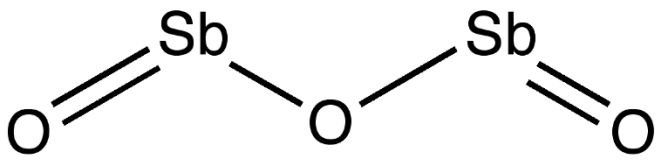
# Properties and Human Exposure

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**National Institute of Environmental Health Sciences**

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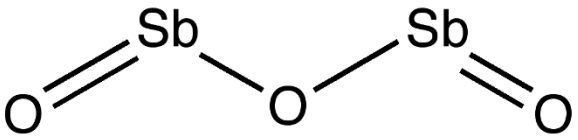
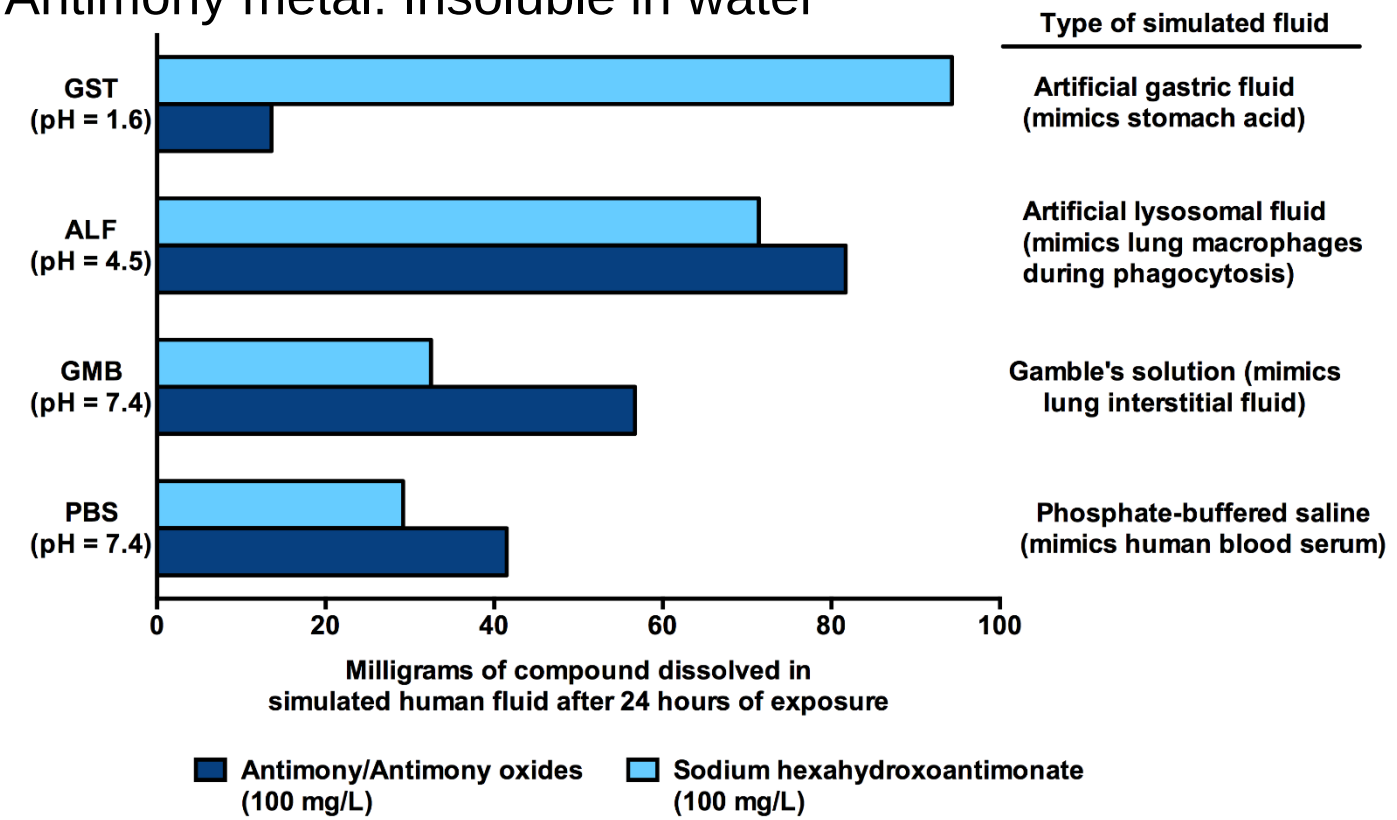
# Antimony and antimony compounds

