An interdisciplinary scientist's overview of why exposure to lead (Pb2+) remains an IEQ issue for American K-12 schools.

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Lead: Part of the History of Environmental Health in our Communities (Homes, Schools)

- Among the issues present even during Ancient Times in Rome, Greece, Europe, etc.:
  - Contamination of water
    - Clean water *necessary for life* (drinking and bathing, cooking).
  - Lead in pottery used to drink wine, hold foods, etc.;
    - Food safety *necessary for life.*
  - Pollution of the air both indoors and outdoors.
    - Breathing clean air *necessary for life.*

Defining Human Exposure

Contact between a person *(or animal, plant, fish, etc.)*
and an **agent**, or the vector of an agent,
in one or more **media**,
through one or more defined **pathways** and **routes**,
at a *specific (acute)* or over a *period (chronic)* of **time**.

Chronic exposure may be intermittent, continuous or episodic.

Each type is relevant to ongoing issues with lead (Pb2+)
in our communities, including homes and schools!

Exposure Agents

Four categories, classified as carcinogenic or non-carcinogenic:

1. Biological
   - Bacteria and mold (fungi, mildew, spores), including metabolic products and cell-wall components; pollens from trees, flowers
2. Chemical
   - Organic: contain C and H, with/without metals
   - Non-organic: N, S, H, O and ***heavy metals like lead or Pb2+***
3. Physical
   - Light, noise, ergonomics, weather and climate-related variables (temperature, relative humidity, wind)
4. Radiological
   - Radon gas, electromagnetic field, ionizing/non-ionizing, nuclear

Also, an emerging area of research: Psychosocial factors, or social determinants of health

Exposure Science Terms (*continued*)

- *Pathways:*

To describe process of the emission(s) of agent(s) from identified source(s)—either natural or human (anthropogenic) or both—to various environmental media.

- *Routes:*

The major *routes* for the general population:

