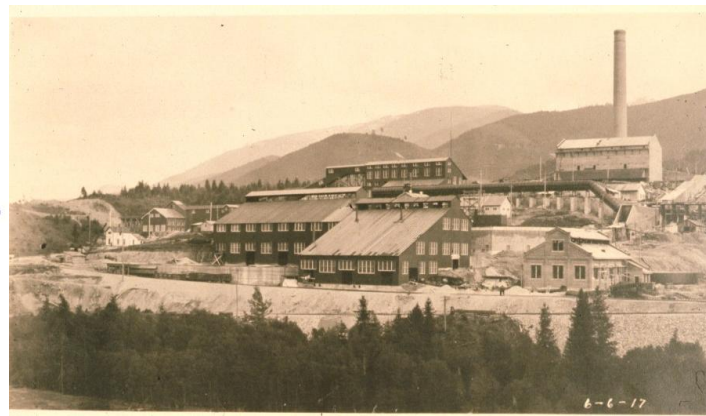


Exposure Assessment and Risk Management in Mining Communities: The Bunker Hill Site Example

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TerraGraphics Environmental Engineering, Inc.

April 22, 2013



Risk Assessment

- Risk = probability of harm from exposure to a hazard
- In U.S. – Risk assessment is the method chosen to help make decisions
 - decide what needs to be cleaned up, where, and to what level
- To protect public health and the environment
- **People do not have to be sick to take action**

Risk Assessment Answers These Main Questions:

- Do hazards exist at a site? (Hazard Identification)
- How toxic is it? (Toxicity Assessment)
- Who is exposed to it, how much, how often, and for how long? (Exposure Assessment)
- How great is the risk and what is causing the risk? (Risk Characterization)

Exposure Assessment

- Early community involvement is important
 - Community members can help answer questions about who is exposed, how they get exposed, and where they get exposed
- Develop Conceptual Site Model
 - evaluates sources of contamination, transport mechanisms, exposure pathways

Exposure Requires Understanding:

- **Culture**
- **Demographics**
- **Economics**



Risk Management

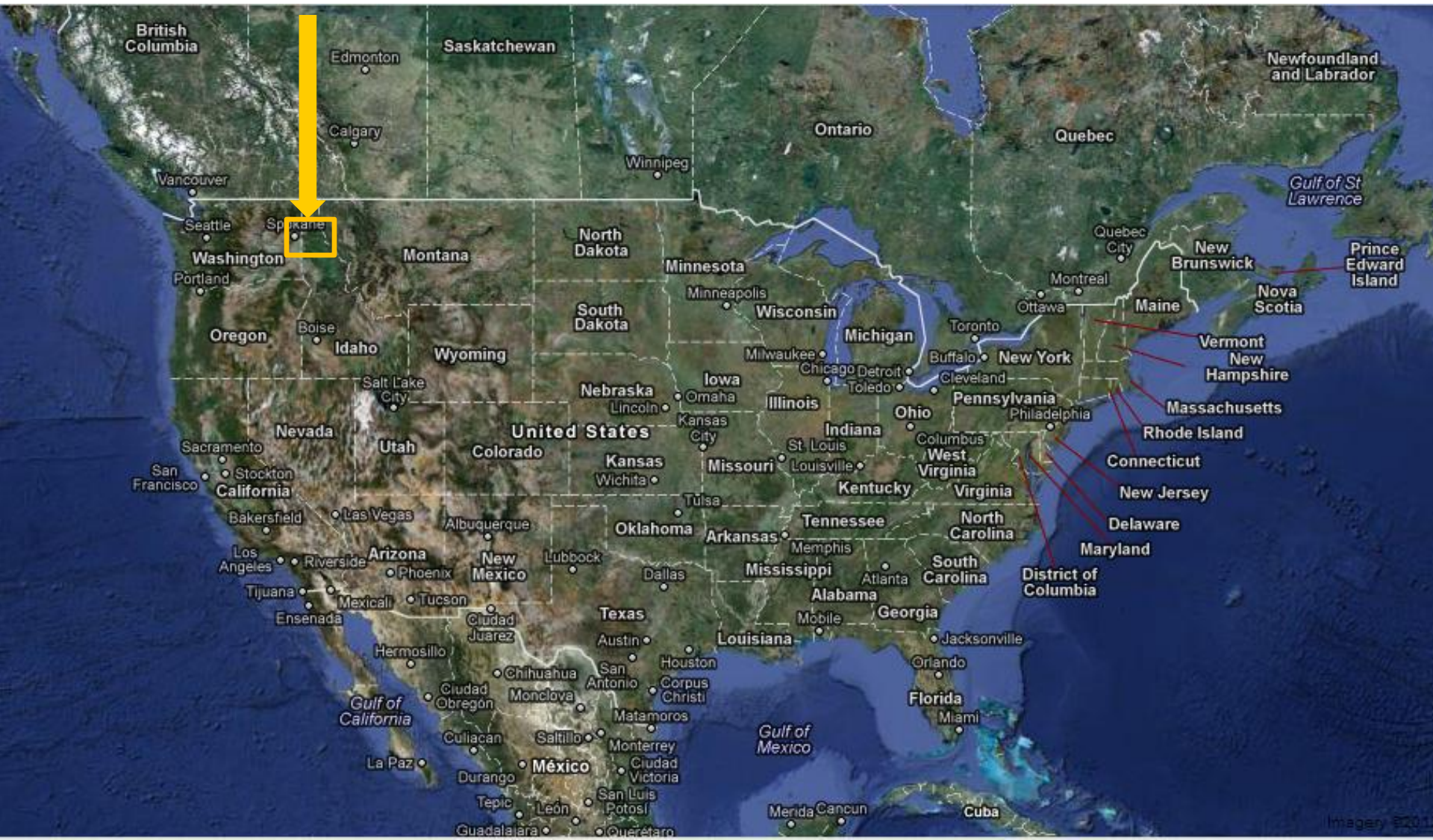
- Use of risk assessment information combined with social, economic, ethical, political and technical considerations to eliminate or reduce risk