- Antimony is a metalloid found in nature in over 100 mineral species
  - Exists as four oxidation states: -3, 0, +3 and +5
    - +3 (trivalent) and +5 (pentavalent) are most common in environmental, biological, and geochemical systems
  - Antimony species can undergo transformation during manufacturing processes, in the environment, or *in vivo*
- Elemental antimony is a silver-white metal used to make alloys
- Antimony(III) trioxide exists as an odorless white powder or polymorphic crystals



# Solubility of antimony oxides and antimony metal is higher in biological fluids than in water

- Antimony trioxide: 3.3 mg/L in water
- Antimony pentoxide: 0.043 mg/L in water
- Antimony metal: Insoluble in water




Source: ECHA Registration Dossiers for diantimony pentoxide and diantimony trioxide.

# Human Exposure

# Human Exposure

## A significant number of people in the United States are exposed to antimony(III) trioxide based on:

- Consumption (~ 70 million lb/yr; 1 producer and 10 importers reported in the United States) in manufacturing
- Widespread use in industrial applications (e.g., 273 companies in the flame retardant industry)
- Occupational exposure
- General population exposure
  - Consumer products
  - Environmental exposure

# Uses of Antimony(III) Trioxide

## Antimony(III) trioxide is the most commercially significant form of processed antimony

- Workers in formulation, processing, and manufacturing of consumer products are exposed to antimony(III) trioxide

| Formulation | Processing | Consumer products | |
|---|---|---|---|
| flame retardant synergist | flame retardant plastics (including PVC), textiles, rubbers | e.g., furniture, electrical and electronic equipment |  |
| PET catalyst | PET packaging and fibers | e.g., PET containers for water, soft drinks, etc. |  |
| special glass manufacture additive | glass screens, optical art | e.g., fluorescent light bulbs, glass for TV and computers |  |
| pigments, paints, ceramics | application of adhesive, paints, and coatings | e.g., glazed ceramics and painted products |  |

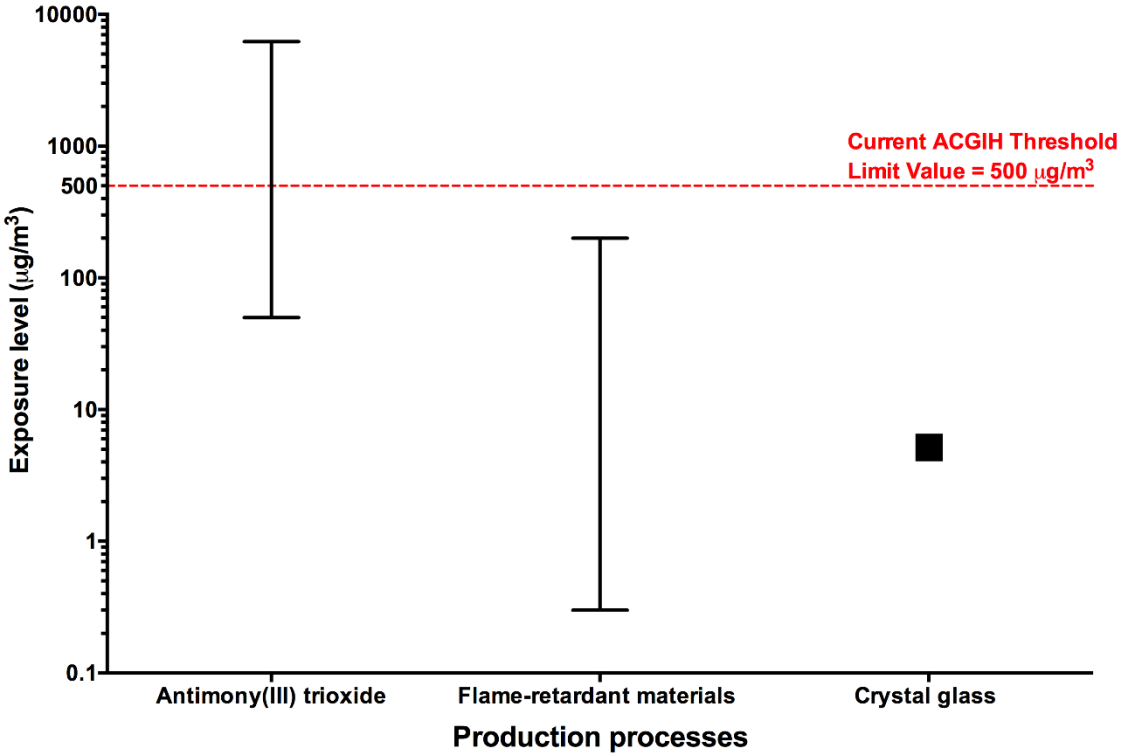
Blue – $Sb_2O_3$; yellow – no longer $Sb_2O_3$; green – depends on circumstance

