



Environmental Hazards in Air and Water

Stephanie M. Chalupka, EdD, APRN, BC, CNS, FAAOHN

Objectives

- Identify major media for exposure to environmental hazards through air and water.
- Describe basic environmental risk management and risk communication strategies for environmental hazards.

Clean Air Act

- 1970-National Ambient Air Quality Standards
(NAAQS “nax”)
- Criteria Pollutants
 - Primary Standards-human health
 - Secondary Standards-agricultural crops, livestock, vegetation, buildings

Criteria Air Pollutants

- Particulate Matter (PM_{2.5})
- Sulfur Dioxide (SO₂)
- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO₂)
- Ozone (O₃)
- Lead (Pb)

1970-National Ambient Air Quality Standards

Ambient Air Quality

- “non-attainment areas” *What is the evidence?*
 - Asthma
 - Adult Cardiac M & M
 - Congenital heart defects



8-Hour Ground-level Ozone Designations

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8-Hour Ground-level
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Frequent Questions

Related Links

Glossary

Map of nonattainment areas

Attainment and Nonattainment Areas in the U.S.
8-hour Ozone Standard



- Attainment (or Unclassifiable) Areas (2668 counties)
- Nonattainment Areas (432 entire counties)
- Nonattainment Areas (42 partial counties)

Hazardous Air Pollutants (HAPs)

- Asbestos
- Mercury
- Beryllium
- Benzene
- Vinyl chloride
- Arsenic
- Radionuclides
- Coke oven emissions

Airborne Contaminants

- Direct assimilation
- Bioaccumulation/Bioconcentration

e.g., atmospheric Hg



into methyl Hg



concentrated in fish

Airborne Contaminants & Children

- May promote
 - Cancer
 - Birth defects
 - Adverse effects on:
 - Respiratory System
 - Cardiovascular System
 - Neurologic System
 - Immune System

Increased Exposure of Children

- Spend ↑ time outdoors (↑ resp. rt)
- Spend ↑ time outdoors/afternoons in summer (when ozone levels highest)
- Less likely to report exposure related symptoms

Increased Susceptibility of Children to Air Pollutants

- Lungs may be ↑ susceptible to pollutant induced injury
- Oxidant-induced injury may → inflammatory mechanisms (permanently alter lung structure)
- Pollutants may → decreased lung growth/max. lung size

Indoor Air Pollutants



Indoor Pollutants

- Biological
- Vapors
- Gases
- Particulate matter
- Outdoor pollutants

90% of day

Human Activity Factors

- Cleaning agents
- ETS
- Solvents
- Allergens
- Particulates
- Dust fibers
- Mold
- Pesticides

Heavy Metals: Airborne Pb & Hg

■ *Sources:*

Pb-

- Lead paint
- Lead containing dust from outside
- Arts & crafts material
- Treated or painted wood (in fireplace)

Hg

- Latex indoor paint containing phenyl mercuric acetate
- Thermostats
- Fluorescent light bulbs
- Barometers
- Glass thermometers

Lead: Sources

- Home remedies
 - Litargirio
 - Azarcon
 - Greta
 - Paylooah
 - Ghasard
 - Bala goli
 - Kandu
- Mini blinds?

Airborne Mercury

- Religious practices including:
 - Santaria
 - Voodoo
 - Palo Mayombe
 - Espiritismo
- Some Chinese & Indian folk remedies

Water



- **Americans drink more than one billion glasses of tap water daily**

Sources of Water Pollution

- Point Sources-well defined
 - Industrial waste water
 - Municipal waste water
- Non-Point Sources*-run off or seepage from land
 - Agricultural/urban runoff
 - Atmospheric deposition
 - Migration from disposal site
 - LUSTs



Sources of Water Pollution

- Non-Point sources
 - Underground Injection Wells
 - 750 billion gallons hazardous/non-hazardous waste annually
 - 89% can threaten aquifer



Drinking Water Supplies

- Ground water-
50% of US population
- Mixed surface & ground water-
50% of US population

Safe Drinking Water Act

- Maximum Contaminant Levels
 - Biological
 - Chemical
 - Radioactive
- Regulates “community” water systems

Microbial Contaminants

- Morbidity
- Mortality
- Limited recognition & reporting
- Gaps in passive disease surveillance

Chemical Contaminants in Water

- Synthetic/organic chemicals
 - Mutagenic
 - Carcinogenic
 - Long-term health effects?

Radon in Water

- **Inhalation exposure**
 - Showering
 - Flushing
 - Laundering
 - Dishwashing
- **Remediation**

Safe Drinking Water Act

- 45,000,000 Americans use unregulated water supplies daily:
 - Size criteria
 - Private wells
- Vulnerable to contamination from:
 - Septic systems
 - Industrial/Agricultural chemicals
 - Chemicals applied to lawns

Fish Advisories

- **Advisories in 48 states**
 - 32.9% of lakes (94,715 lakes)
 - 15.3% of river miles
 - 71% of all coastal waters in 48 contiguous states
- **Statewide advisories**
- **Bioaccumulative pollutants**
 - Hg
 - PCBs
 - Clordane
 - Dioxins
 - DDT