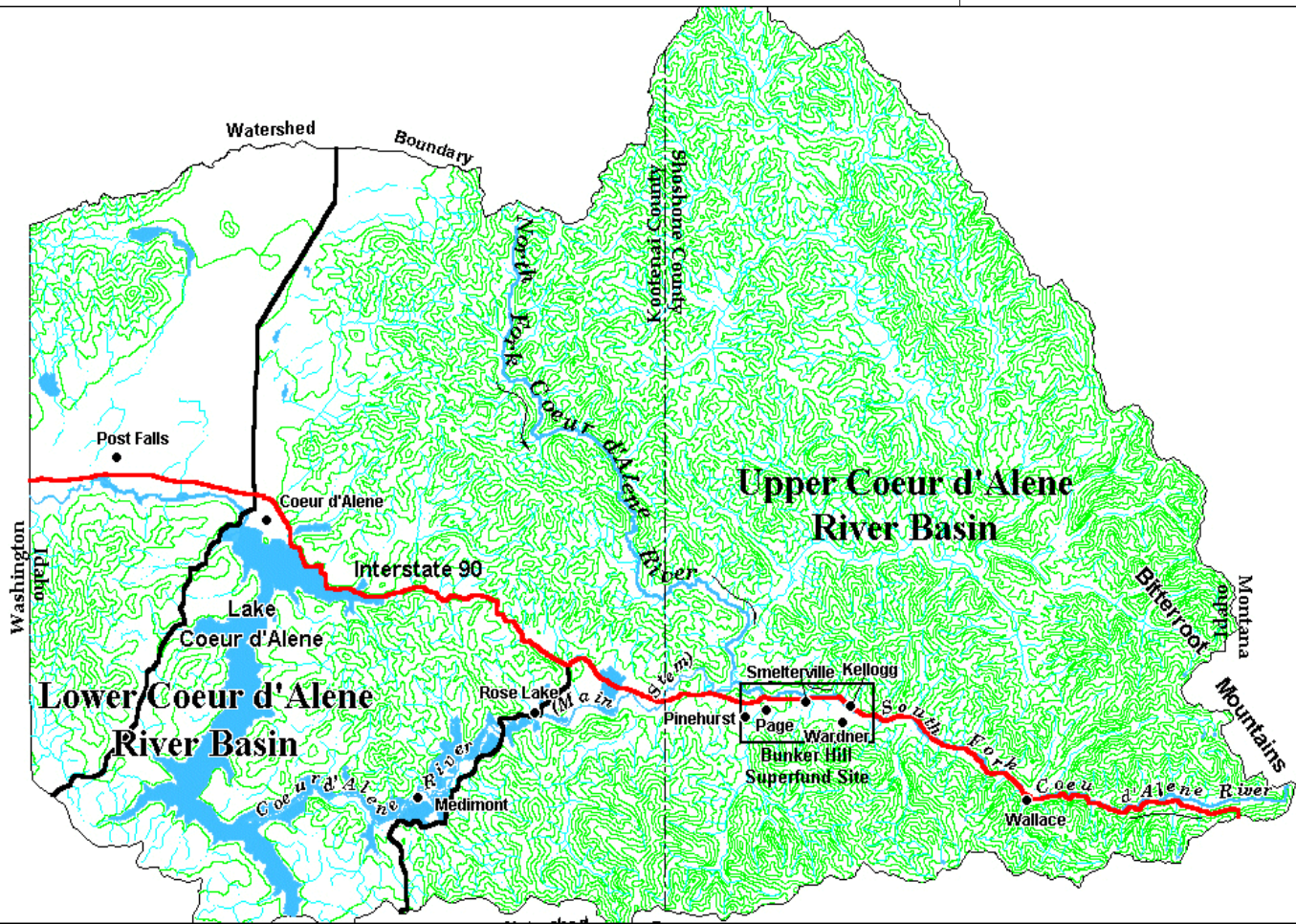
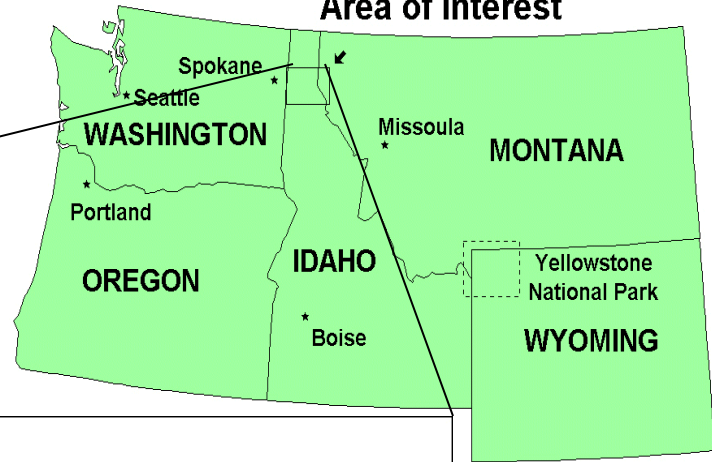
Application of Risk Management and Exposure Assessment at the Bunker Hill Site