1. Inhalation (nose, mouth)
2. Dermal (skin)
3. Ingestion (food, liquids)

An Exposure Assessment Flowchart

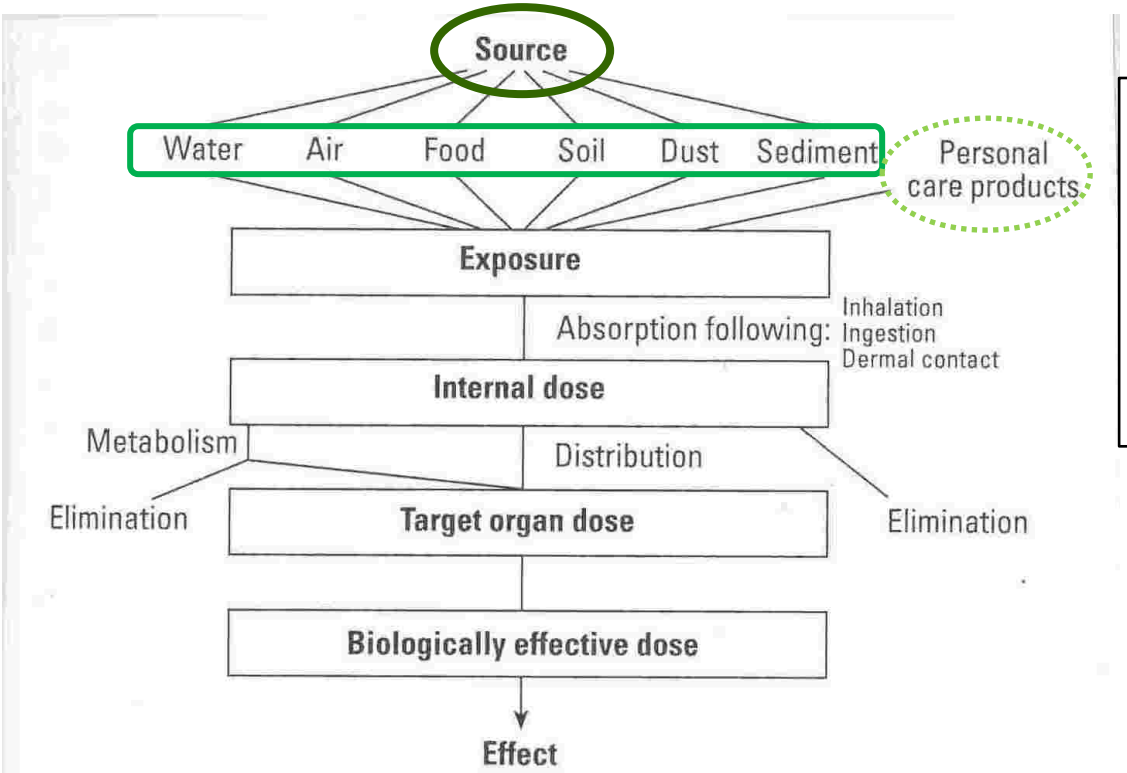


Figure 1. Source to exposure to health effects pathway.

