

## Environmental Health

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N5290  
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## Session Goals

- ◆ Orientation to basic components of environmental health
- ◆ Roles of public health agencies in limiting threats to health from the environment
- ◆ Environmental health activities typically involving nurses

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## Essential public health services

- ◆ Not specific to any population or program area
- ◆ Developmental over time



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## Public Health Infrastructure

Data and Information

Prepared Workforce

Systems and Relationships

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## Environmental health

- ◆ comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial processes in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations (WHO, 1993)

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## Scenario #1

- ◆ *Your neighbor calls you to say that her child broke a thermometer and ate the silvery-grey material inside.*
- ◆ *You know the silvery-grey material is mercury, and you have heard that pregnant women and children should limit consumption of fish because of mercury contamination. Does this mean that eating the material from the thermometer is a serious problem?*

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## Food For Thought About Mercury

- ◆ Do you think that the health risks from mercury in a thermometer might be different from the risks related to mercury in fish? What could be different?

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## More Food For Thought About Mercury

- ◆ With the mercury from the thermometer, what risks other than swallowing might be a problem? How else might the mercury be absorbed?
- ◆ Do you think there could be a difference in health effects depending on the route of exposure?
  - Hint: Is there a difference between the effects of a medication given orally, versus parenterally? Why isn't insulin given orally?

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## Yet More Food For Thought...

- ◆ Do you think there could be a difference in health effects related to the form of mercury in the thermometer, as opposed to fish?
  - Hint: Is there a difference between the oral form and parenteral form of the same medication? If you gave the oral form parenterally, would it have the same effect?

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## One More Thought...

- ◆ Do you think there could be a difference in the effects of mercury on children, as opposed to adults?
  - Are there differences between children and adults with regard to the effects of medications?

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## Principles and Concepts

- ◆ **Route of exposure is significant**
- ◆ **Elemental Mercury**
- ◆ eaten by mouth
- ◆ inhaled as vapor
- ◆ ↓
- ◆ GI tract
- ◆ lungs
- ◆ ↓
- ◆ health effects unlikely
- ◆ possible health effects
- ◆ (poorly absorbed from gut)
- ◆ (readily absorbed from lungs)

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## Principles and Concepts

- ◆ One **form** of a substance can have very different effects from another.
- ◆ **Elemental Mercury**
- ◆ ↓
- ◆ air
- ◆ ↓
- ◆ **Bodies of Water**
- ◆ (bacteria)
- ◆ **Methylmercury**
- ◆ ↓
- ◆ **Methylmercury** ⇒ fish ⇒ people ⇒ significant health effects
- ◆ (all routes; neurotoxic)

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## Principles and Concepts

- ◆ Effects may vary in **different populations** and **different individuals**

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## To Find Out More About....

- ◆ **Mercury:**
  - [www.epa.gov/mercury](http://www.epa.gov/mercury)
  - [www.hcwh.org](http://www.hcwh.org)
  - [www.nih.gov](http://www.nih.gov) → "Mad As A Hatter"
- ◆ **Children's Environmental Health:**
  - [www.epa.gov/children](http://www.epa.gov/children)
  - [www.cehn.org](http://www.cehn.org)
- ◆ **Maternal Health:**
  - S. Steingraber: *Having Faith* (HarperCollins, 2001)

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## Scenario #2

- ◆ *A mother tells you that she arrived home last Wednesday to discover that the lawn care company had sprayed. There was a strong odor, and liquid could be seen on the grass and furniture. After playing outdoors that afternoon, her child developed nausea and vomiting, with some sweating but no fever. She also had mild tremors. Her pediatrician diagnosed her child with "flu" (GI virus). However, she is asking you if you think the pesticides may have had something to do with her child's illness.*

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## Food For Thought About Pesticides

- ◆ Do you think that pesticide poisoning (or poisoning by other environmental toxicants) could be misdiagnosed?
- ◆ If the child in this scenario did develop illness from the pesticides, why didn't her mother get sick?

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## Principles and Concepts

- ◆ Environmental health effects may mimic other conditions

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## Principles and Concepts

- ◆ Children's behavior may increase susceptibility to environmental toxicants.