# Disposal of Antimony-Containing Products

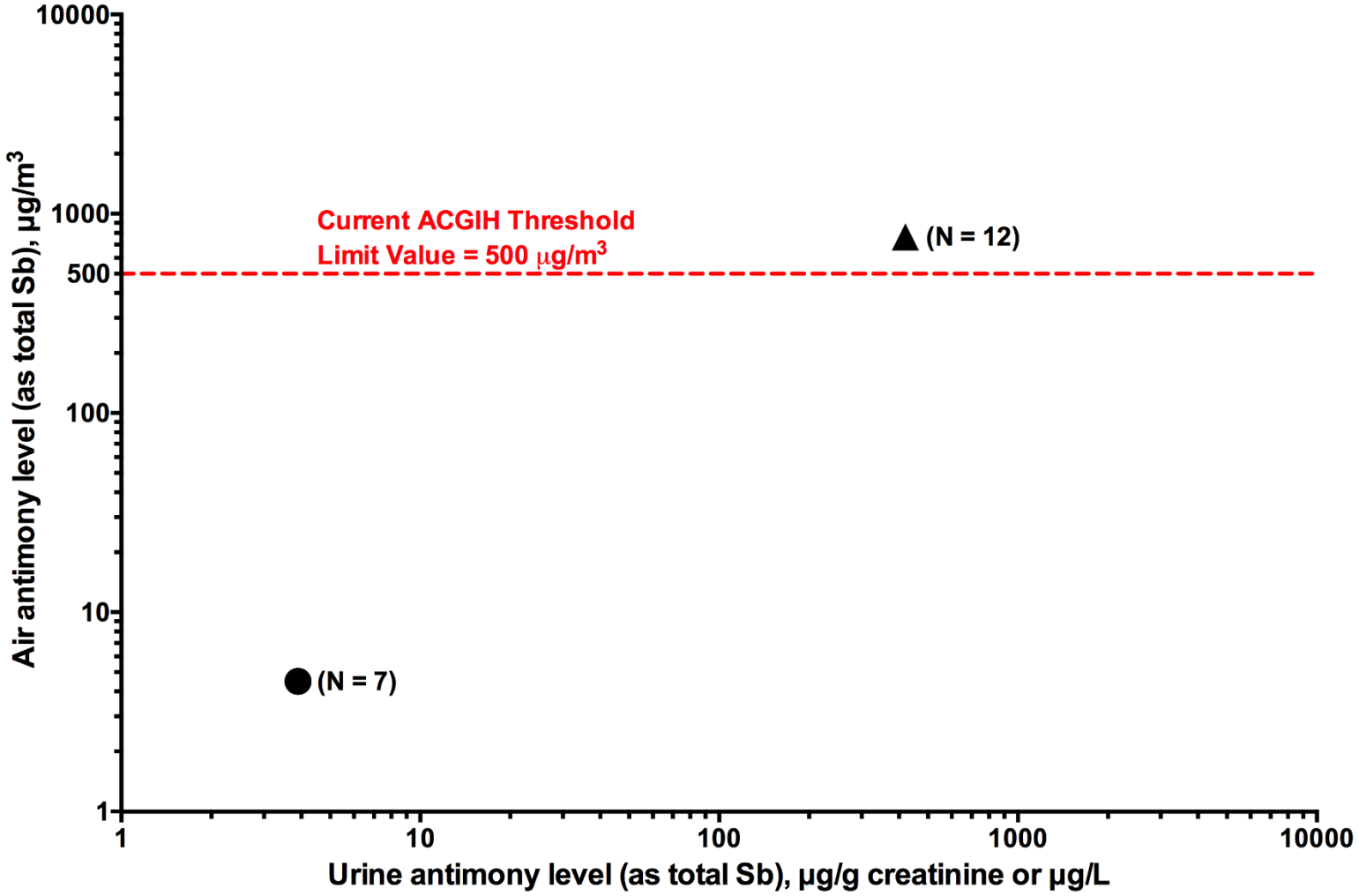
- The life cycle of antimony-containing products is completed by recycling, incineration, or waste disposal in landfills
- The process of recycling and incineration can result in oxidation of antimony and release of antimony(III) trioxide to the air regardless of the form of antimony in the product

