

# Biomonitoring for Chemical Exposure Evaluation

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# Overview

- My background
- I was asked to discuss:
  - The value of biomonitoring for understanding human exposure to chemicals
  - The ways that biomonitoring is used to track human exposure to chemicals in the environment
  - A brief overview of toxicokinetics and how it informs approaches to biomonitoring
  - Limitations of biomonitoring in measuring exposure to chemicals.

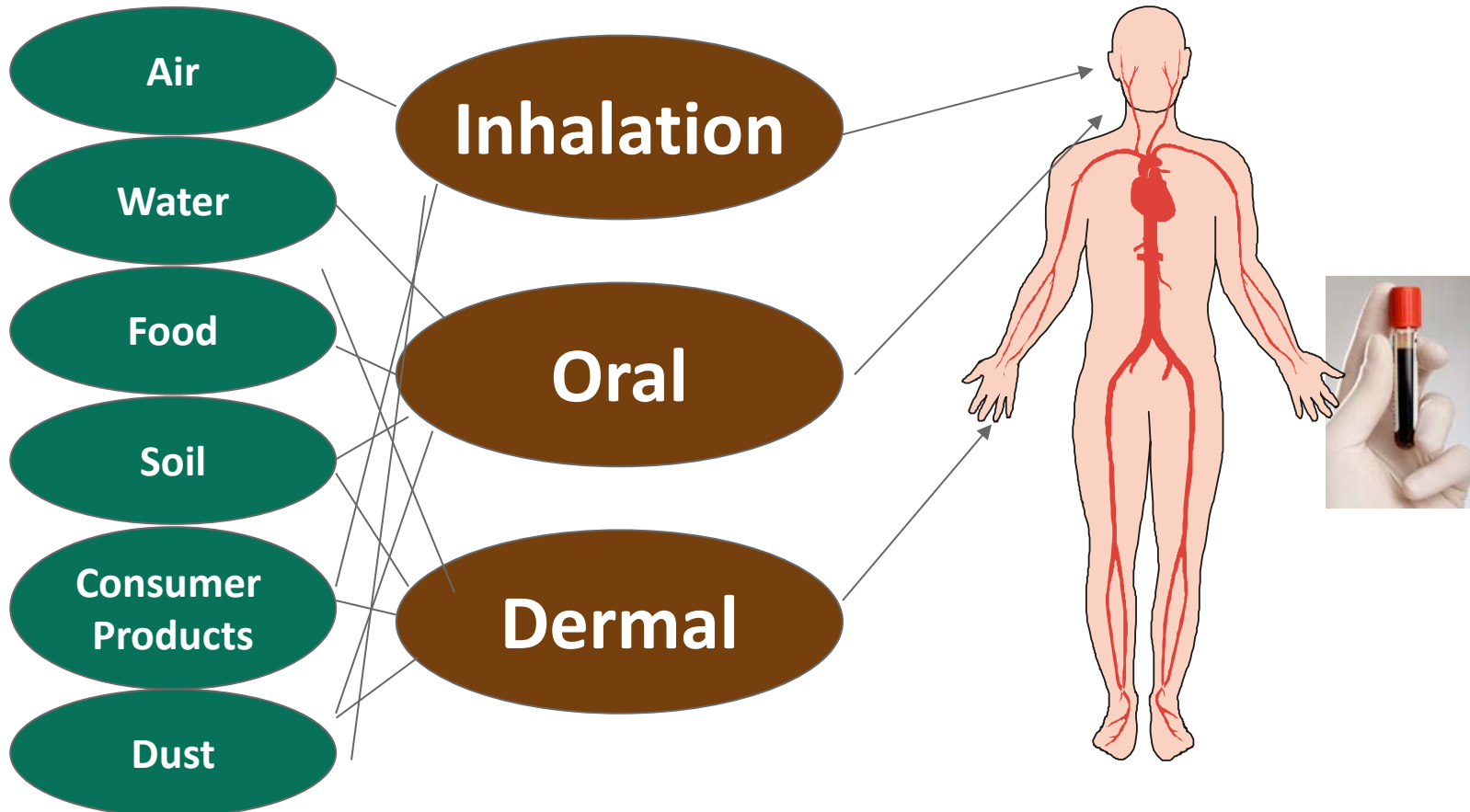
# Biomonitoring and Biomarkers



- Biomonitoring: Measurement of a chemical or its metabolite(s) – “biomarkers” – in a biological tissue or fluid
- Many possible tissues, but blood and urine used most often



