

METR/ENVS 113

Lecture 4: Ambient Air Pollution (Part 1)

SJSU Fall Semester 2020

Module 2: Outdoor Air Pollution

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Outline

- **Air Pollution: Definitions**
 - Formal Definition
 - Ambient Air Pollution
- **Air Pollution: Concentration, Duration and Health Effects**
 - Acute versus Chronic Health Effects & Exposure
 - Long-term versus short-term exposure
 - Levels of Concern for Health Effects
- **Air Pollution: Regulation (next lecture)**

Air Pollution: Definitions

Nitrogen in atmosphere

Anthropogenic emission (NO_x)

Deposition

$\text{N}_2, \text{O}, \text{N}_2$

Lightning

A natural source of NO_x

Combustion from Industry and Automobiles

An anthropogenic source of NO_x

Fertilizer production

production

Nitrogen organic matter in soil

Nitrate

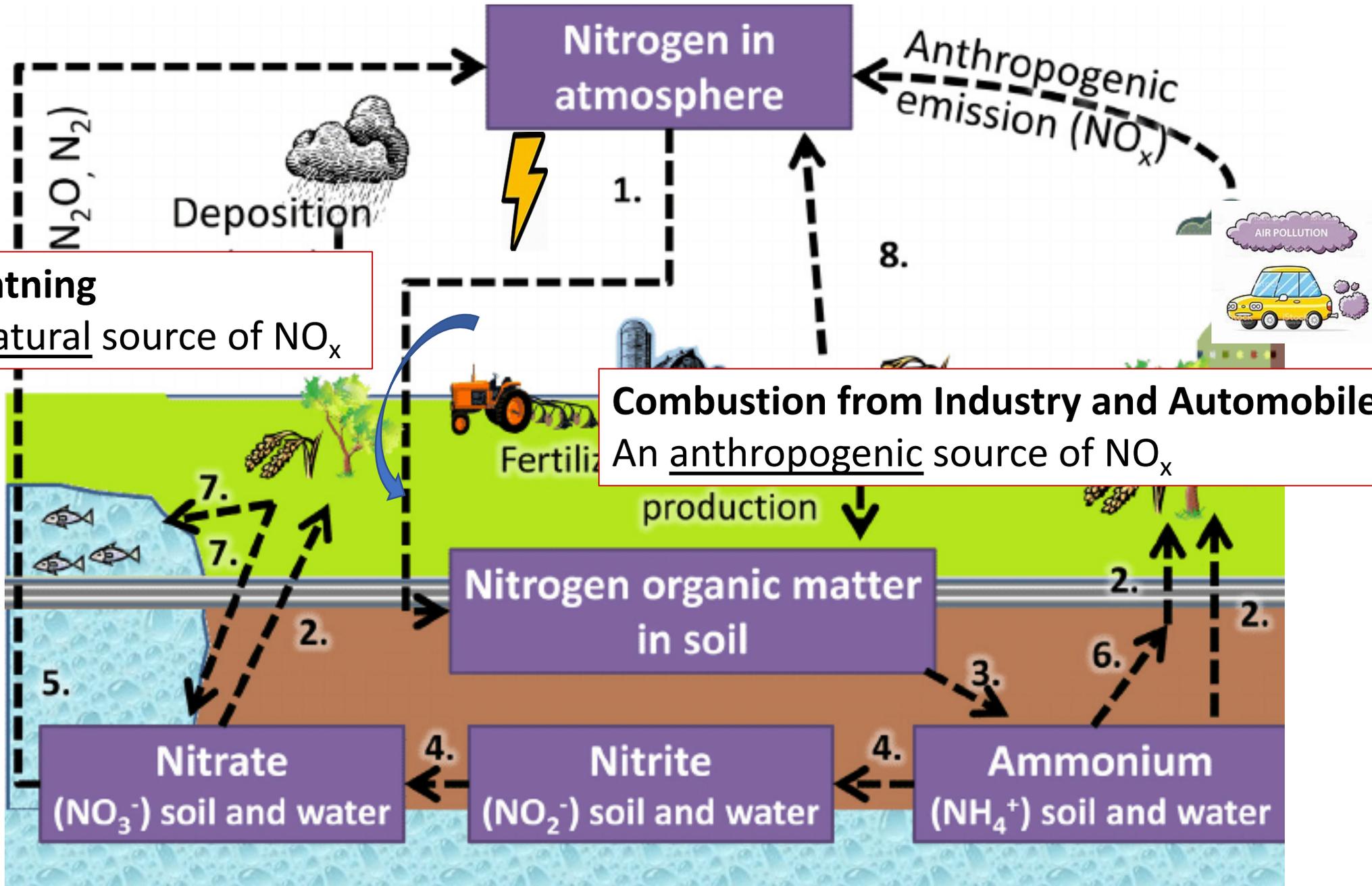
(NO_3^-) soil and water

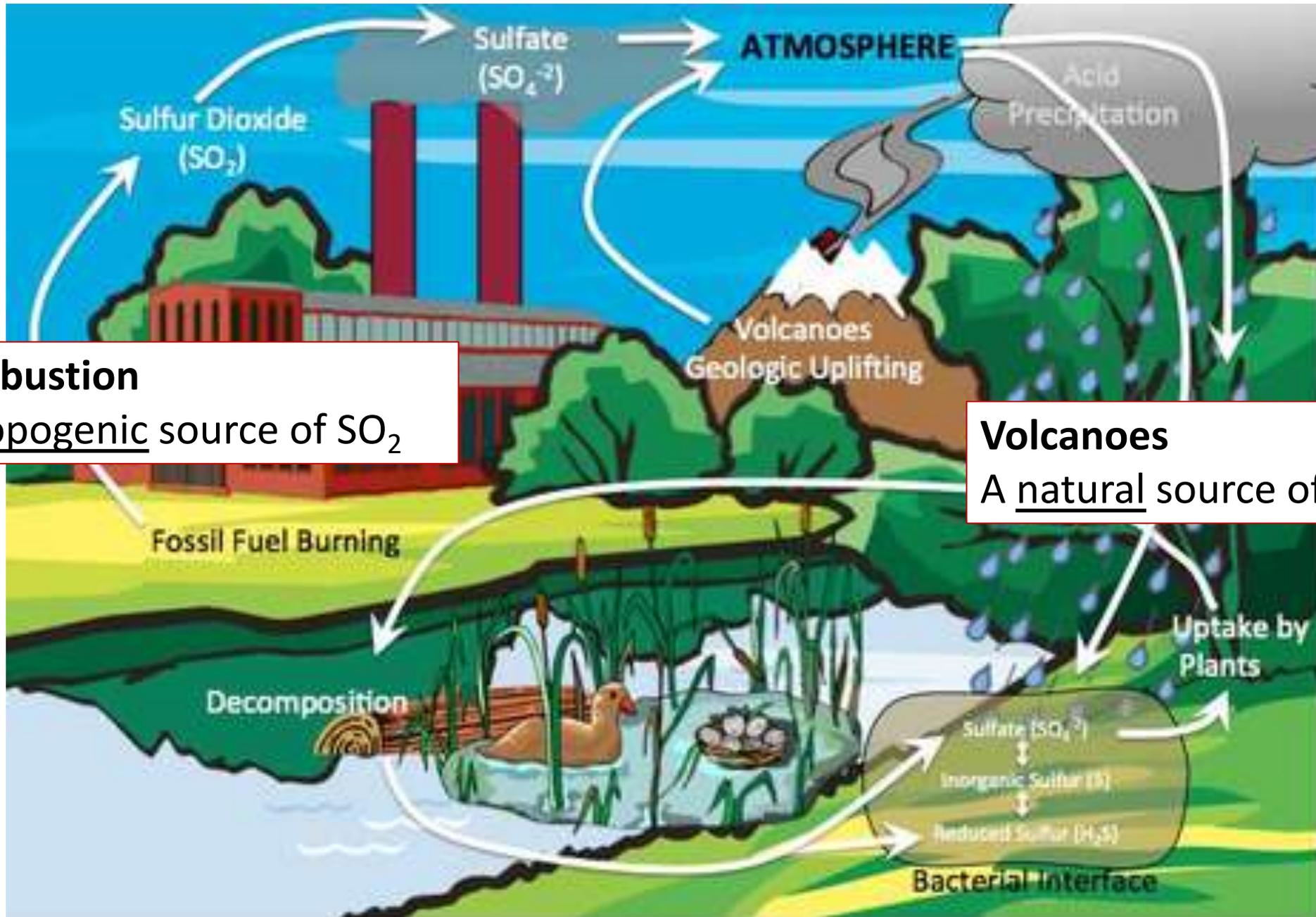
Nitrite

(NO_2^-) soil and water

Ammonium

(NH_4^+) soil and water





Coal Combustion

An anthropogenic source of SO_2

Volcanoes

A natural source of SO_2

Natural Background Concentrations in Air

(Current-Day, remote areas ... away from major air pollution sources)