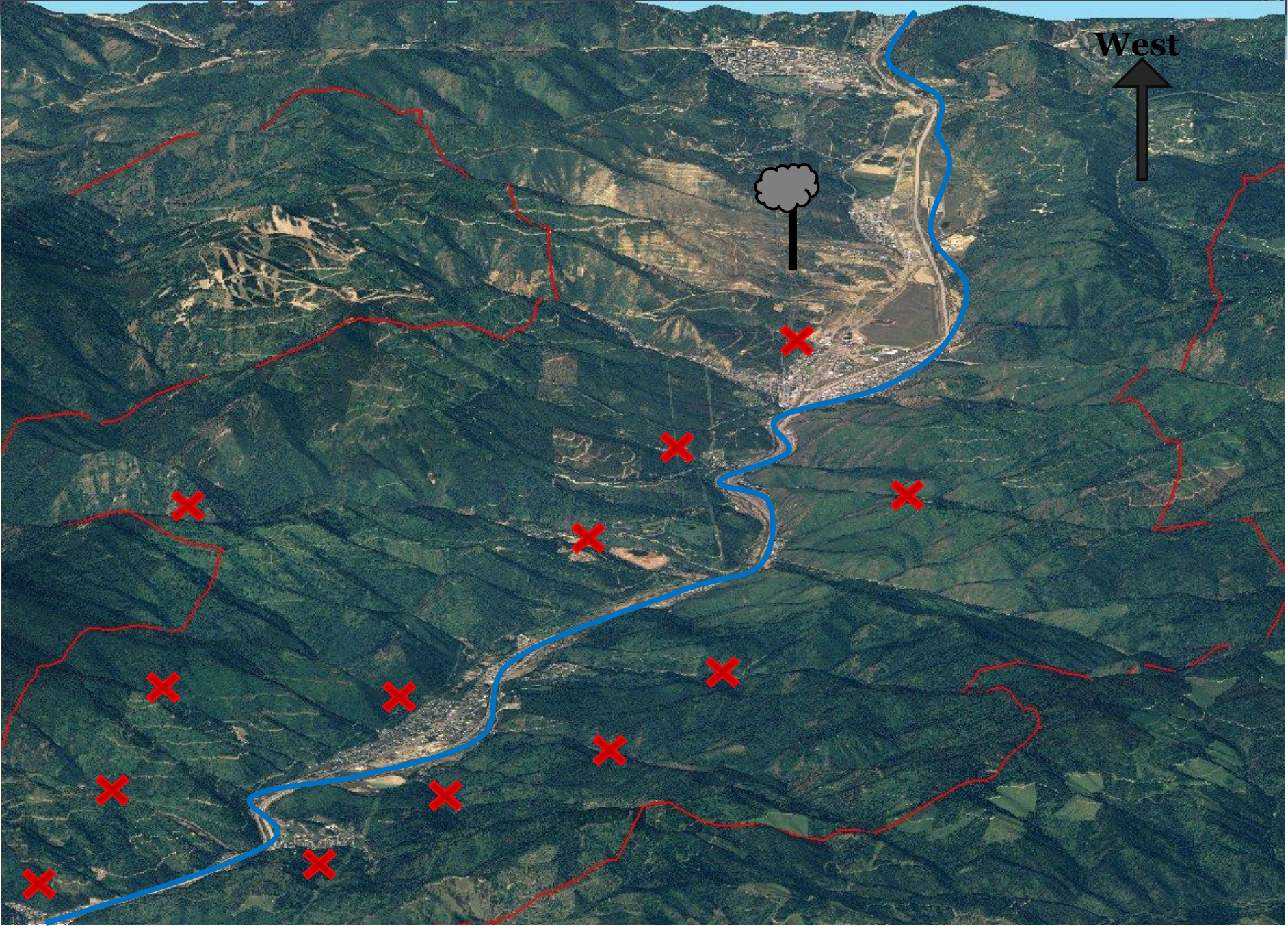
Located in North Idaho



Area of Interest



West



Bunker Hill Company Mining and Smelter Complex

- Produced $\frac{1}{3}$ the nation's lead, $\frac{1}{2}$ the silver, $\frac{1}{4}$ zinc
- Idaho's largest employer





