

OUTDOOR AIR POLLUTION

And

CHILDREN

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OBJECTIVES

- The epidemic of injury to children from environmental toxicants is already here
- Infants and children are especially vulnerable to environmental toxicants

THE EPIDEMIC

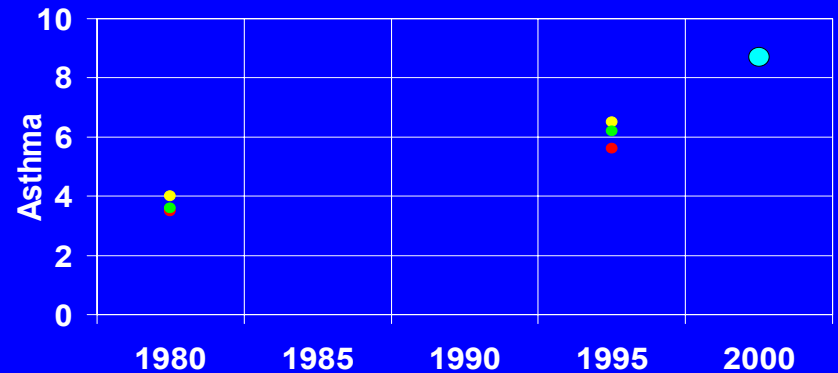
- The prevalence of childhood asthma has risen over the past two decades:

- from 3.5% to 5.6%

- from 4.0% to 6.9%

- from 3.6% to 6.2%

- latest EPA figures: 8.7% in 2001



- Asthma deaths doubled from 1979 to 1993

THE EPIDEMIC

- The prevalence of autism appears to have doubled between 1966 and 1997
- There has been a doubling of the incidence of atrial septal defects (a type of congenital heart defect) and a 50% increase in congenital obstructive uropathy (kidneys and bladder)
- The incidence of cancer in children increased from 130 cases per million 1975 to 150 per million in 1995

THE EPIDEMIC

- The National Academy of Science has estimated that 3% of developmental disabilities in children are due to known toxins (cigarette smoke, drugs, chemicals, etc).
- 40 states have issued health advisories warning pregnant women to avoid or limit fish consumption because of mercury contamination

ENVIRONMENTAL TOXINS ARE UBIQUITOUS

- Air (inhalation)
- Water (drinking; bathing, swimming)
- Food
- Other ingestions (pica, accidental ingestions)
- Surface contact (cutaneous absorption)
- Medications (injection as well as oral)

RELEASE OF CARCINOGENS IN THE YEAR 2000 (in pounds)

SUBSTANCE	RELEASE TO AIR	RELEASE TO WATER
DICHLOROMETHANE	30,782,468	10,292
FORMALDEHYDE	11,607,326	408,134
BENZENE	6,895,255	22,660
TETRACHLOROETHYLENE	3,453,932	1,159

Report of US Public Interest Research Group, based on data
from EPA's Toxic Release Inventory