Pollutant	Natural Background Concentrations	Source
Carbon Dioxide (CO ₂)	410 ppm	Mauna Loa (Hawaii) https://www.esrl.noaa.gov/gmd/ccgg/trends/
Carbon Monoxide (CO)	50 – 120 ppb	http://www.euro.who.int/_data/assets/pdf_file/0020/123059/AQG2ndEd_5_5carbonmonoxide.PDF
Nitrogen Dioxide (NO ₂)	0.2 – 5 ppb	http://www.euro.who.int/_data/assets/pdf_file/0017/123083/AQG2ndEd_7_1nitrogendioxide.pdf
Sulfur Dioxide (SO ₂)	< 1 ppb	http://www.temis.nl/products/so2.html

Air Pollution: General Definition

Buildup of naturally or anthropogenically emitted gases and/or particles in air concentrations sufficiently high to cause, or produce excessive risk of, damage to human health, plants, animals, other life forms, ecosystems, structures, or works of art.

KEY POINTS OF DEFINITION

1. Includes both natural and anthropogenic emission sources
2. Build-up of concentrations sufficiently high to cause damage, or excessive risk, of damage
3. Damage is broad ... spanning several forms (human health, environment, etc ...). Primary focus of METR113, however, is human health.

Ambient Air Pollution: General Definition

“Ambient Air”: Outdoor air to which the general population across an area is exposed.

Example of ambient air pollution: Summer smog layer San Jose



Air Pollution in Urban Area: Los Angeles

(Another image of “ambient air pollution”)



*Air Pollution:
Concentration, Duration & Health Effects*

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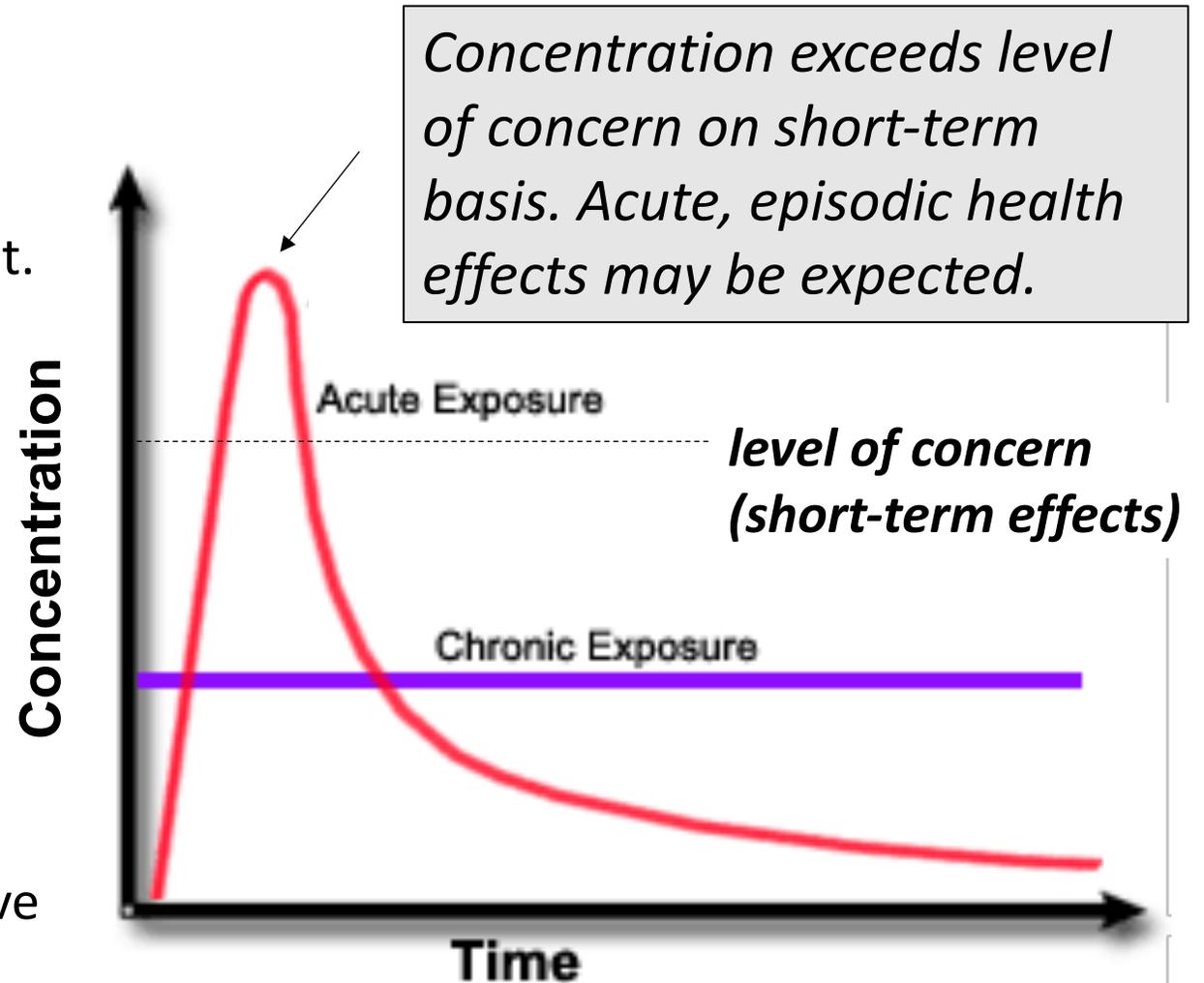
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Adverse Health Effects Due to Air Pollution