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## To Find Out More About...

### ♦ Pesticides:

- [www.epa.gov/pesticides](http://www.epa.gov/pesticides)
- [www.ace.orst.edu](http://www.ace.orst.edu)
- [www.psrla.org](http://www.psrla.org) ( → “Pesticides and Human Health”)
- J.R. Reigart & J.R. Roberts: *Recognition and Management of Pesticide Poisonings* (EPA,1999). Available on line at: [www.epa.gov/pesticides/safety/healthcare](http://www.epa.gov/pesticides/safety/healthcare) or by calling 703-305-7666

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## Scenario #3

- ♦ *Your aunt has just moved to a new town that has a chlorinated water supply. She is concerned about possible health effects of the chlorine. She hasn't gotten sick from it, but she really dislikes the taste and she feels concerned. She asks you what you know about this.*

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## Food For Thought About Chlorinated Water

- ♦ *If this person hasn't gotten acutely ill from the chlorinated water, is it still possible that there is a negative health effect occurring?*
  - *Hint: Are side effects of medications always manifested in acute symptoms? Or do medications sometimes cause negative effects over time?*

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## More Food For Thought About Chlorinated Water

- ♦ *Organic chlorine compounds (such as those formed in chlorinated water, and also in various manufacturing processes) rarely occur naturally. Are human-made substances more dangerous than natural substances? Can you think of examples of toxic natural substances?*

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## Yet More Food For Thought About Chlorinated Water

- ♦ *How can we tell if a substance is causing chronic effects? If you wanted to study the long-term health effects of chlorine in water, how would you go about it? What would some of the problems be?*

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## Principles and Concepts

- ♦ Adverse health effects may result from chronic low-dose exposure.

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## Principles and Concepts

- ◆ Compounds that do not exist naturally (or rarely do) can be especially problematic

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## Principles and Concepts

- ◆ Assessing risks from chronic exposure is complicated and difficult
  - Epidemiological studies: assess health trends and associations
  - Risk assessment: combines toxicological research (often animal studies) with estimated exposures to determine estimates of risk

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## To Find Out More About...

- ◆ **Carcinogens** (environmental cancer-causing substances):
  - [www.niehs.nih.gov](http://www.niehs.nih.gov) (→National Toxicology Program → Report on Carcinogens)
  - [www.epa.gov/children](http://www.epa.gov/children) (→ childhood cancer)
  - S. Steingraber: *Living Downstream* (Vintage Books, 1998)
- ◆ **Effects of chronic exposure to neurotoxins in children:**
  - [www.igc.org/psr](http://www.igc.org/psr) (→*In Harm's Way*)
  - [www.epa.gov/children](http://www.epa.gov/children) (→ developmental and neurological problems)

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## Federal agencies

- ◆ US Environmental Protection Agency and its state equivalent agencies, clean air, water, etc.
- ◆ Department of Transportation, hazardous materials transportation
- ◆ Food and Drug Administration and US Department of Agriculture regulate food safety
- ◆ Agency for Toxic Substances and Disease Registry (within HHS) environmental health related issues associated with Superfund sites.

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## Additional agencies

- ◆ Housing and Urban Development (HUD); Healthy Homes
- ◆ Department of Energy (DOE)
- ◆ National Library of Medicine (NLM); Toxicology and Environmental Health
- ◆ Occupational Safety & Health Administration (OSHA) and OSHA technical links (SLTC)
- ◆ Joint Commission on Accreditation of Healthcare Organizations (JCAHO)

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## Typical local public health concerns

- ◆ Restaurants
- ◆ Drinking water
  - Public
  - Wells
- ◆ Septic tanks/sewage
- ◆ Solid waste/landfills
- ◆ Lodging places
- ◆ Day care
- ◆ Schools
- ◆ Swimming pools
- ◆ Pests/animals

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## Local Environmental Assessment: where do you fit in?

- Do we have the necessary capacity & community relationships to undertake a community environmental health assessment?
- What do we know about the community (political, social, economic, and cultural)?
- Who will participate in the team? How will the project be governed & who will make decisions?
- What is the geographic & topical scope & what are the expected outcomes and decisions?
- What issues does the public team care about and why?

