Risk Assessment of Air Contaminants

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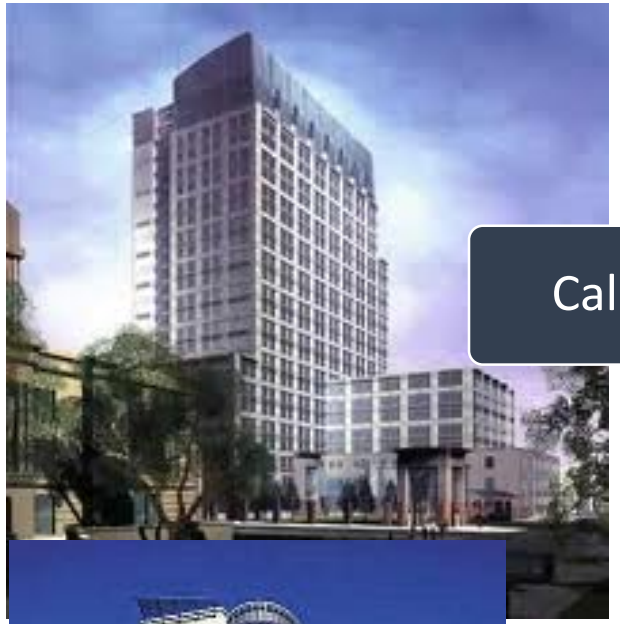
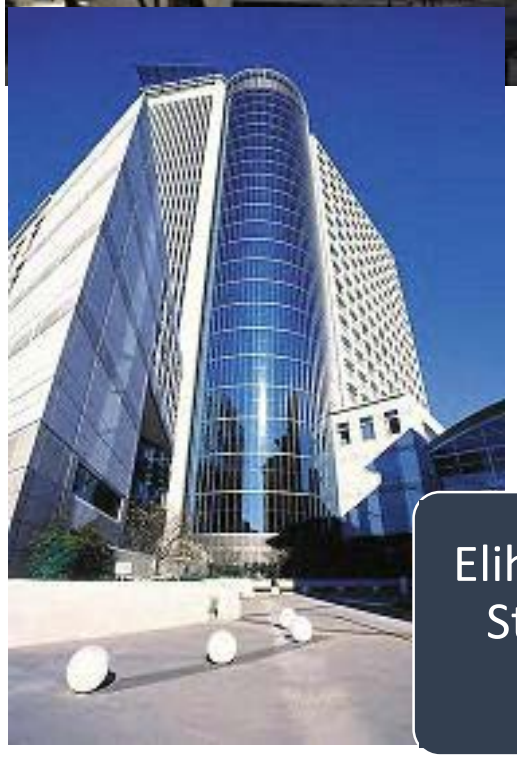
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY





CalEPA

Elihu M. Harris State Office Building

- 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
- Suggestions for presenting air monitoring data

Risk = Toxicity x Exposure

Toxicity

How dangerous is the chemical?

Health Guidance Values

Exposure

Does the chemical contact or enter our body?

