003 per µg/m³ Inhalation Cancer Potency Factor: 1.1 (mg/kg-day)⁻¹ Effect: Lung tumors in workers





Health Concerns: Wood Smoke

Contains thousands of chemicals, most concerning are:

- PM_{10} and $PM_{2.5}$
- Carbon monoxide
- Irritants (nitrogen dioxide, sulfur oxides, aldehydes like acrolein and formaldehyde)
- > May play a role in smoke-triggered asthma attacks
- Carcinogens, including polyaromatic hydrocarbons (PAHs), benzene, 1,3-butadiene, formaldehyde

Contributes to indoor air pollution, particularly for PAHs

SJVAPCD program requiring reduction of residential wood burning associated with decreased hospitalization for cardiovascular disease (Yap & Garcia, 2015)







Health Concerns: Volatile Organic Compounds (VOCs)



https://www.istockphoto.com/in/photo/human-organs-gm497303869-41750622

How do we determine the risk from the amount of a chemical measured in air?

Noncancer

How does the amount in air compare to the Reference Exposure Level?



Cancer

How much does the amount in air increase cancer risk by?



Reduced PM exposures linked with clear health improvements

- Utah Valley Steel mill shutdown reduced PM and respiratory hospital admissions
- Dublin, Ireland Coal sale ban reduced PM and death from heart and lung disease
- So. California Children who moved to less polluted areas had improved lung function growth; those who moved to more polluted areas had decreased growth rates
- Review of cardiovascular mortality and PM in 51 U.S. metro areas shows PM reductions increased life expectancy
- Reduced diesel PM expected to decrease cancer risk





Questions?

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