Environmental Health Perspectives • VOLUME 113 | NUMBER 8 | August 2005

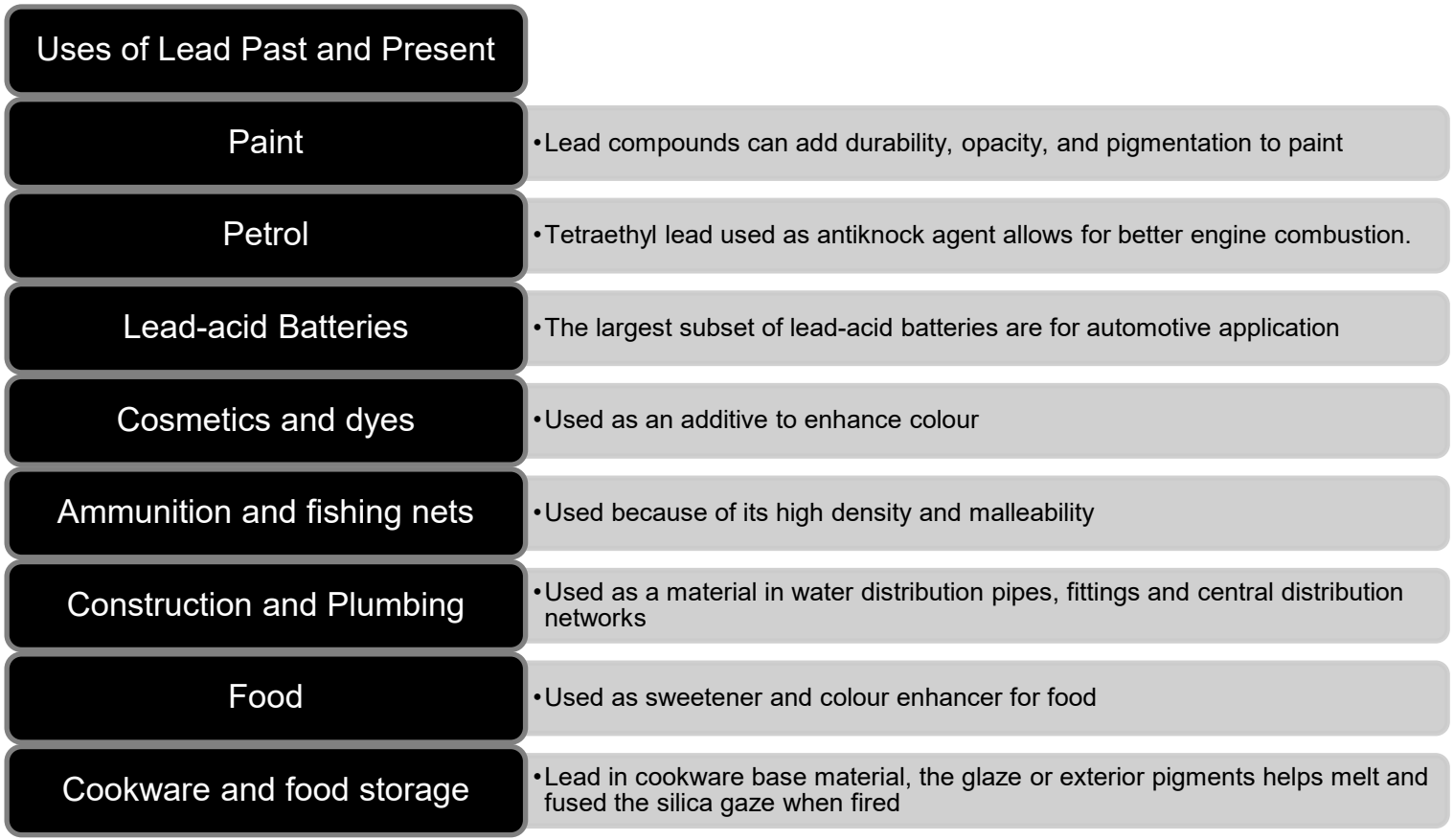
Source: Needham et al., p.1077

Note:
Bodily fluids may be sampled for biomarkers, e.g., blood (including placental), urine, breast milk, saliva/sputum, nails.

***Today discuss** lead (Pb2+) in context of industrial hygiene hierarchy of controls.*

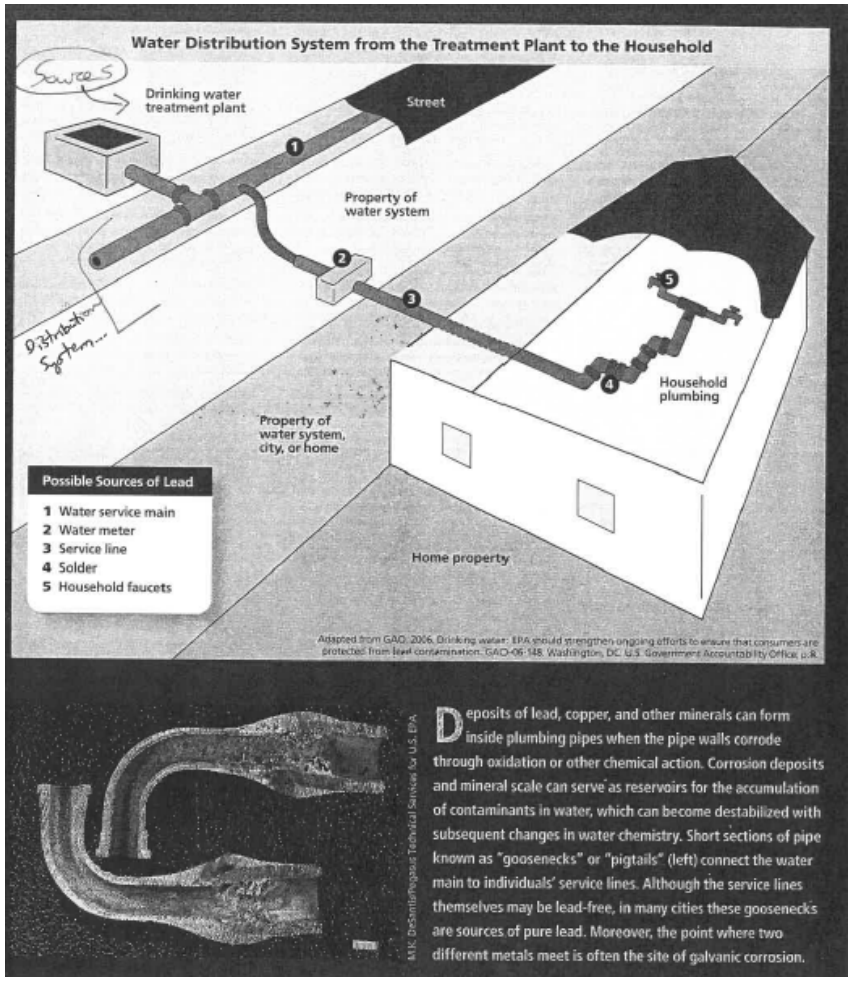
Ongoing Omnipresent Sources of Lead (Pb2+), and Other Pollutants