Air monitoring data

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

http://clipart-library.com/clipart/163895.htm

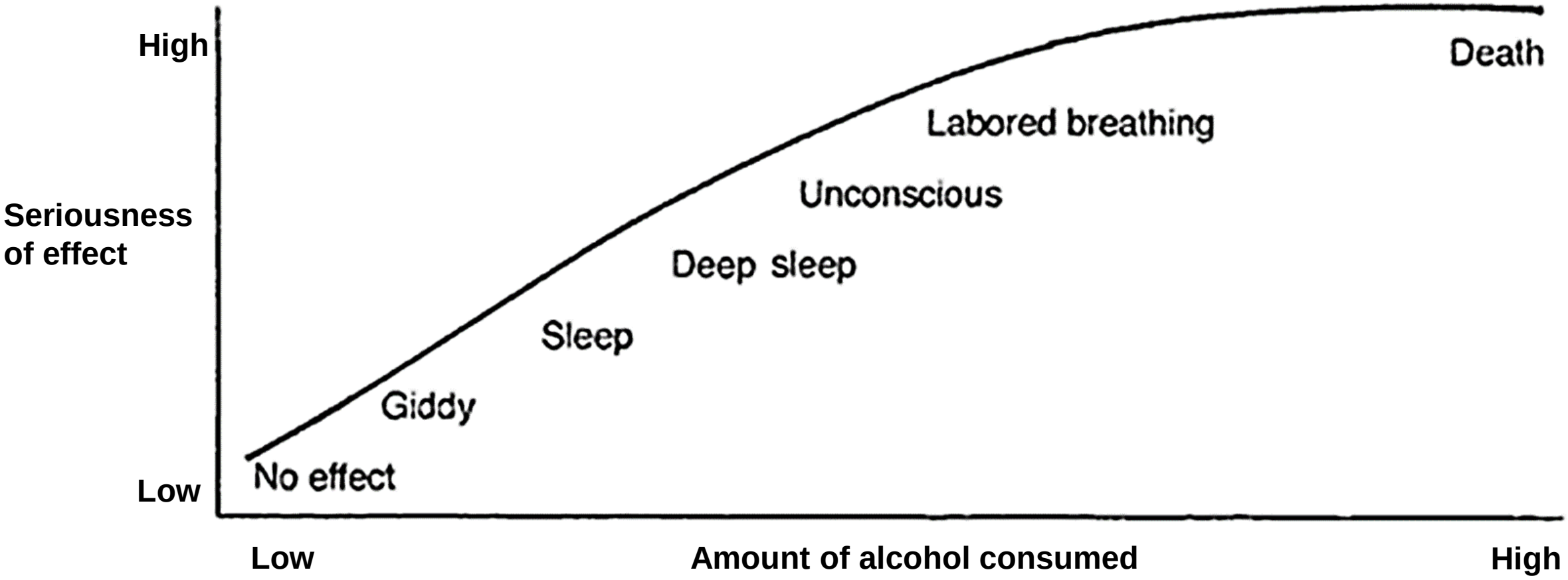
What influences toxicity?

- Amount
- Length of exposure (time)

- Sensitivity

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

Health effects can become more serious if 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

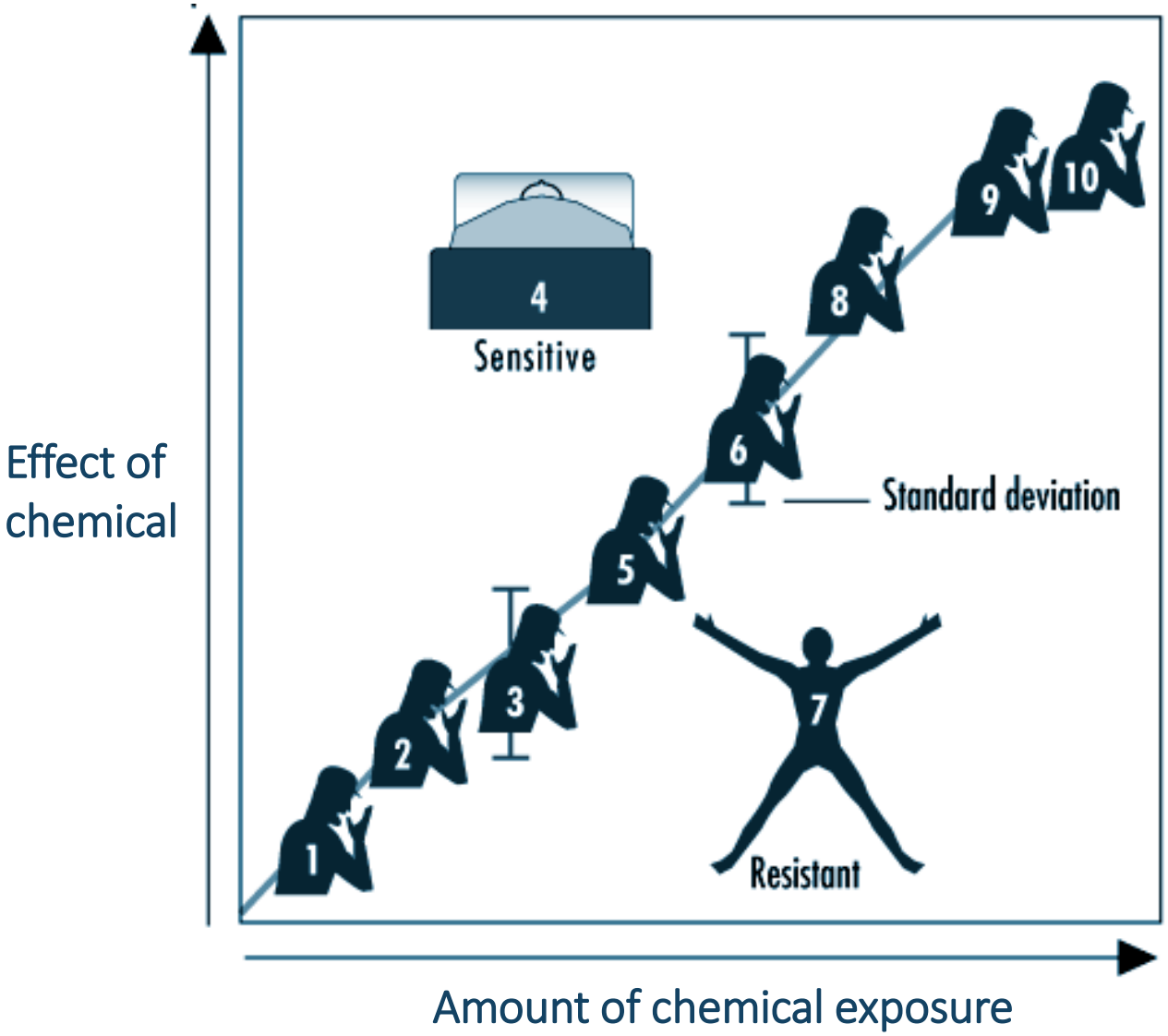
OEHHA develops Reference Exposure Levels for specific amounts of time