Residential
Community

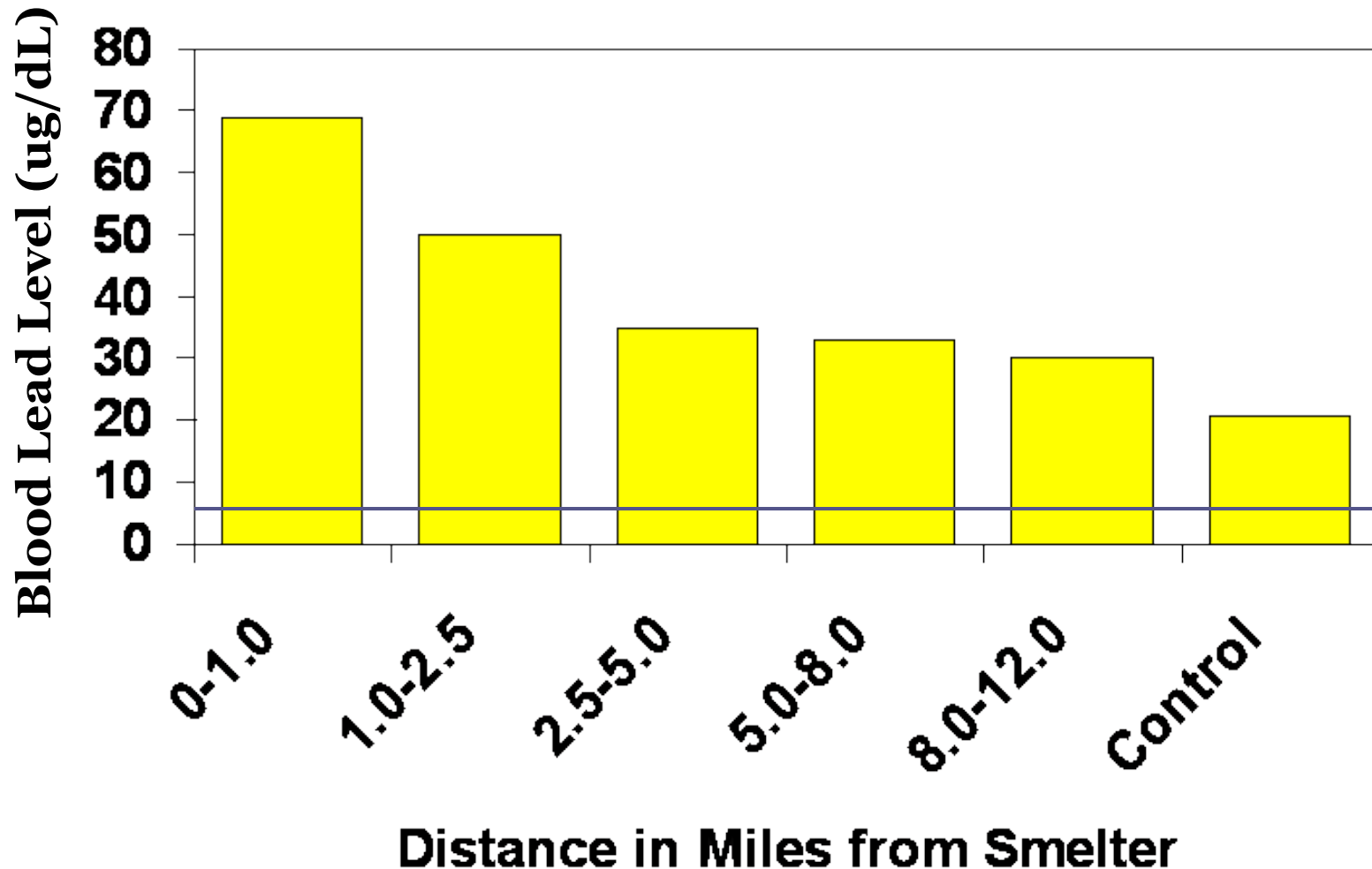
School

Tailings and
Waste
Impoundment

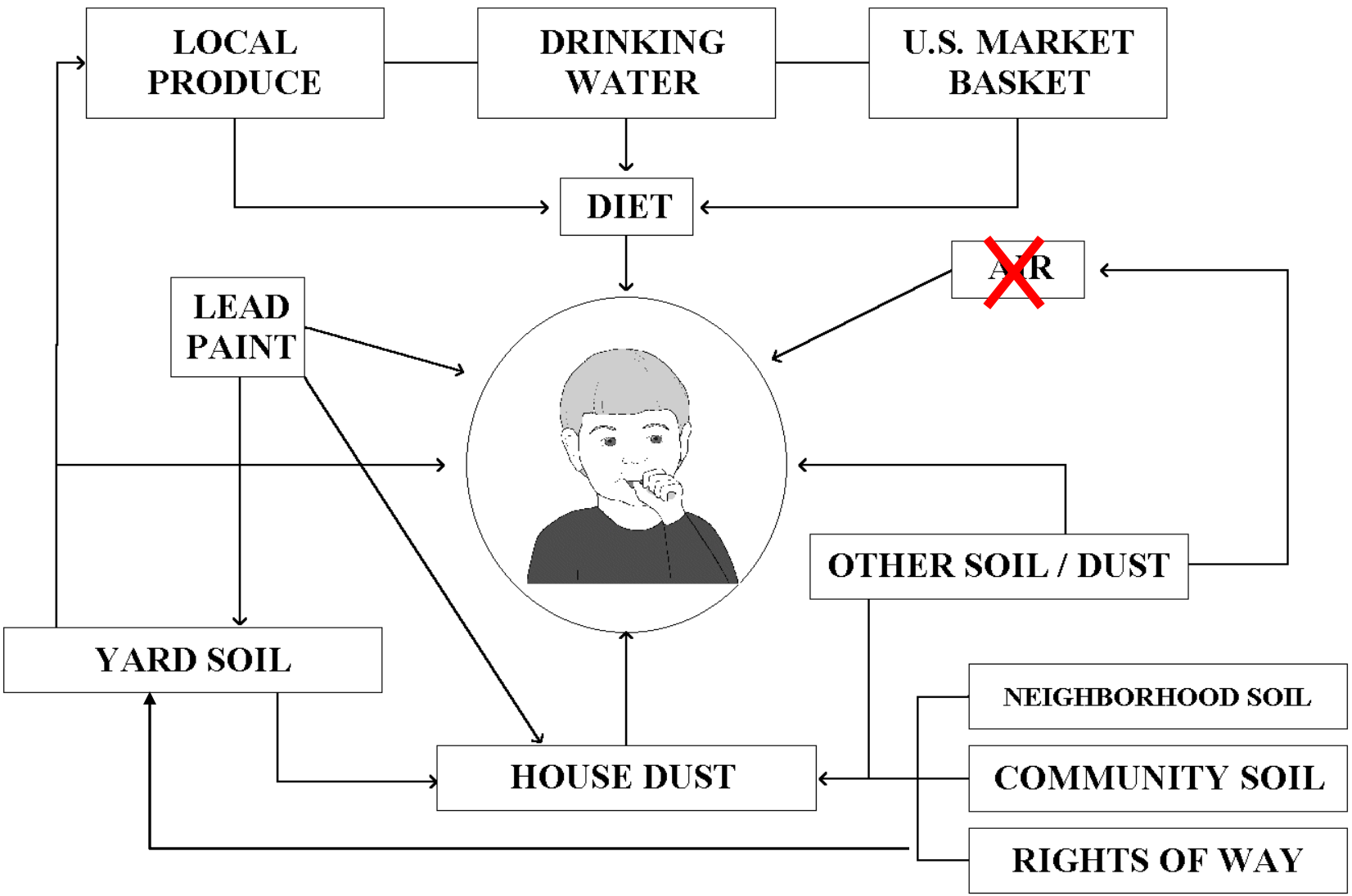
In 1973, one of the worst child lead poisoning events in U.S. history occurred at the Bunker Hill Smelter.



1974 Mean Blood Lead Levels



Home Exposures at the Bunker Hill Site



1974 Blood Lead and Environmental Data Analysis

BLOOD LEAD = f [AIR LEVELS
YARD SOIL LEVEL
HOME DUSTINESS
CHILD'S AGE
FATHER'S OCCUPATION]



-Yankel, von Lindern, & Walter. The Silver Valley Lead Study: the relation ship between childhood blood lead levels and environmental exposures. *J. Air Pollut Control Assoc*, 27(8). 1977.