MECHANISM OF TOXICITY

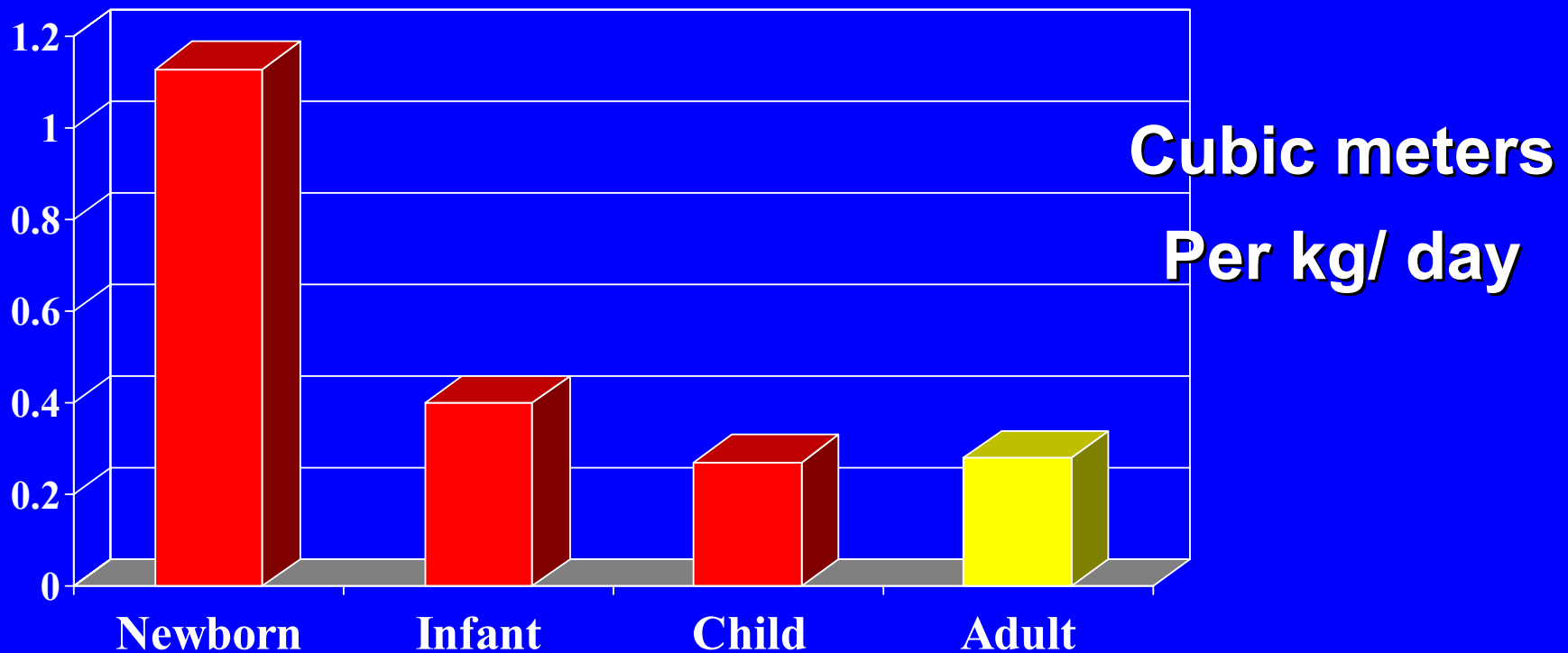
- Airway and lung irritant and injury – sulfur dioxide, acidic aerosols, ozone, nitrogen oxides, particulates
- Cardiac injury/dysfunction – particulates
- Neurotoxins and neurodevelopmental toxins – mercury, lead, toluene
- Mutagenes, teratogenes – toluene, benzene
- Endocrine disrupters – carbon disulfide, benzene
- Carcinogens – polycyclic aromatic hydrocarbons, dichloromethane, asbestos

CHILDREN ARE NOT JUST LITTLE PEOPLE

**They are more vulnerable to
environmental toxicants than
are adults**

CHILDREN ARE NOT JUST LITTLE PEOPLE

- infants and children have a greater minute ventilation per kg body weight



CHILDREN ARE NOT JUST LITTLE PEOPLE

- infants drink more water, juice, milk, and other liquids and eat more food per kg body weight
- a 12 lb infant drinks 1 to 1.5 quarts a day; for a 150 lb adult this would equal 7 to 10 quarts a day
- a 12 lb infant ingests about 600 to 900 calories/day; for a 150 lb adult this would equal 7,000 to 10,000 calories/day

CHILDREN ARE NOT JUST LITTLE PEOPLE

- Newborns and young infants have increased gastrointestinal absorption of calcium, lead and mercury
- infants have a greater total surface area of skin for absorption relative to their weight
- the skin of the newborn is more absorptive

CHILDREN ARE NOT JUST LITTLE PEOPLE

- children are close to the ground; they crawl on the ground: dust and chemicals settle on the ground, chemical fumes may be most intense close to the ground
- children ingest more than 20 times as much soil (dirt) per kg per day than do adults