- 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&sectionid=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?

Review health effects information

↓

Identify most sensitive effects

↓

Determine relationship between amount of chemical and effect

↓

Determine amount that causes a specific effect

↓

Adjust amount for route, species, length of exposure

↓

Adjust amount for uncertainty (time differences, missing information, species)

↓

Adjust amount for differences in sensitivity between people

↓

Health Guidance Value

<u>Hypothetical example</u>

1000 parts per billion (ppb) (rat)

↓

100 ppb (human)

↓

÷ 10 (no developmental study)

↓

÷ 10 (asthmatic children)

↓

1 ppb

Health Concerns: Diesel Exhaust

Noncancer

- Respiratory irritation, cough, allergies, lung inflammation
- ↑ hospitalizations, ER visits, asthma attacks, premature deaths
- Sensitive populations
  - Those with respiratory and cardiovascular conditions
  - 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 $\mu g/m^3$

Effect: Changes in rat lung

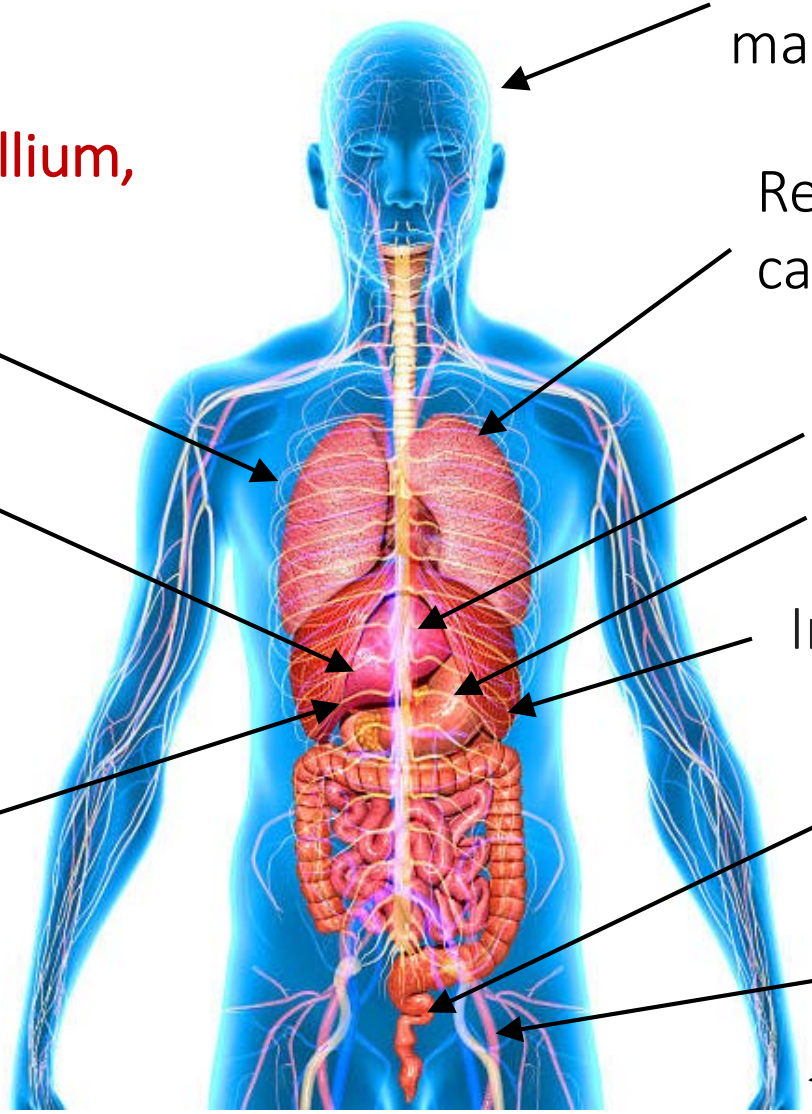
Cancer

Unit risk: 0.0003 per $\mu g/m^3$

Inhalation Cancer Potency Factor: 1.1 $(mg/kg\text{-}day)^{-1}$

Effect: Lung tumors in workers

Health Concerns: Metals



Nervous system (arsenic, lead, manganese, selenium)

Lung cancer (arsenic, beryllium, cadmium, cobalt, nickel)

Respiratory system (beryllium, cadmium, cobalt, nickel)

Liver (selenium)

Adrenal cancer (cobalt)

Kidney (cadmium)

Immune system (beryllium, nickel)

Reproduction and development (arsenic)

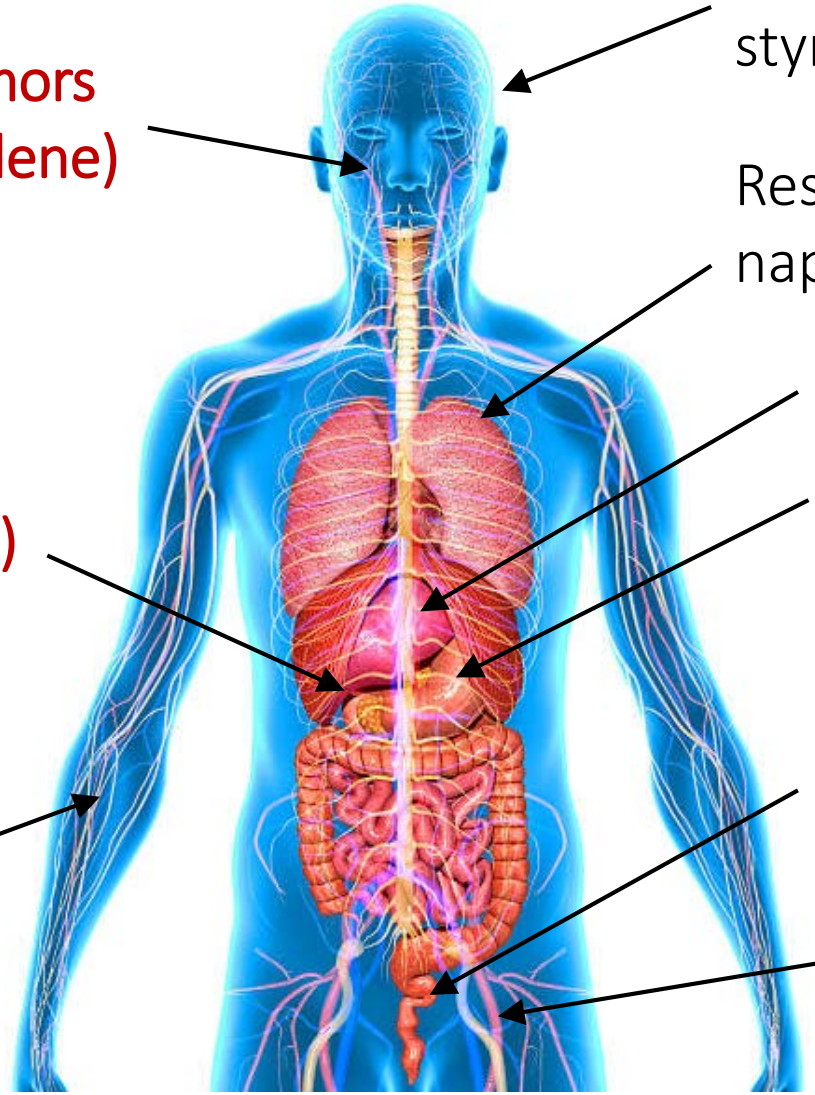
Kidney cancer (lead)