- What are the links among health status, populations, environmental agent, exposure/health risk and health protection factors for selected issues?
- What do we need to know/track?
- What is the nature and extent of the problem in our community?
- What are the biggest/most serious problems in our community?
- What are our priorities for action?
- What can we do about our priorities?
- Have we been successful? What else do we need to do?

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## Others involved

- ♦ Environmental health professionals in private industries
  - Occupational health
  - Food safety
  - Industrial hygiene
- ♦ Advocacy groups

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## Types of threats

- ♦ Threats can be
  - Biological
  - Chemical
  - Radioactive
  - Physical
- ♦ In the
  - Natural environment
  - Built environment
    - Home
    - Workplace
    - Community
- ♦ They can be spread by
  - Air: indoor and out
  - Water: drinking or not
  - Soil: direct or indirect
  - Or a combination
- ♦ And caused by
  - Natural events
    - Seasonal
    - Exceptional
  - Human activity
    - Incidental
    - Deliberate

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## Radon: a problem or not?

Cause	Deaths per year
RADON	21,000
Drunk Driving	17,400
Falls in the Home	8,000
Drownings	3,900
Home Fires	2,800

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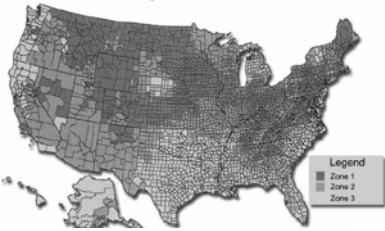
## Routes of exposure

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## And repair

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## But the problem isn't everywhere



Zone 1 counties have a predicted average indoor radon screening level greater than 4 pCi/L  
 Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L  
 Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L

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## Responsible actions

- ◆ Know the 'zone' you are in
- ◆ Exercise healthy questioning when a new threat is announced
- ◆ Be wary of 'quick fix' advertisements
- ◆ Use good risk communication with the public

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## Food and threats

- ◆ USDA: Meat, poultry, eggs
  - In order for the USDA to investigate a problem with meat, poultry or egg products, you must have:
    - The original container or packaging
    - Any foreign object that you might have discovered in the product
    - Any uneaten portion of the food (refrigerate or freeze it)
- ◆ FDA: labeling and standards
  - Cooperative programs for milk and shellfish
- ◆ States
  - Pesticides
  - Markets
  - Restaurants: premises and food handlers

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## Nurses encounter environmental issues

- ◆ In home visits
  - Construction
  - Safety
  - Food and water
  - Waste products
- ◆ In the workplace
- ◆ In vulnerable settings
  - Hospitals
  - Day care
- ◆ In the community at large

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## Child environmental history

- ◆ Screening Questions for Environmental Exposures (should be asked in most cases):
  - Do you think the child's health problems are related to the home, daycare, school, or other location?
  - Has there been any exposure to pesticides, solvents or other chemicals, dusts, fumes, radiation, or loud noise?
  - What kind of work do the parents or other household members engage in?

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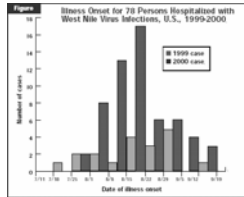
## Detailed History (when environmental etiology is suspected):

- ◆ Do you live next to/near an industrial plant, commercial business, dump site, or nonresidential property?
- ◆ Which of the following do you have in your home? Air conditioner; air purifier; central heating (gas or oil); Gas stove; electric stove; fireplace; Wood stove; humidifier
- ◆ Have you recently acquired new furniture or carpet, refinished furniture or remodeled your home?
- ◆ Have you weatherized your home recently?
- ◆ Approximately what year was your home built?
- ◆ Are pesticides or herbicides (bug or weed killers, flea and tick sprays, collars, powders, or shampoos) used in your home or garden or on pets?
- ◆ Do you (or any household member) have a hobby or a craft?
- ◆ Do you work on your car?
- ◆ Have you ever changed your residence because of a health problem?
- ◆ Does your drinking water come from a private well, city water supply, or grocery store?