Important Exposure Co-Factors:

- Poverty
- Poor Grass Cover
- Nutritional Deficiencies
- Poor Hygiene
- Smoking
- Low Socio-economic Status
- Parents' Occupation
- Use of Locally Grown Produce
- Child's Age
- Number of Hours Spent Outside by Children



Intervention and Risk Management

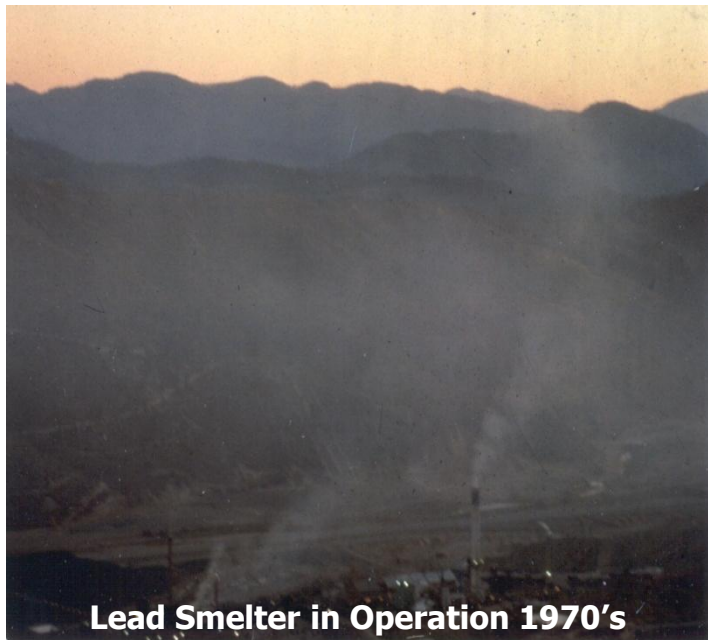
Objective:

- Minimize lead absorption while source control actions were underway by:
 - In-home intervention
 - Public awareness
 - Outreach and Education

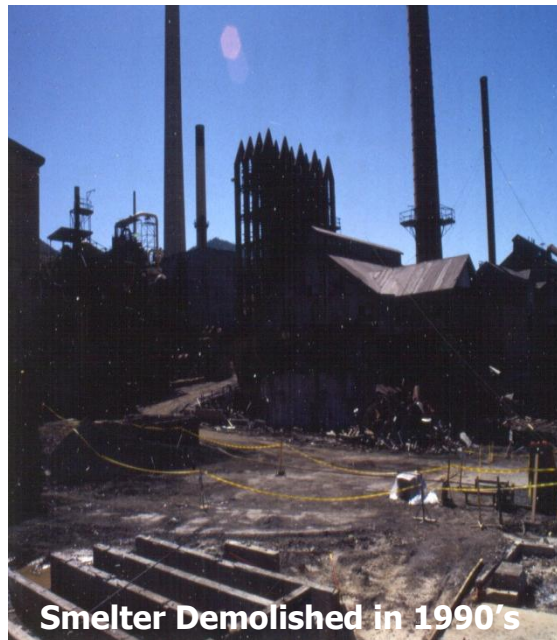
Biological Monitoring & Public Outreach

- 1984 – voluntary fixed-site screening and was met with low participation
- 1985 – door-to-door solicitation was employed to secure blood samples
- 1988 – payment for participation strategy was initiated for blood samples
- **CONTINUES TODAY**

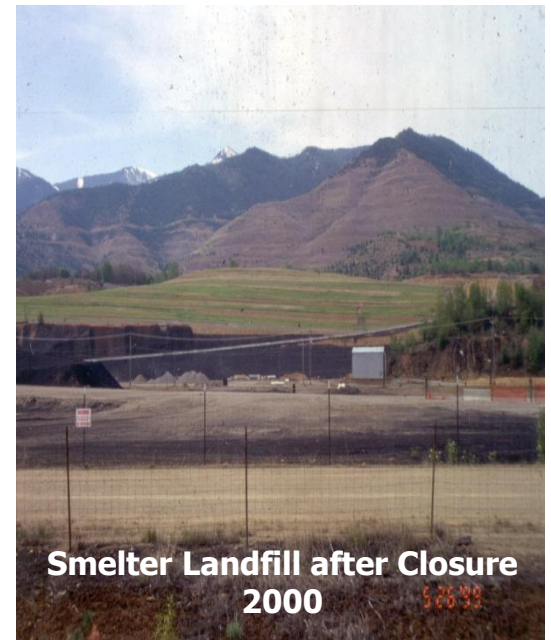
Industrial Complex Demolished and Disposed of in High Level Waste Repository