# Highest levels of exposure to antimony(III) trioxide occur in the workplace

- NIOSH National Occupational Exposure Survey (1981–1983)
  - > 200,000 male and female workers potentially exposed
- Major exposure route is inhalation of airborne solid dust
  - Dermal exposure also can occur
- Highest exposures from production of:
  - Antimony(III) trioxide (e.g., from smelting and refining)
  - Flame-retardant materials
  - Crystal glass
- The European Union reports similar levels for recent exposures



# Urinary excretion for exposed workers increases with levels in air for antimony(III) trioxide



# The general population is exposed to antimony

- NHANES urinary antimony levels indicate low exposure to antimony
  - General population geometric mean urinary antimony level = 0.043 µg antimony/L (0.05 µg antimony/g creatinine)
  - Measurement is for total antimony, which includes antimony(III) trioxide and other forms of antimony
- Analyses of NHANES data indicate higher urinary antimony levels in individuals with lower socioeconomic status

# Releases to air are the most relevant source of exposure to antimony(III) trioxide

- Primary releases from industrial uses (TRI 2010 – 11,365 lb to air)
- Secondary releases to air by oxidation of other antimony species
  - Traffic pollution from oxidation of automobile brake materials during use
  - Antimony in coal is oxidized to antimony(III) trioxide during combustion
  - Antimonial lead in automobile batteries is oxidized to antimony(III) trioxide during recycling

# Exposure from consumer products

- From use of antimony(III) trioxide as a synergist with flame retardants in products
  - Mainly via inhalation of particles from wear and tear of these products
    - Form of antimony in exposure is largely antimony(III) trioxide
  - Oral and dermal exposure also can occur
    - Form of antimony in exposure is antimony ions

# Summary

- Workers in industries using antimony(III) trioxide have the highest levels of exposure
- The general population is exposed to antimony(III) trioxide
  - From some consumer products
  - From primary (i.e., pollutant is antimony(III) trioxide) and secondary (i.e., pollutant is transformed from other antimony species into antimony(III) trioxide) environmental releases