Freshwater Fish Consumption Advisory List

Massachusetts Department of Public Health

Center for Environmental Health

(617) 624-5757

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WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Aaron River Reservoir	Cohasset, Hingham, Scituate	P1 (all species), P2 (CP, YP), P4	Mercury
Ames Pond	Tewksbury	P1 (LMB), P3 (LMB)	Mercury
Ashumet Pond	Mashpee, Falmouth	P1 (LMB), P3 (LMB)	Mercury
Attitash, Lake	Amesbury, Merrimac	P1 (all species), P2 (LMB), P4	Mercury
Baldpate Pond	Boxford	P1 (all species), P2 (LMB), P4	Mercury
Ballardvale Impoundment of Shawsheen River	Andover	P1 (LMB & BC), P3 (LMB & BC)	Mercury
Bare Hill Pond	Harvard	P1 (LMB), P3 (LMB)	Mercury
Big Pond	Otis	P1 (all species), P2 (LMB), P4	Mercury
Blackstone River above Blackstone Gorge	Blackstone	P1 (all species), P2 (C & WS)	PCBs
Boon, Lake	Hudson, Stow	P1 (LMB & BC), P3 (LMB & BC)	Mercury
Box Pond	Bellingham, Mendon	P1 (WS), P2 (WS)	DDT
Buffomville Lake	Charlton, Oxford	P1 (all species), P5	Mercury
Burr's Pond	Seekonk	P1 (LMB), P3 (LMB)	Mercury

Advice Codes

- P1 (all species) Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body.
- P1 (species) Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any of the affected fish species (in parenthesis) from this water body.
- P2 (species) The general public should not consume any of the affected fish species (in parenthesis) from this water body.
- P3 (species) The general public should limit consumption of affected fish species (in parenthesis) to two meals per month.
- P4 The general public should limit consumption of non-affected fish from this water body to two meals per month.
- P5 The general public should limit consumption of all fish from this water body to two meals per month.
- P6 The general public should not consume any fish from this water body.

Fish Codes

- | | | |
|--------------------|----------------------|---------------------|
| AE American Eel | CCS Creek Chubsucker | SMB Smallmouth Bass |
| B Bluegill | CP Chain Pickerel | WC White Catfish |
| BB Brown Bullhead | FF Fallfish | WP White Perch |
| BC Black Crappie | GRS Green Sunfish | WS White Sucker |
| BT Brown Trout | LMB Largemouth Bass | YB Yellow Bullhead |
| C Carp | LNS Longnose Sucker | YP Yellow Perch |
| CB Calico Bass | P Pumpkinseed | |
| CC Channel Catfish | RT Rainbow Trout | |

Drinking Water Choices

- ID contaminants of concern
- Base client counseling on knowledge of *likely* contaminants
 - Chemical
 - Biological
 - Radionuclide

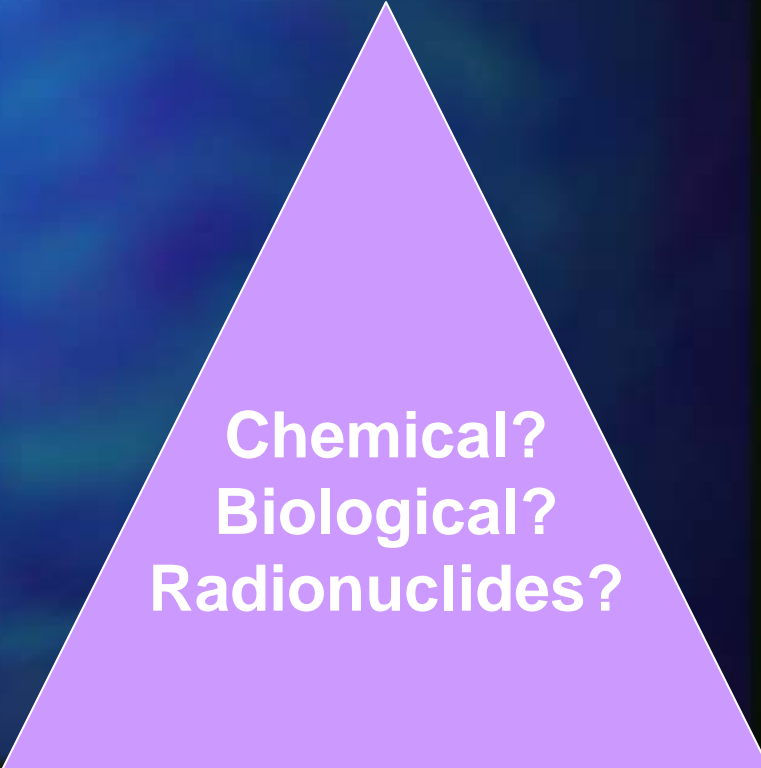
Water Testing

- **Public water supplies**
 - National Primary Drinking Water Regulations
- **Private wells**
 - Not regulated except for newly dug (in *some* states)
 - Should test annually for
 - Nitrate, pH, coliform bacteria, TDS
 - If problem suspected e.g., radon, chemical contamination-more often
 - Testing done at state certified lab

Water Filtration

- Every filter cannot remove *every* contaminant
- NSF Certification
 - Based on ANSI water filtration standards
 - www.nsf.org

Bottled Water?



Chemical?
Biological?
Radionuclides?

Risk Communication

- Scientist see risk objectively
- Public objective and subjective

“What does it mean to me and my family?”

respond to risks as they perceive them

Cardinal Rules of Risk Communication

- Involve the public/stakeholders
- Have a communication plan and a clear message
- Listen to the stories of the stakeholders
- Be honest, frank, and open
- Work with credible sources
- Provide access to information
- Speak clearly and with compassion

-Covello & Allen, 1988

Children are 30% of the world's population and 100% of our future