Lead Smelter in Operation 1970's



Smelter Demolished in 1990's



Smelter Landfill after Closure
2000

Fugitive Dust Sources Eliminated

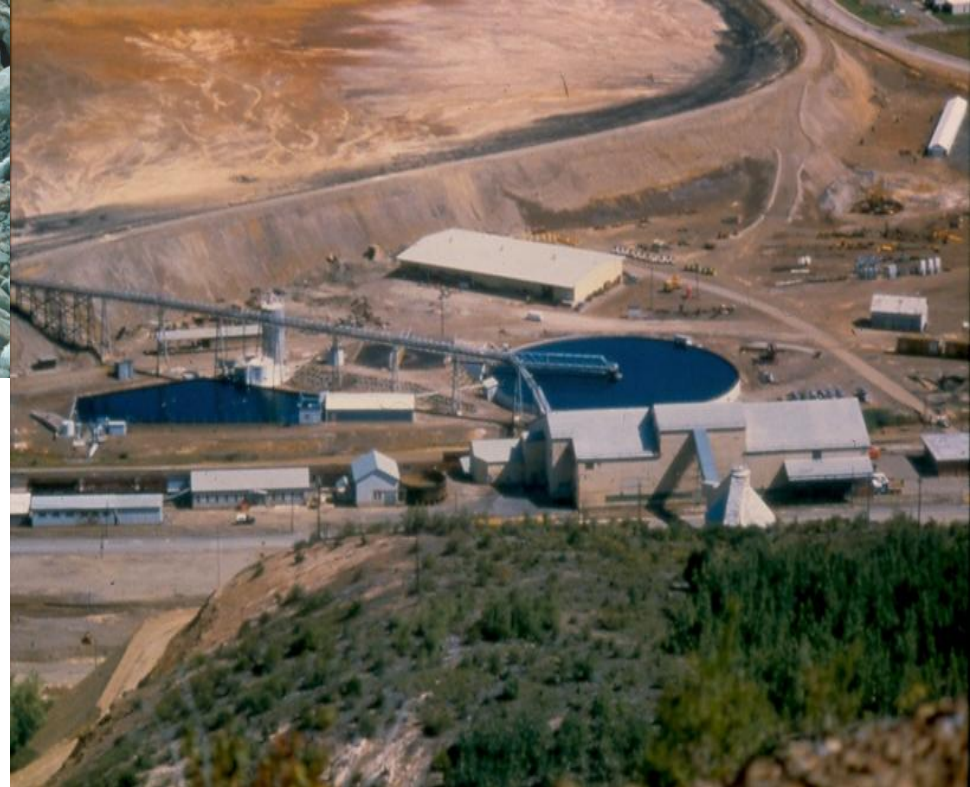


Common Area Cleanups

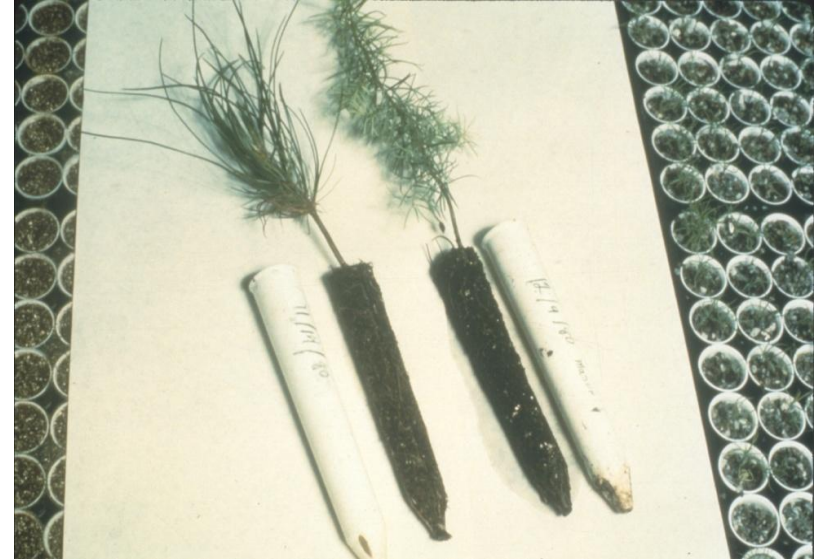
Parks, Playgrounds, Schools, Daycares



Water Pollution and Treatment



Hillsides Re-vegetation and Restoration



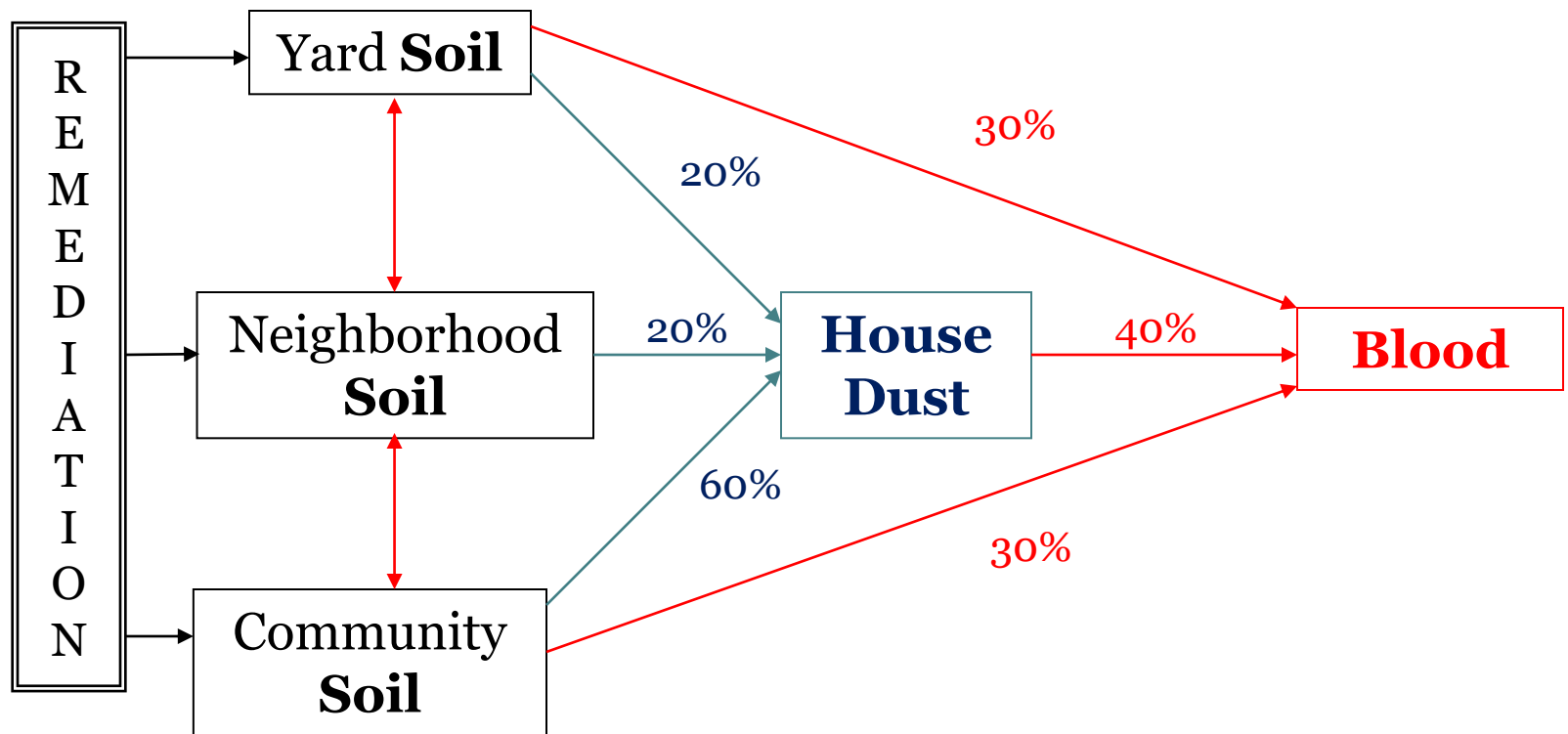
Residential Area Cleanups



Bunker Hill Site Remediation Action Objectives

- 95% of all children blood lead levels $\leq 10 \mu\text{g}/\text{dl}$
- No child with blood lead level $\geq 15 \mu\text{g}/\text{dl}$