CHILDREN ARE NOT JUST LITTLE PEOPLE

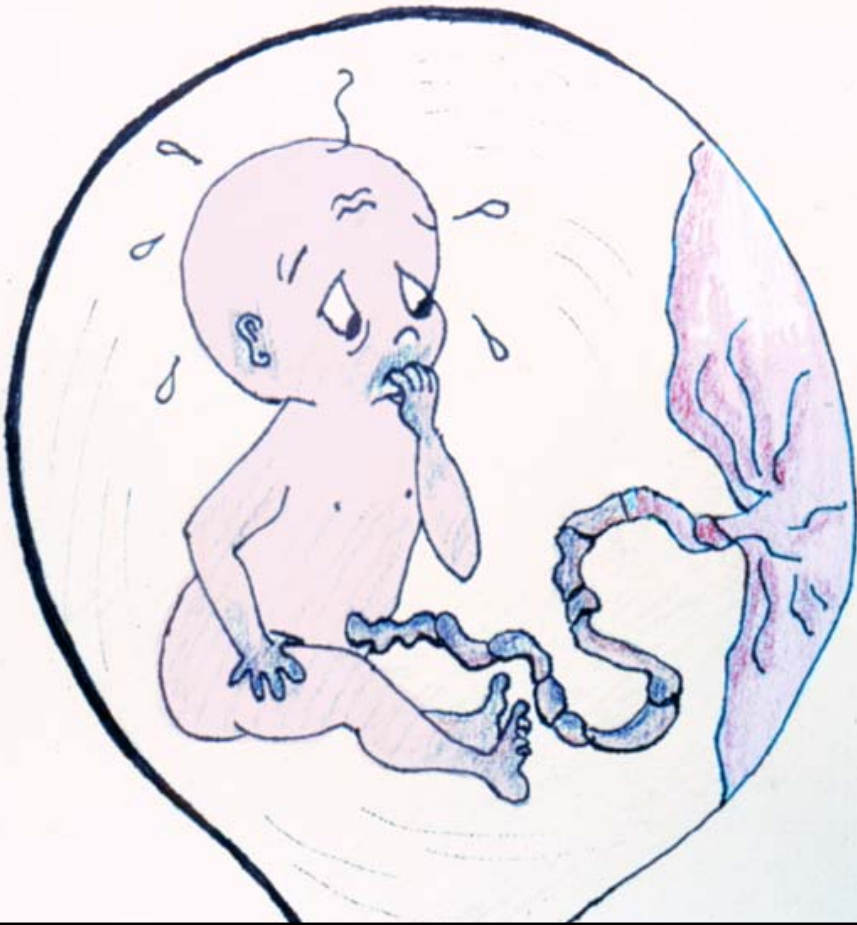
- and children put everything into their mouths



CHILDREN ARE NOT JUST LITTLE PEOPLE

- **children are not only growing, they are developing**
- **the developing brain is especially vulnerable to toxins such as lead and mercury**