Blood (selenium)

Hair, skin, nails (selenium)

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

Health Concerns: Volatile Organic Compounds (VOCs)



Nasal tumors (naphthalene)

Kidney cancer (ethylbenzene)

Leukemia (benzene)

Nervous system (benzene, hexane, styrene, toluene, xylenes)

Respiratory system (acrolein, naphthalene, styrene, toluene, xylenes)

Liver (ethylbenzene)

Kidney (ethylbenzene)

Reproduction and development (benzene, ethylbenzene, toluene)

Blood (benzene)

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?

Higher? May be some concern

Reference Exposure Level

Lower? Little concern

Cancer

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

Higher? Concern

Lower? Less concern

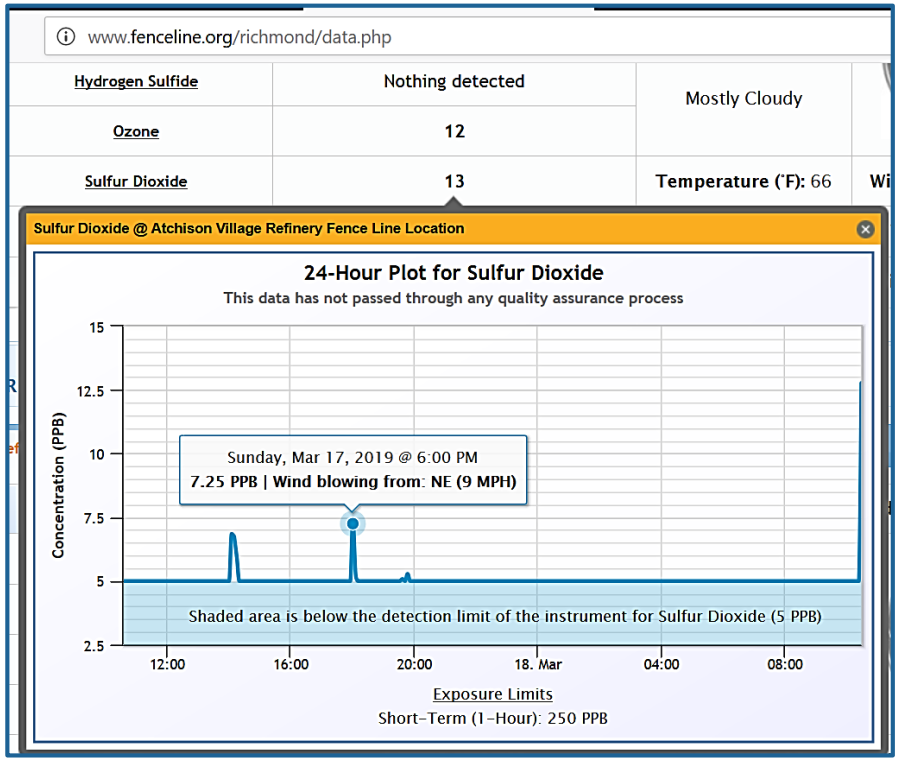
Data Presentation

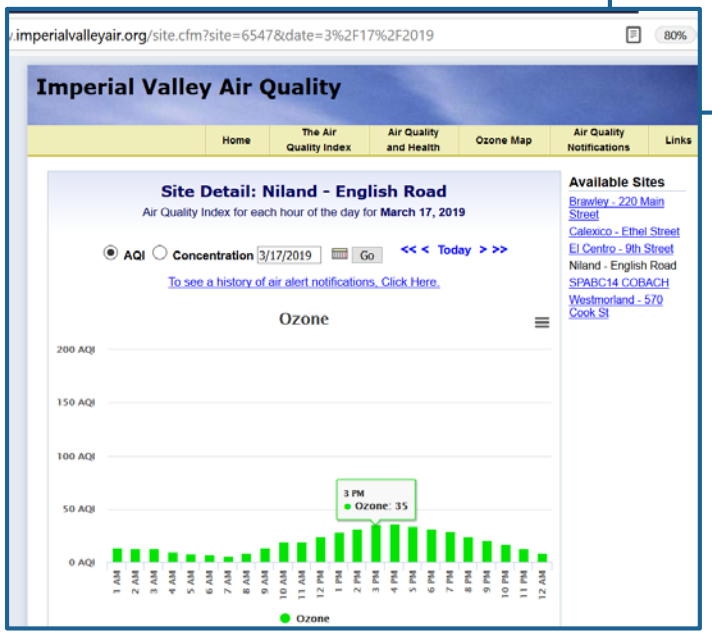
Engage stakeholders

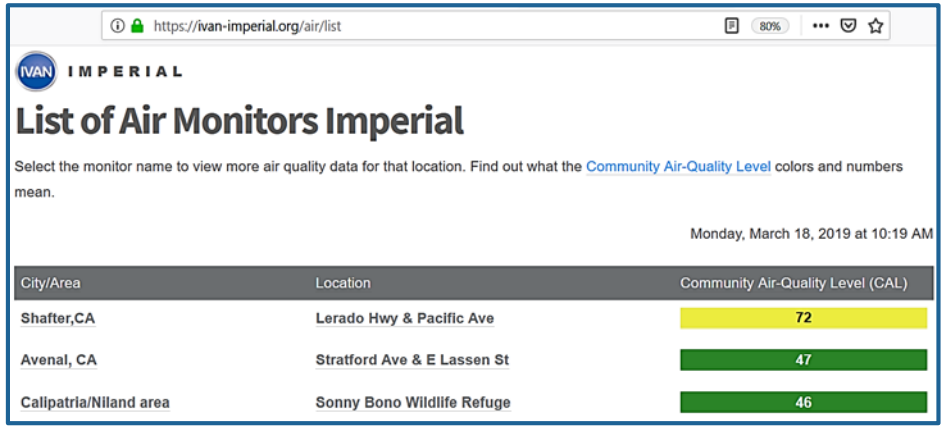
Define terms and chemical formulas

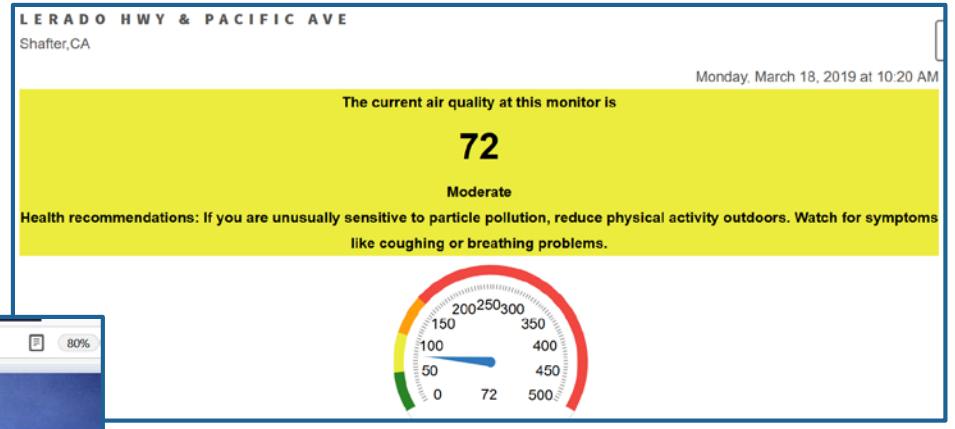
Graphs: lines for health standard and limit of detection

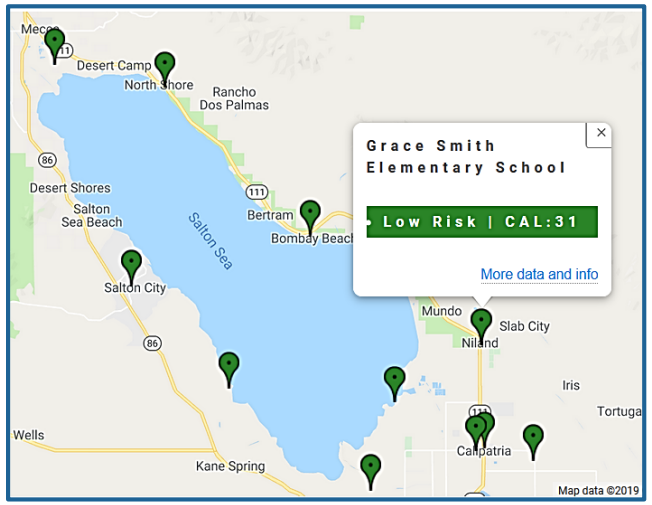
Example formats











Questions?

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