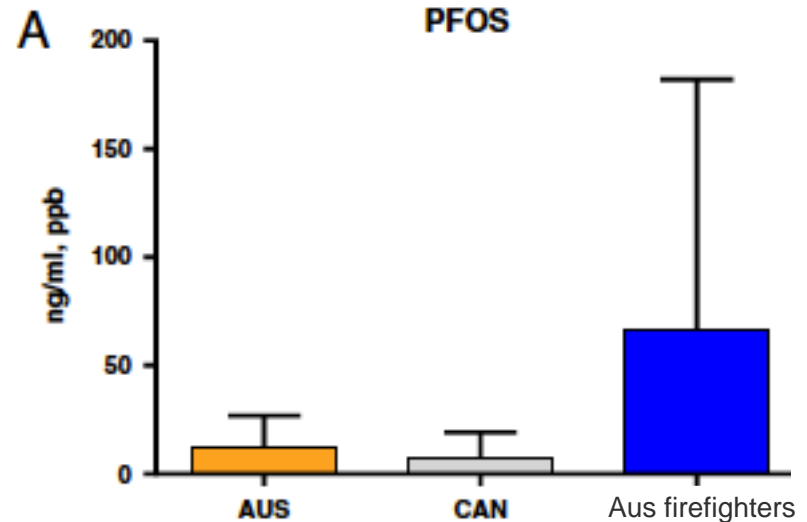
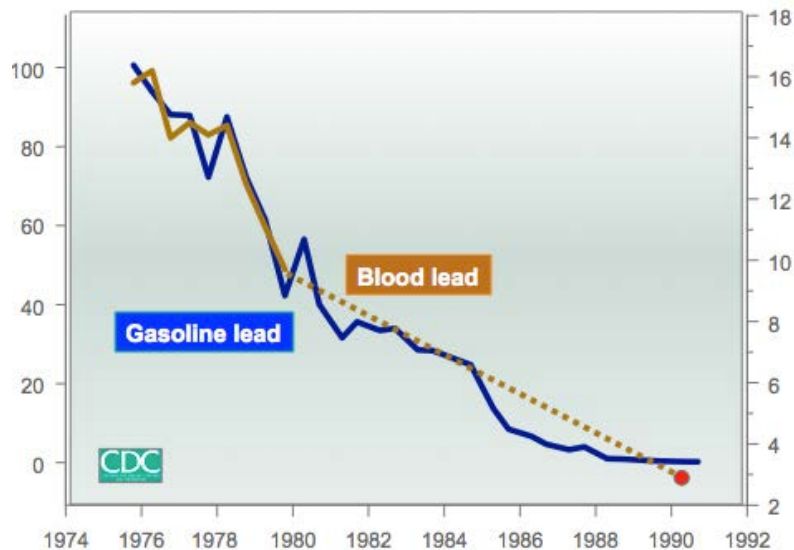
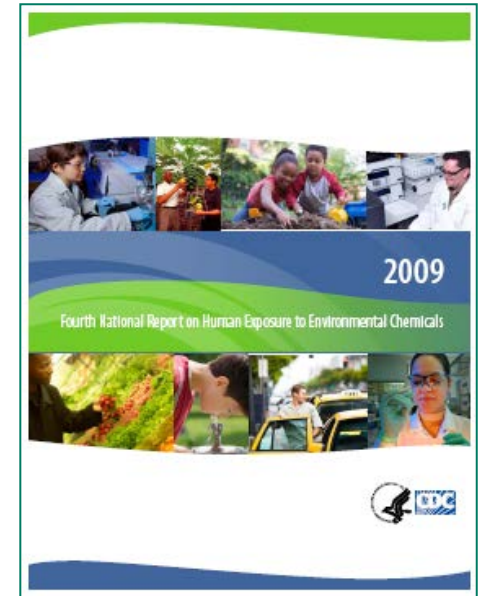
# Chemical Exposure Pathways, Routes



- Biomonitoring reflects exposures from all environmental media and routes of contact
- But cannot determine source of exposure

# Uses of Biomonitoring

- Understand general population exposures
- Track temporal trends
- Evaluate exposures in specific populations
- Study possible relationships between exposure and health effects



# Biomonitoring Together with Environmental Measures

What chemicals are present?



Who may have been exposed?



Can we measure in the environment and people?