Examples of substances concentrated in breast milk: dioxins and PCBs



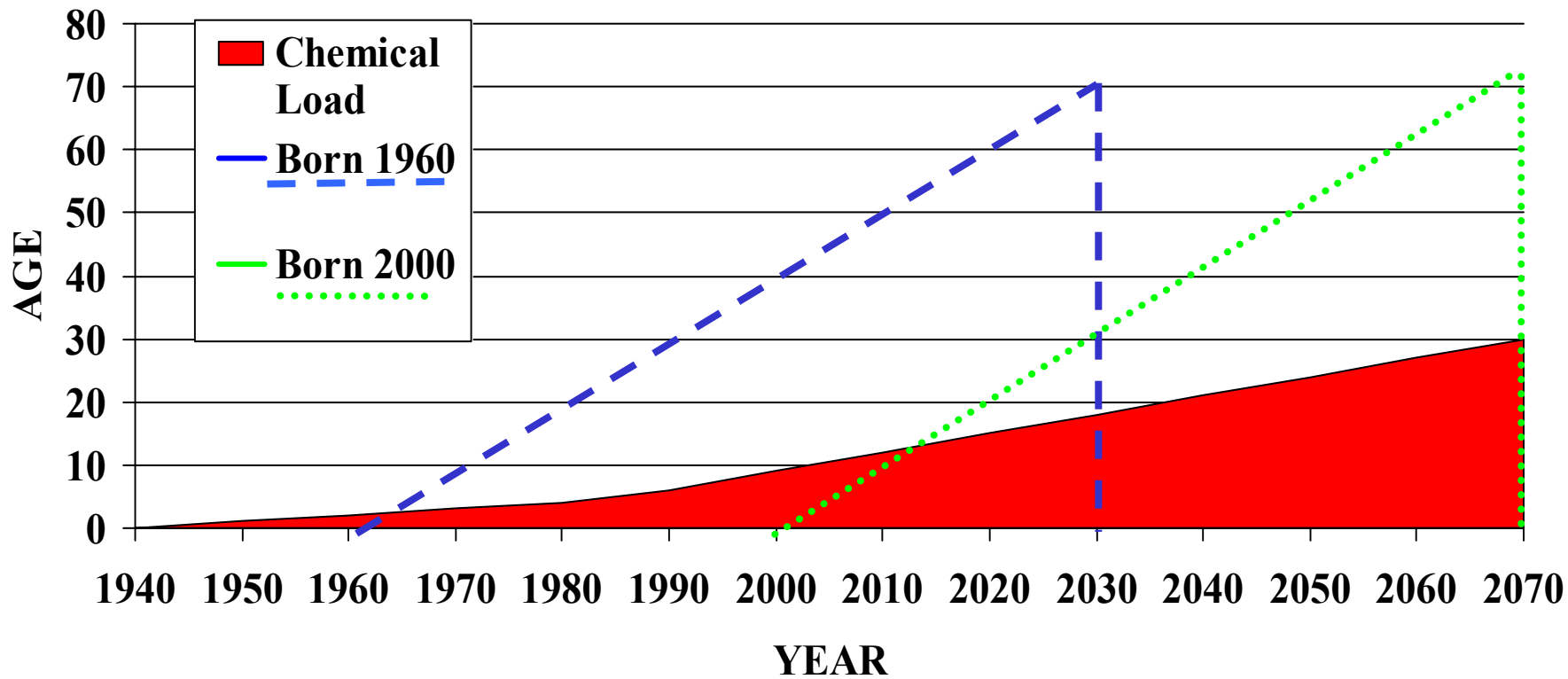
Examples where fetus more vulnerable than mother or other adults: alcohol, mercury, radiation