# Questions?

# Reviewer Questions

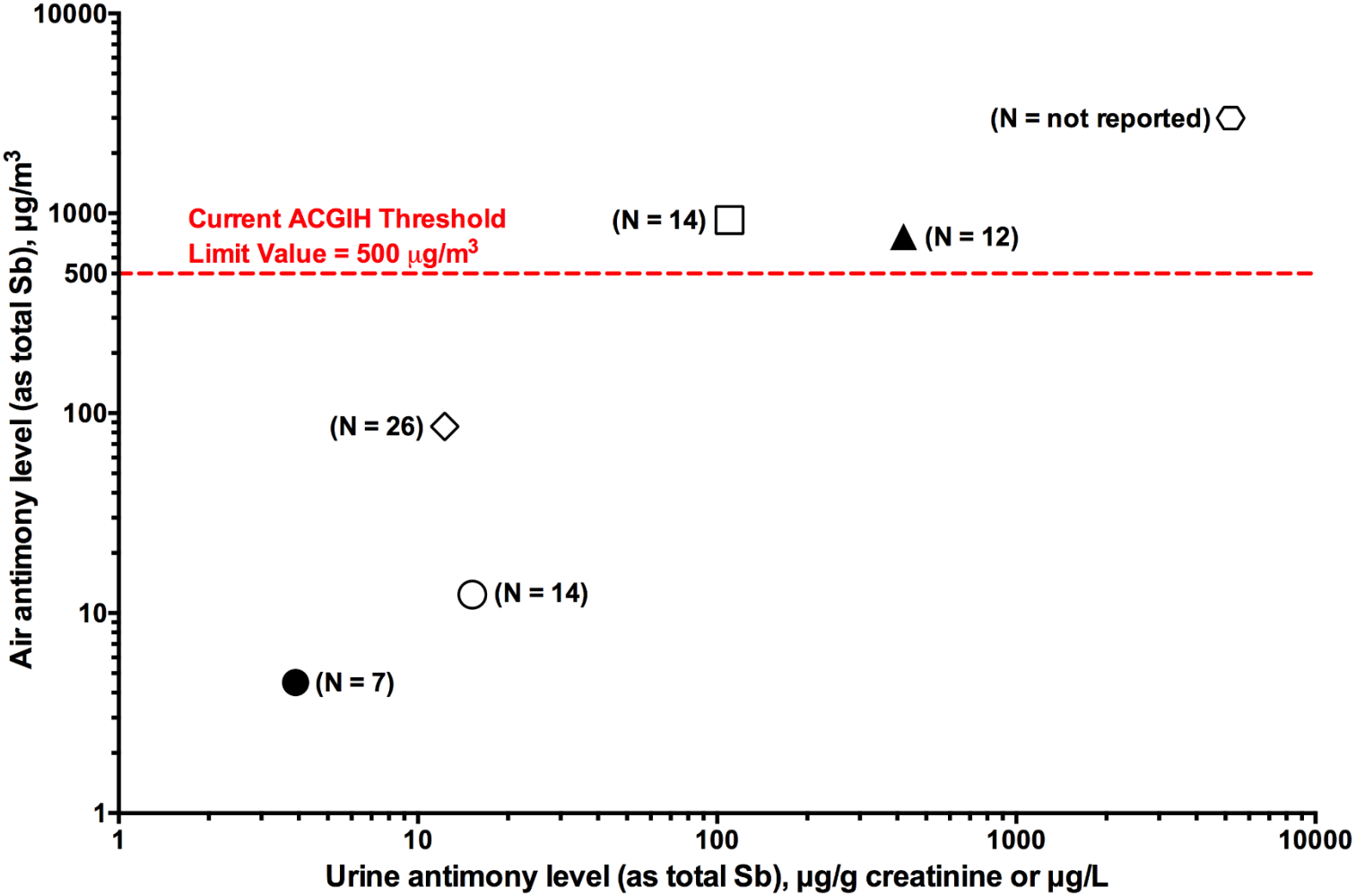
## Properties

- **Comment on whether the chemical identity and property description of antimony trioxide and selected other antimony compounds (Section 1: Chemical Identification and Properties) are clear and technically accurate.**
  - **Identify any information that should be added or deleted.**

## Human Exposure

- Comment on whether the information on use, production, and human exposure to antimony trioxide (Section 2: Human Exposure) is clear and technically accurate.
  - Identify any information that should be added or deleted.
- Comment on whether adequate information is presented to document past and/or current human exposure to antimony trioxide in the United States. Exposure can be inferred by data on usage, production, or evidence for exposure in the workplace, from the environment or consumer products, diet, or medical use.

# Urinary excretion for exposed workers increases with levels in air for antimony(III) trioxide and other forms



# Urinary excretion for exposed workers increases with levels in air for antimony(III) trioxide