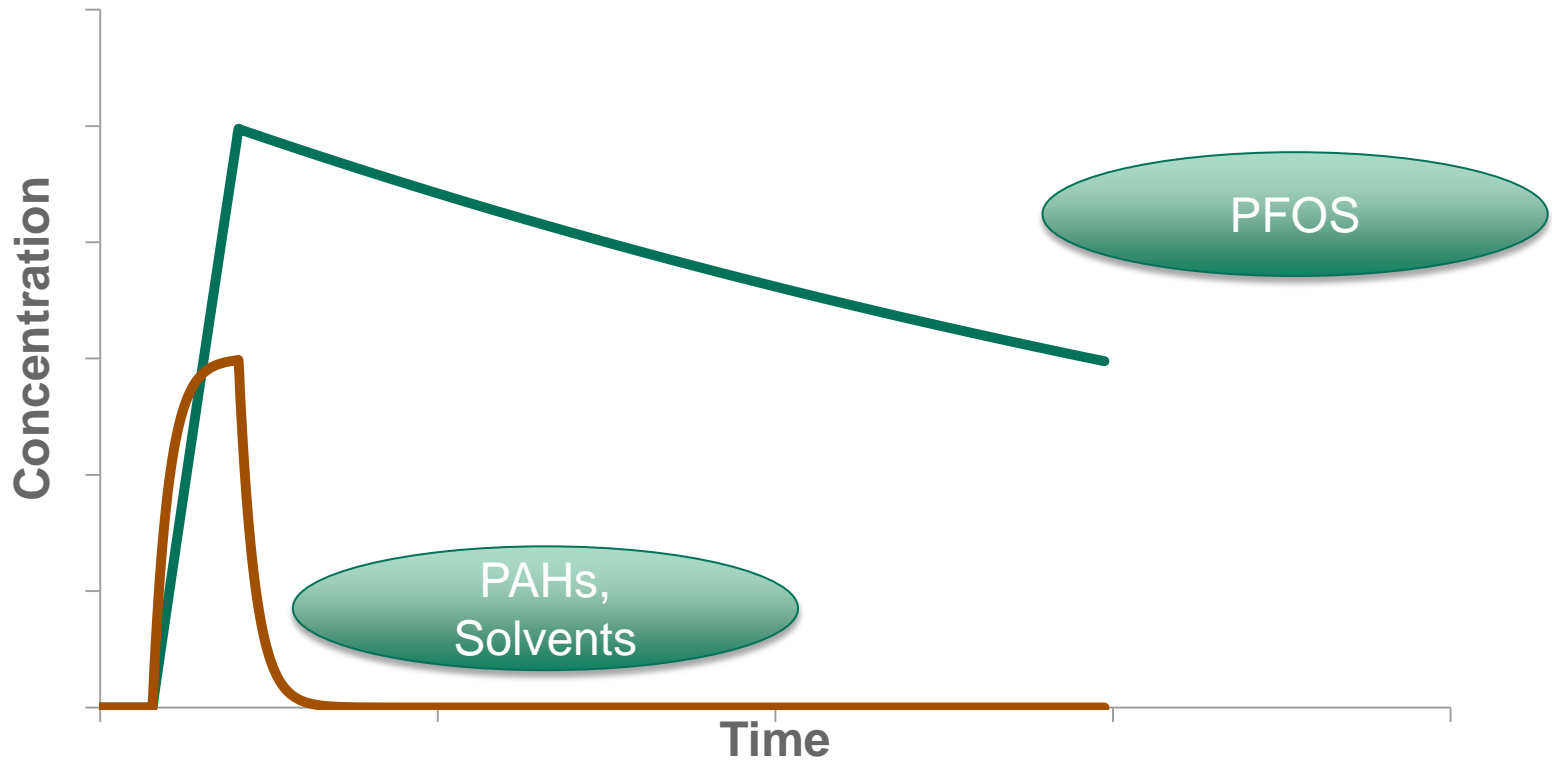
Are biomarkers available and elevated?



If so, how are people exposed?

How can we reduce exposures?