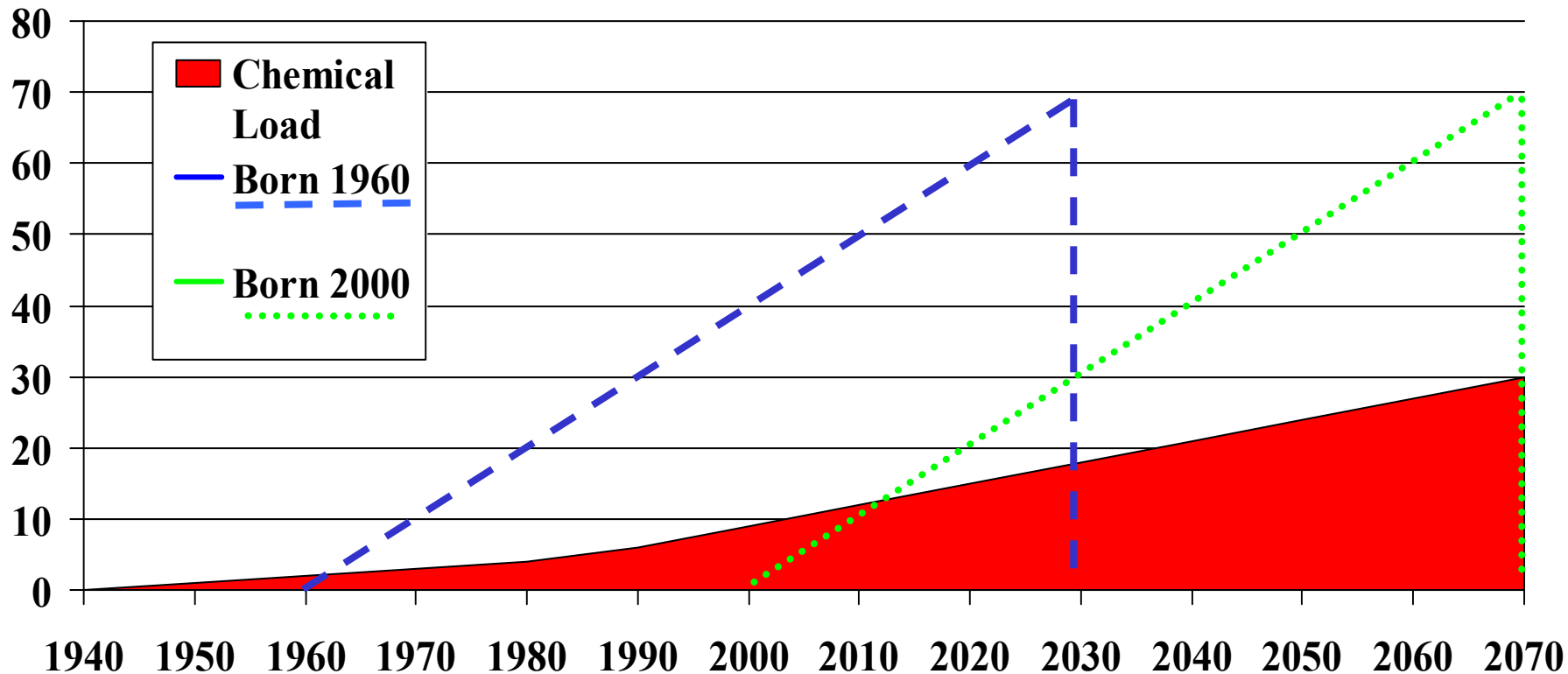
CHILDREN ARE NOT JUST LITTLE PEOPLE

- children have a longer “shelf-life” than adults
 - heavier life-time exposure
 - longer time in which to develop diseases with long latency