Soil and Dust Lead to Blood Pathways



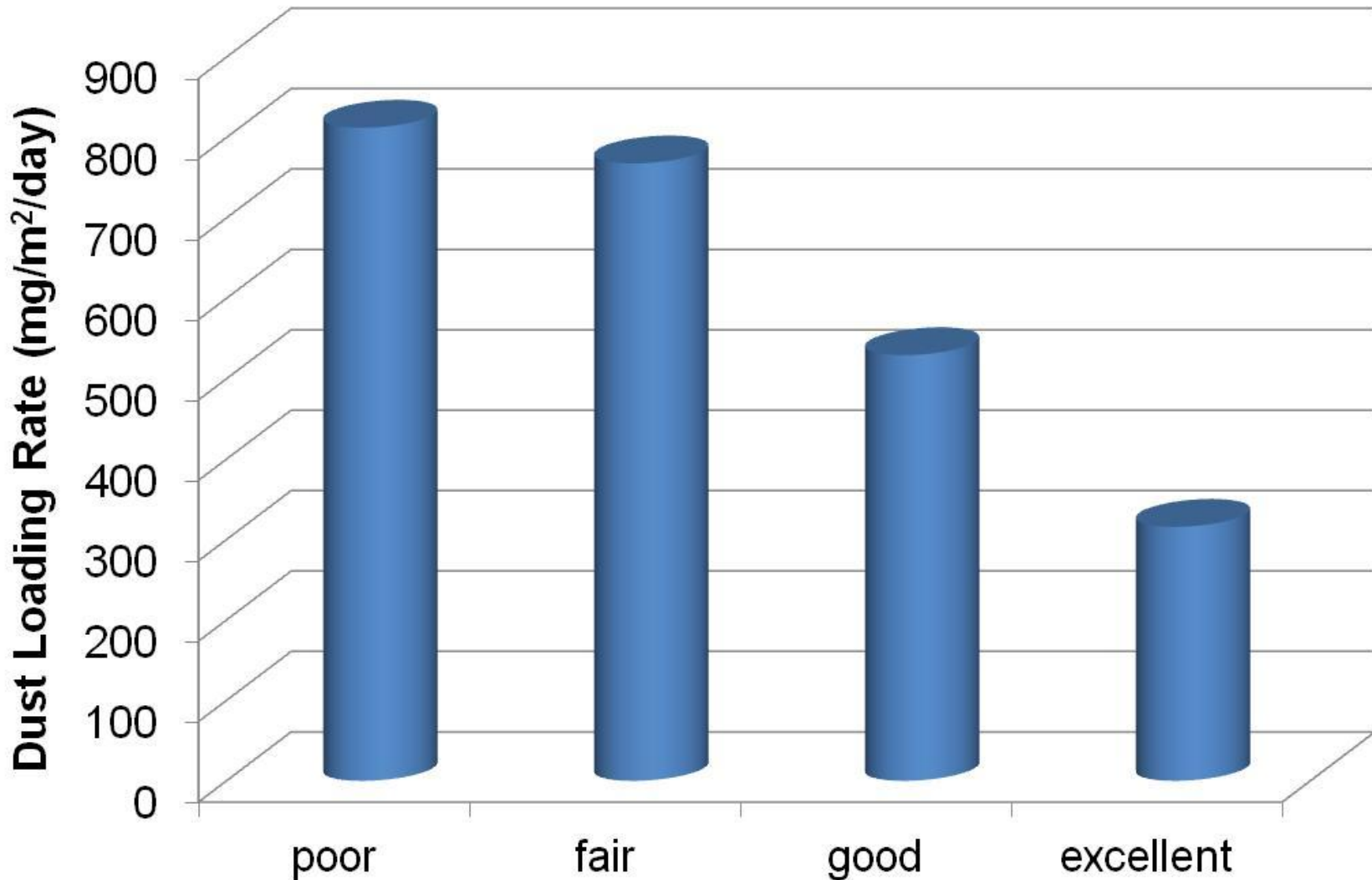


Factors Correlated to House Dust Lead Loading Rates (1998)

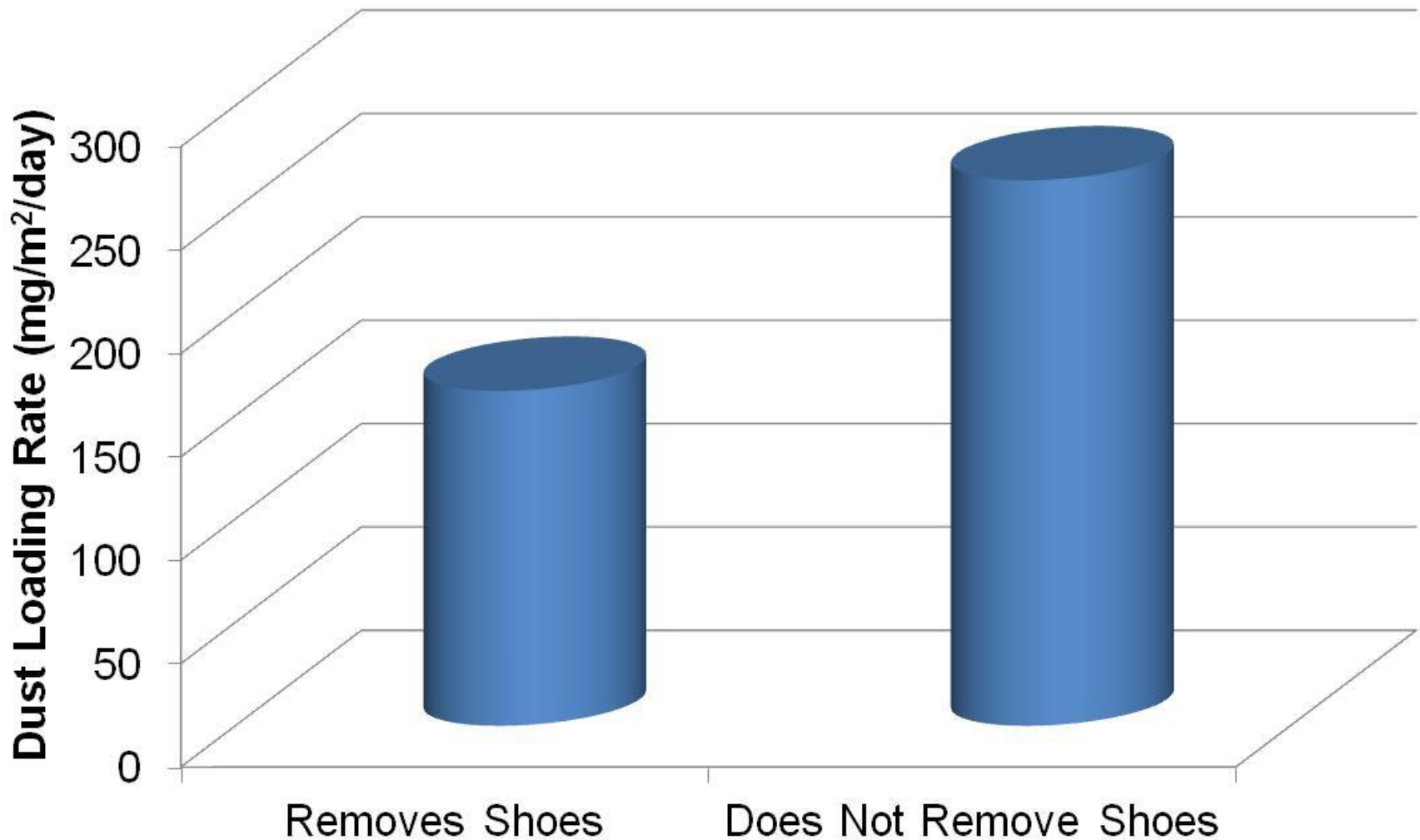
- Nearby Soil Concentrations
- Use of Entry Mats
- Number of Adults that Regularly Live at the Home
- Number of Children that Regularly Live at the Home
- Hours Spent Outside by Children
- Interior Paint Condition