# Biomonitoring – Persistent vs. Rapidly-Eliminated Chemicals “Toxicokinetics”



- Elevated levels persist for years following exposures to persistent chemicals
- But rapidly-eliminated chemicals cannot be detected once exposure ceases

# Chemical Properties Influence Biomonitoring Choices



Water soluble

Fat soluble

- Environmental phenols
- Phthalates
- PAHs
- Current-use pesticides

- Protein-binding
- Slowly
- PFCs
- POPs

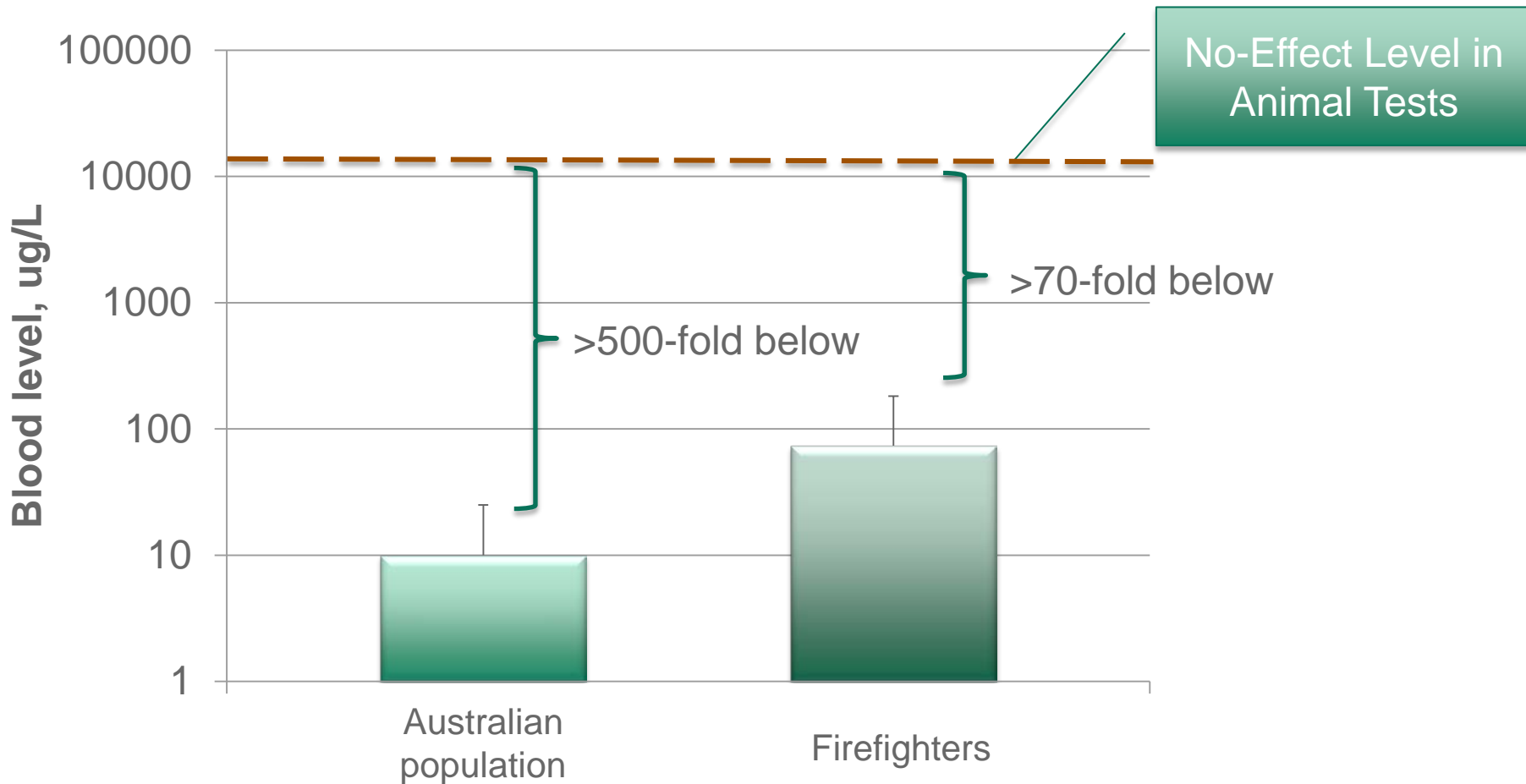
- Solvents
- Metals

*Measure parent compound or metabolite*

*measure parent compound or persistent metabolite*



# PFOS Biomonitoring Data - Risk Assessment Context



Rotander et al. 2015, *Environ. Int.* 82:28; Ludwicki et al. 2015, *Environ Int.* 74:112

# Strengths and Limitations of Biomonitoring

## Strengths

- Provides information about aggregate exposure from all sources
- Provides biologically relevant measure of exposure
- Provides information about exposure for a population and on an individual basis

## Limitations

- Does not identify the specific exposure source
- Information about past exposures limited to persistent compounds
- Does not allow prediction of health effects for individuals

Thank you very much!