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## West Nile Virus

- ♦ Classic zoonotic disease
  - Agent: a virus
  - Host: birds
  - Vector: mosquito



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## Nurses and West Nile virus

- ♦ Case finding: alert to unusual symptoms or severity
- ♦ Prevention:
  - Individual behavior
  - Household management
  - Community management

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## From the DOHMH

**Table 3. How to Avoid Exposure To West Nile Virus**

From June to October (when mosquitoes are most active) take these precautions:

- Mosquitoes breed in standing water. To eliminate breeding sites, remove tires, buckets, and other water holding objects from your property. Change the water in bird baths at least once a week. Clean and chlorinate swimming pools or drain and cover if not in use. Prevent water from accumulating in pool covers. Use Mosquito Dunks (commercially available larvicides) in areas of standing water around the home that cannot be eliminated. Unclog gutters and downspouts.
- Make sure that doors and windows have tight fitting screens.
- If outside when mosquitoes are most likely to bite (in the evening, at night, or early in the morning), or in an area where there are woods, tall grass, bushes or known high mosquito activity at other times of the day, wear protective clothing such as long pants, long sleeved shirts, and socks. Consider the use of an insect repellent containing DEET (N, N-diethyl-methyl meta toluamide). Do not apply DEET directly to children. Adults should apply the product to their own hands and then put it on the child. Follow manufacturer's directions carefully when using insect repellents. These personal precautions are especially important for older adults, who are more likely to develop severe neurologic disease if infected with West Nile virus.
- For up-to-date information, call the Automated West Nile Virus Information Line at (877) 368-4662 or check the Website at [www.nys.gov/health](http://www.nys.gov/health)

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## City Health Alert to Professionals

### Pesticide Spraying Notification for Staten Island

Please Distribute to Staff in the Department of Emergency Medicine

Weather Permitting, Ground-based Pesticide Application is scheduled for **September 23 (overnight), between 7:00 P.M. – 6:00 A.M.**, in selected areas of **Staten Island**, **Midland Beach, Old Town, Dongan Hills, Shore Acres, Arrochar, South Beach and Grasmere**

•A map of areas to be treated is available online at [nyc.gov/health/wny](http://nyc.gov/health/wny). In the event of rain or high winds, all operations will continue on the next possible evening, weather permitting.

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## Additional information

### Dear Colleagues,

For pesticide spraying activities this year, the City will use Anvil (Sumithrin), a synthetic pyrethroid utilized in mosquito control efforts. The public, in general, is not expected to experience symptoms given the anticipated low levels of exposure. Some individuals, however, may be particularly sensitive to these agents, either to the active ingredients or other ingredients (e.g., inert ingredients which may include petroleum solvents).

Such individuals could experience transient effects such as skin, eye and mucous membrane irritation, as well as exacerbation of conditions such as asthma and other respiratory illness.

For additional information regarding Anvil and other mosquito control products, please see the City Health Information issue Vol. 20, No. 2 on our website at: <http://www.nyc.gov/html/doh/pdf/chi/chi20-2.pdf>.

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**Products Containing Pyrethroids:** The public, in general, is not expected to experience symptoms given the anticipated low levels of exposure. Some individuals, however, may be particularly sensitive to these agents, either to the active ingredients or other ingredients (e.g., inert ingredients which may include petroleum solvents.) Such individuals could experience transient effects such as skin, eye and mucous membrane irritation, as well as exacerbation of conditions such as asthma and other respiratory illness.

Signs and symptoms of poisoning following very high exposure, such as that which might occur among workers involved in the mixing or application of the pyrethroids, may include abnormal facial sensation, dizziness, salivation, headache, fatigue, vomiting, diarrhea, and irritability to sound and touch. Pulmonary edema, seizures, paresthesias, and fasciculations may occur in severe cases.

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## Nurses should know

- Basic Knowledge and Concepts
  - basic mechanisms and pathways of exposure to environmental health hazards, basic prevention and control strategies, the interdisciplinary nature of effective interventions, and the role of research.
- Assessment and Referral
  - environmental health history, potential environmental hazards and sentinel illnesses, appropriate referrals; access and provide information to patients and communities, and to locate referral sources.
- Advocacy, ethics, and risk communication
  - role of advocacy (case and class), ethics, and risk communication in patient care and community
- Legislation and Regulation
  - Legislation/regulations related to environmental health.