-TerraGraphics Environmental Engineering, Inc.
Final 1999 Five Year Review Report. 2000.

Observed Household Hygiene versus House Dust Loading Rates at the Bunker Hill Site in 1998



Shoe Removal Prior to Entering Home versus House Dust Loading Rates at the Bunker Hill Site in 1998

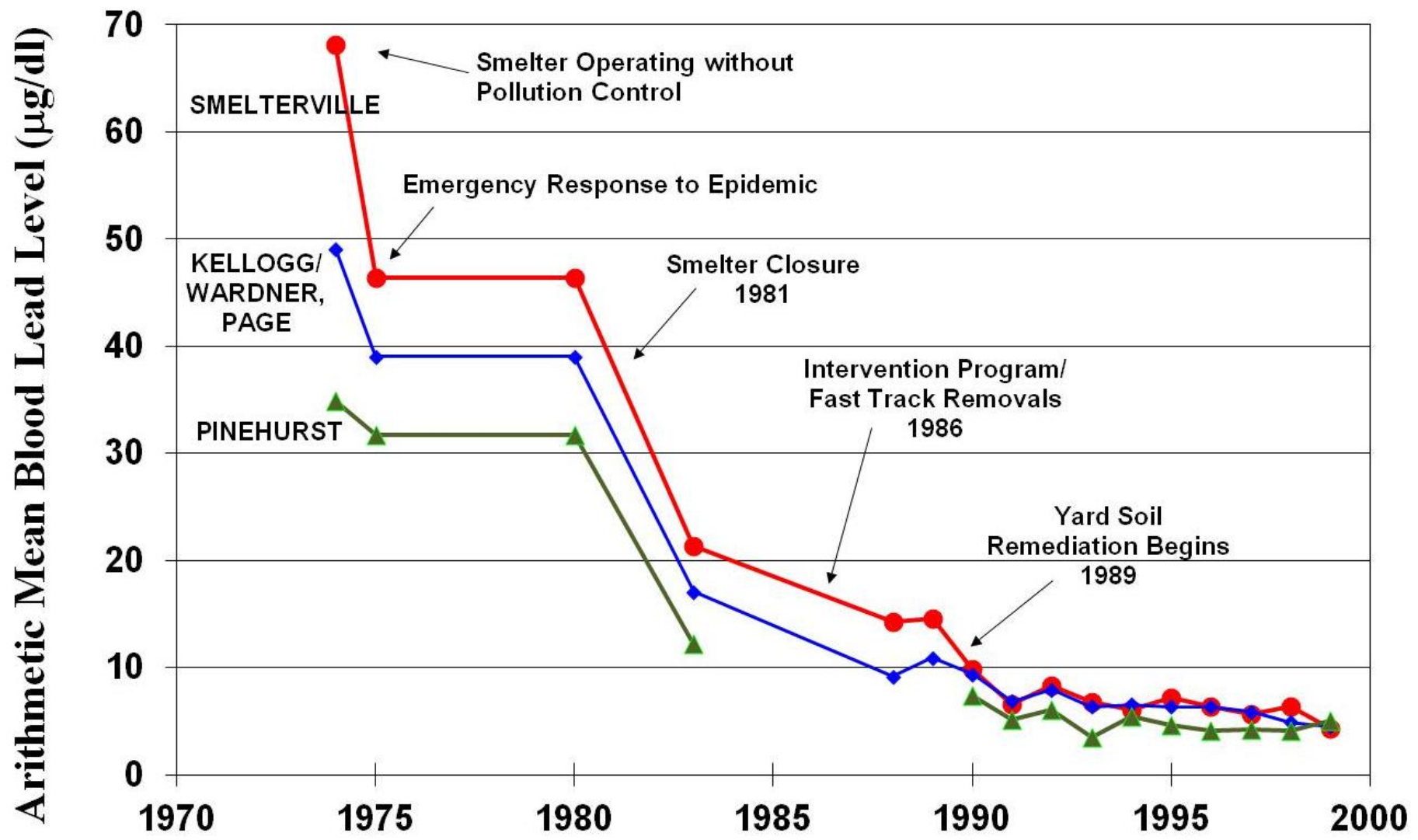


SOURCE CONTROL + INTERVENTION =

ELIMINATE EXPOSURE =

RISK MANAGEMENT

Children's Blood Levels by Year, 1974-1999



More to come...



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