Note how these could still be at/in a house or at/in a school! ***Today we discuss why?***



Source: Presentation by Monika MacDevette, WHO-UNICEF et al. 10/28/2020.
(Infographic: Uses of Lead Past and Present)

Ongoing Omnipresent Sources of Lead (Pb2+) in Water

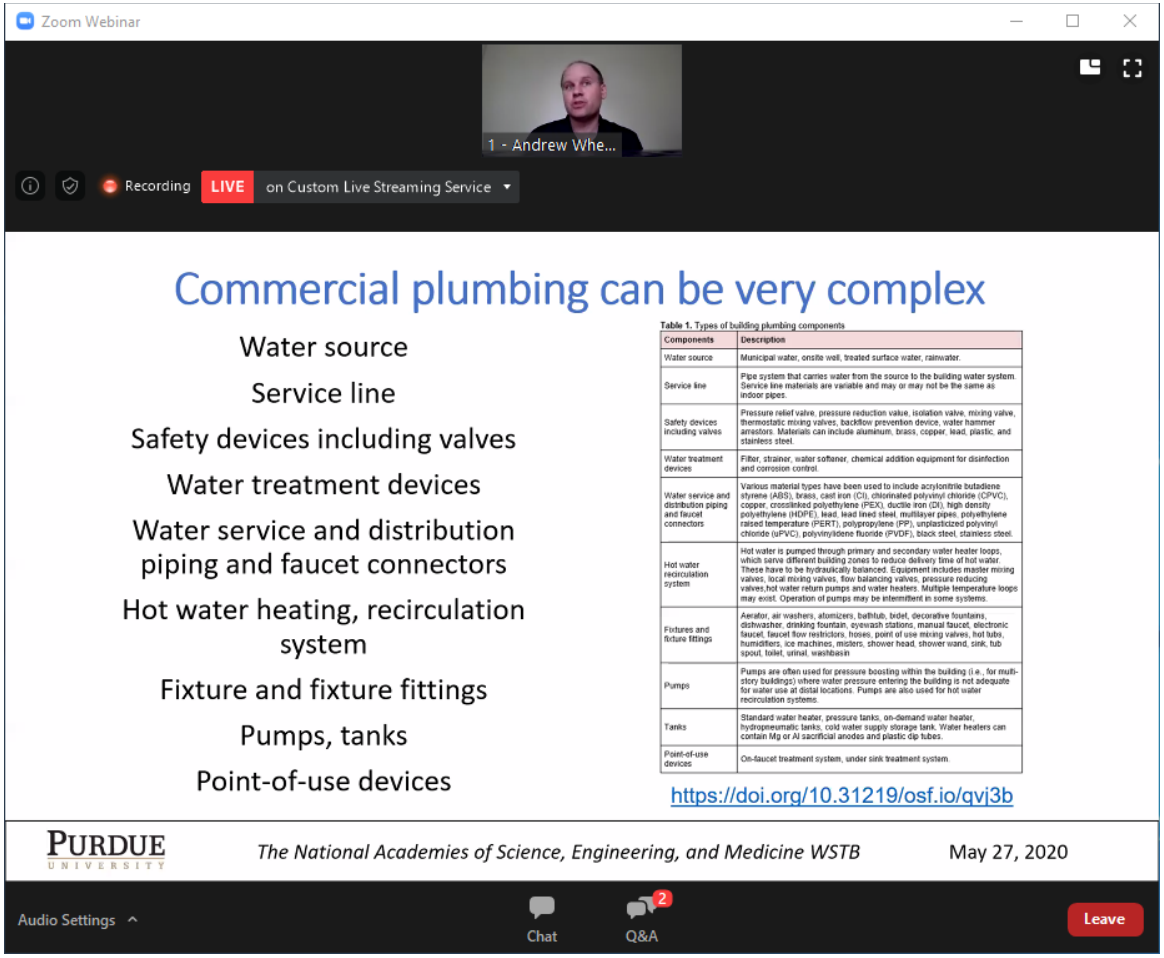


Note how this could be a house or a school building… serving bathrooms and sinks, classrooms, cafeteria, teacher and staff break room, etc.