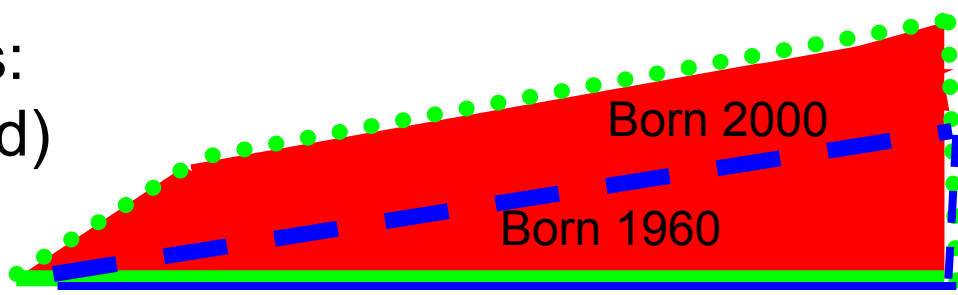
Lifetime Exposure Burden



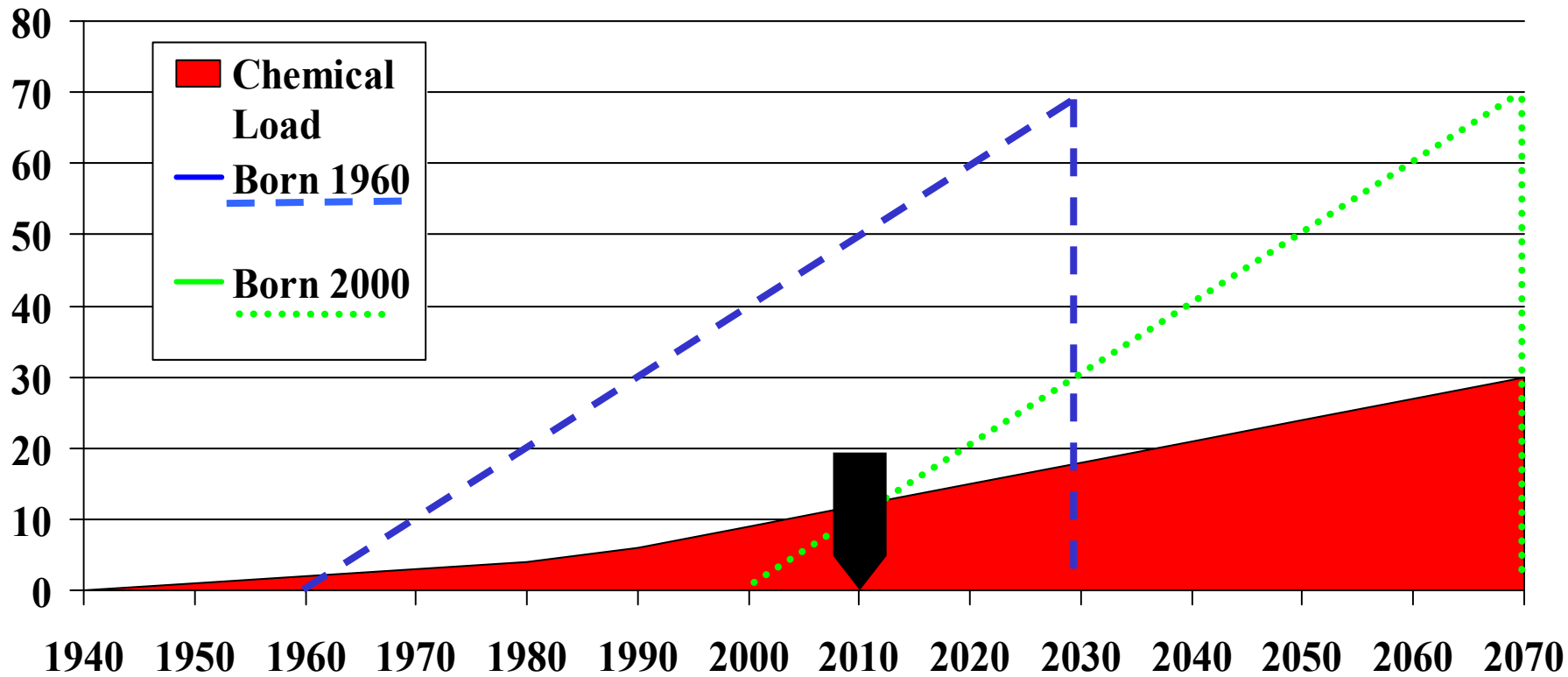
Lifetime Exposure Burden




Lifetime exposure loads:
area under blue (dashed)
superimposed on area
under green (dotted)