(Acute vs. Chronic Health Effects)

Acute Health Effects

- Due to short-term (< 24 h) exposure of an unhealthy concentration level of an air pollutant. Causes **short-term** health effects.
- Examples: Lung / throat irritation, asthma exacerbation, episodic respiratory symptoms, hospitalizations, death.
- Examples of events: bad air pollution episodes, major wildfires, industrial accidents.
- Implies a “level of concern” or “threshold” above which concentrations levels cause such effects.



Adverse Health Effects Due to Air Pollution

(Acute vs. Chronic Exposure)

Chronic Health Effects

- Long-term (annual to lifetime) exposure of an unhealthy amount of air pollutant. Causes risk of **long-term** health effects.
- Examples: Respiratory or cardiovascular disease, cancer.
- Due to exposure to long-term, average concentration levels above a level of concern.
- Examples: Living in a very polluted city or area for a long period of time. Lifetime exposure in a workplace.

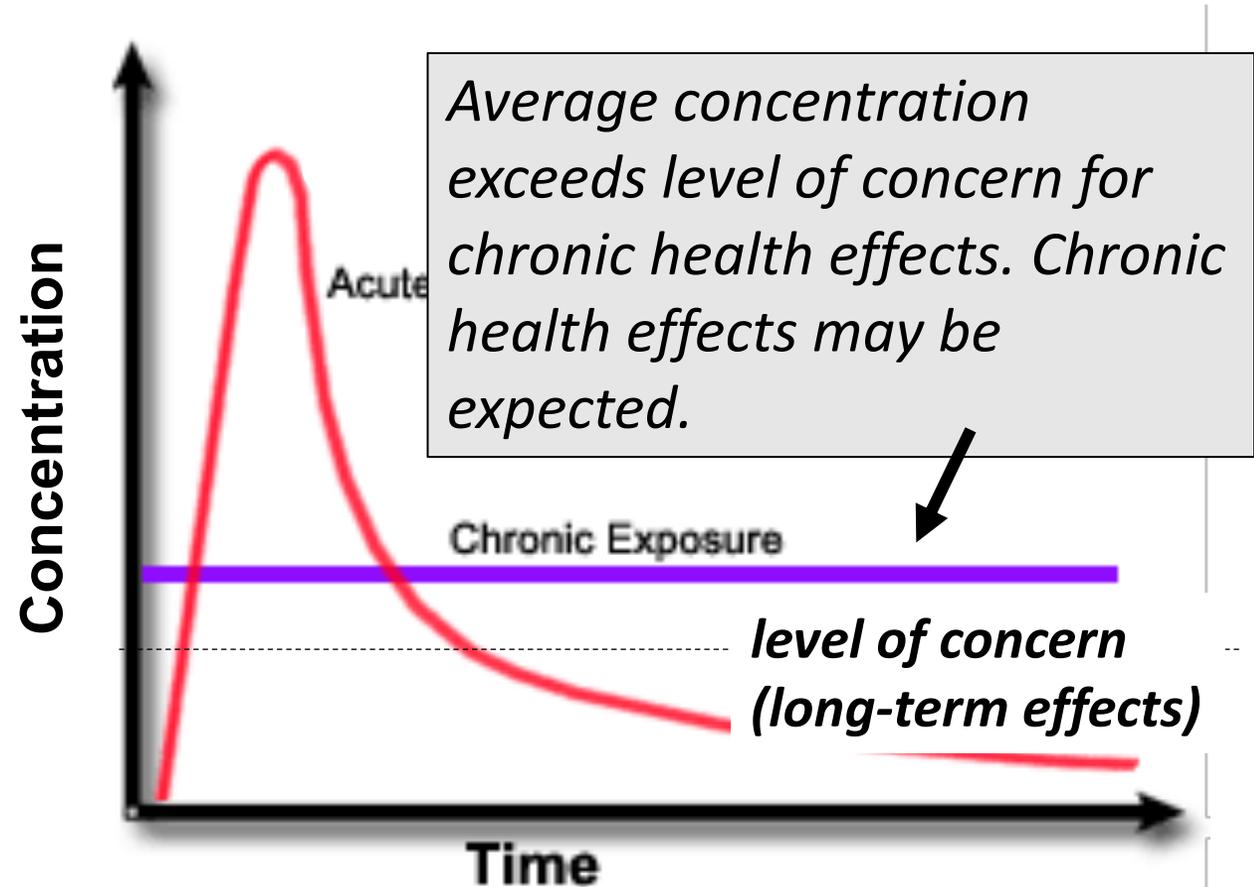


Illustration: Sulfur Dioxide (SO₂)

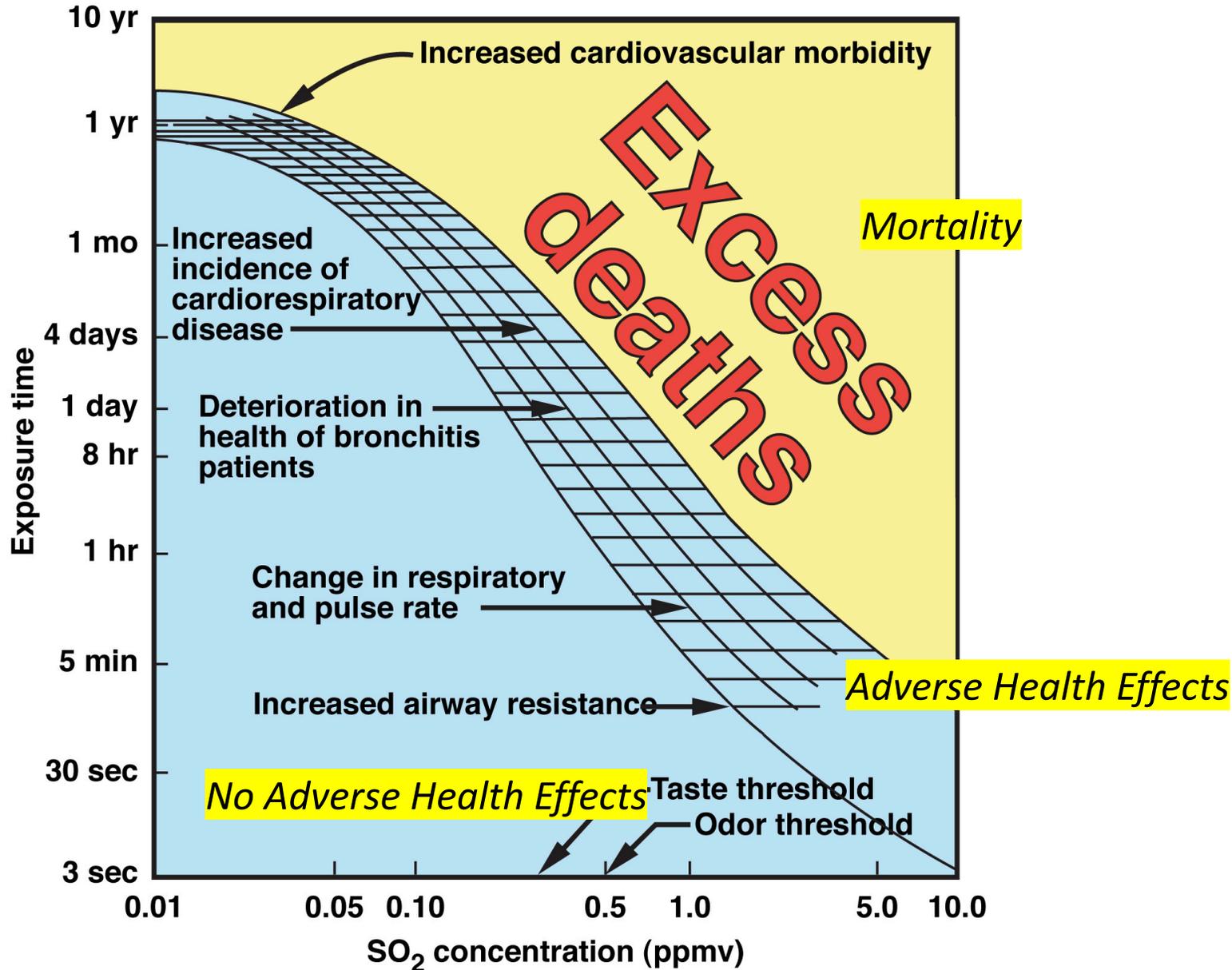


Illustration: Carbon Monoxide (CO)