Source: Environmental Health Perspectives, 2009, volume 117, issue 12, p.A545 (in article "Out of Plumb").

Extra Points of Information, Part 1 of 2: Complexities in Older School Buildings

[Source: from NASEM webinar 5/27/2020 by Prof. Andrew Whelan, PhD (engineering)]



Highlights from U.S. EPA CHPAC report on charge questions related to K-12 Schools and Child Care

- Source (completed and submitted 7/12/2021, response by EPA via OCHP Director late 2021):

https://www.epa.gov/children/chpac-comment-letters
https://www.epa.gov/system/files/documents/2021-11/07-12-21-chpac-schools-charge-response-letter.pdf [pages 6-9 on lead (Pb2+)]

- Some of the highlighted recommendations appear on the following slides. *Note: ASHA assumes EPA will present about testing for lead in water in K-12 schools in another presentation in today's LEPAC meeting.* Re: Revised Lead and Copper Rule, Maximum Contaminant Level (MCL, and MCLG).

Highlights: page 7-8

(from pages7-8):

"Specifically, schools and child care providers should be informed that detectible lead concentrations below the action level does not equate to the water being "safe" and lead-free, and that there are actions they can take to further reduce levels in drinking water to as close to zero as possible.

This communication should include advice on how to achieve further lead reduction…."

Highlights: pages 7-8 part 2

(from pages 7-8):

"…Strengthen public education and risk communication requirements to ensure consistent interpretation, implementation, and enforcement. … to ensure the communication is understood, including appropriate reading level and languages other than English, as needed. … The CHPAC 2020 comment letter "Recommendations for improving EPA risk communication for children's health risks"

Highlights: page 9

(page 9):

Currently, EPA's Lead Renovation, Repair, and Painting Rule (RRP) applies only to the portions of pre-1978 buildings where children aged six years and under regularly visit at least two days a week for at least three hours.

"EPA expand RRP to apply to areas of a school in which elementary school-aged children spend time."

Highlights: Page 9 part 2

(page 9):

In 2012, CDC, in *an acknowledgement of no safe blood lead level (BLL)*, changed the term “level of concern” to “reference level” set at 97.5th percentile of BLL distribution in children (then 5 µg/dL). In 2018, EPA lowered lead dust hazard standards for inspections, risk assessments, and abatement activities in certain school and child care facilities, But, 10 µg/ft^2 for floors and 100 µg/ft^2 for window sills) are based on protection BLL 10 µg/dL.

Highlights: page 9 part 3

(page 9):

Therefore, the CHPAC…

"[R]ecommends … standard[s] be updated to account for the CDC's most recent blood lead [BLL] reference value and to consider the higher cumulative and aggregate exposures that children may face when attending school or child care in communities with CERCLA or RCRA cleanup sites."

Thank you for your efforts to protect our children, and communities including schools and child care centers, from **lead (Pb2+)!**

Now, transition back to Jeanie Alter, PhD, Executive Director of American School Health Association (ASHA), or any questions?

Contacting NJ Safe Schools Program at Rutgers SPH, and Resources

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Questions, Inquiries

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www.njsafeschools.org

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Appendix: Extra Point of Information, Part 2 of 2: Complexities of Environmental Toxicology

[Source: Rutgers EOHSI CROM webinar 2/25/2022 by Brian C. Buckley, PhD (lab analytical chemistry)]

Factors Regulating Toxicity of Metals

- Physical State
  - Solid, liquid, vapor
- Atomic Properties
  - Ionic state, oxidation state, ionic radius
- Chemical Properties
  - Binding form, solubility, complex properties, radical formation
- Biological Phenomena
  - PB/PK, bioavailability, biological residence, compartmentalization
  - Organ specificity