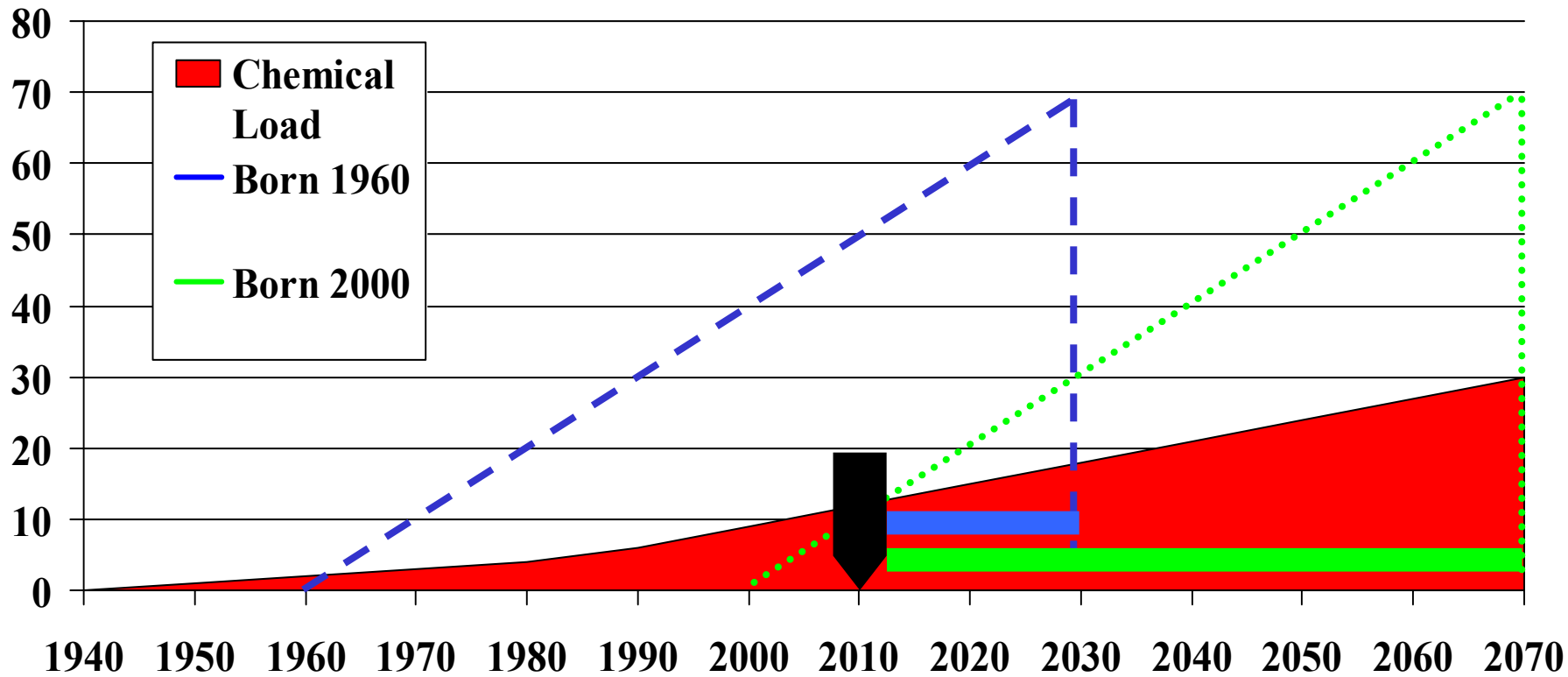


Latency Time After Exposure



 Exposure event

Latency Time After Exposure



 Exposure event

Latency for 50 yr old = 20 yrs

Latency for 10 yr old = 60 yrs

PROBLEMS WITH STUDIES

- fetuses and young animals most susceptible yet the majority of studies have been on adult animals
- studies rarely look at exposure during critical period in fetal development
- The toxic effects of the same substance may be different in children versus adults.
E.g. PCBs
 - Adults: chloracne, peripheral neuropathy
 - Children: decreased mental capacity, immune function, and thyroid function

Concept of “Acceptable Risk”

- based on prediction of number of cases of serious toxicity (e.g. cancer) per 100,000 exposed individuals
- “safe” levels are calculated as if the substance were the only toxicant and the source in question the only source
- toxicants are probably additive, possibly synergistic
- almost all testing done in adult animals

The End

**Thank you for your time
and attention,
and**

**I appreciate your efforts towards
a cleaner and healthier environment for all
our children**

References:

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- National Center for Health Statistics. Pediatrics. 2002;110:315-322
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- Samet JM et al. Fine particulate air pollution and mortality in 20 US cities. 1987-1994. *New Eng J Med*. Dec 14, 2000; vol 343, #24.
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