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## Some key terms

- ♦ Risk
- ♦ Risk assessment
  - Hazard identification
  - Dose response
  - Exposure assessment
  - Risk characterization
- ♦ Risk management

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## Precautionary principal

- ♦ where there are threats of serious or irreversible damage, lack of scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation or protect human health.

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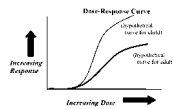
## Pharmacology and toxicology

- ♦ Origin, nature, use of drugs
- ♦ One-time, short term, long term
- ♦ Oral, IM, IV, dermal, topical
- ♦ Adverse effects of chemicals on health
- ♦ Single event, short term, lifetime
- ♦ Ingestion, inhalation, dermal absorption

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## Dose-Response Curve

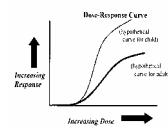
- ♦ Pharmacology:
  - *Dose-response curve* graphically represents the relationship between the dose of a drug and the response elicited



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## Dose-Response Curve

- ♦ Toxicology:
  - *Dose-response curve* describes the relationship of the body's response to different amounts of an agent



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## Interactions

- ◆ Pharmacology:
  - *Drug interactions* define the effect one drug has on another.
- ◆ Toxicology:
  - *Toxicological interactions* define the effect one chemical has on another.

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## Interactions, continued

- ◆ 3 types of effects:
  - *Additive*: the sum = the whole
  - *Synergistic or potentiated*: one enhances the other's effect
  - *Antagonistic*: one reduces the effect of the other

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## Potency

- ◆ Pharmacology:
  - *Potency* refers to the relative amount of drug required to produce the desired response.
- ◆ Toxicology:
  - The *potency* of a toxic chemical refers to the relative amount it takes to elicit a toxic effect compared with other chemicals.

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## The Regulatory Process

- ◆ The regulatory process for approval to sell a medication includes several stages of testing on animals and humans.
- ◆ The regulatory process for hazardous chemicals that are not food, drug, cosmetic, or pesticide in nature does not require any original testing for human health risks.

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## Access to information

- ◆ Clean air act
- ◆ Clean water act
- ◆ Safe drinking water act
- ◆ Superfund amendments

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## % persons living in areas that do not meet air quality standards

- ◆ One or more pollutants: 45%
- ◆ Ozone: 41%
- ◆ Particulate matter (PM -2.5): 11%
- ◆ Carbon monoxide: 13%
- ◆ Nitrogen dioxide: 0%
- ◆ Sulfur dioxide: 1%
- ◆ Lead: 0%

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## Zip Code: 10034 Inwood

- ♦ SULFURIC ACID
  - 29,679 pounds
- ♦ LEAD
  - 37 pounds
- ♦ POLYCYCLIC AROMATIC COMPOUNDS
  - 4 pounds

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## 7 Cardinal Rules for Risk Communication:

- ♦ Accept and involve public as a legitimate partner
- ♦ Plan carefully and evaluate your efforts
- ♦ Listen to your audience
- ♦ Be honest, frank, and open
- ♦ Coordinate and collaborate with other credible sources
- ♦ Meet the needs of the press
- ♦ Speak clearly and with compassion

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## Perception of risk

Less Risky	More Risky
Voluntary	Involuntary
Familiar	Unfamiliar
Controllable	Uncontrollable
Controlled by Self	Controlled by Others
Not Memorable	Memorable
Not Dreaded	Dreaded
Chronic/Diffuse in space and time	Acute/Focused in time and space
Not Fatal	Fatal
Immediate	Delayed
Natural	Artificial
Individual mitigation possible	Individual mitigation not possible
Detectable	Undetectable

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## Airline water, September 20, 2004

- ▶ Drinking water onboard 87.4% of 158 randomly selected passenger airplanes met EPA standards.
- ▶ 12.6 % of domestic and international passenger aircraft tested carried water that did not meet standards.
  - 20 aircraft had positive results for total coliform bacteria; two of these aircraft (1.3 percent) also tested positive for E.coli
- ▶ Passengers with compromised immune systems or others concerned may want to request canned or bottled beverages.

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## What will you say?

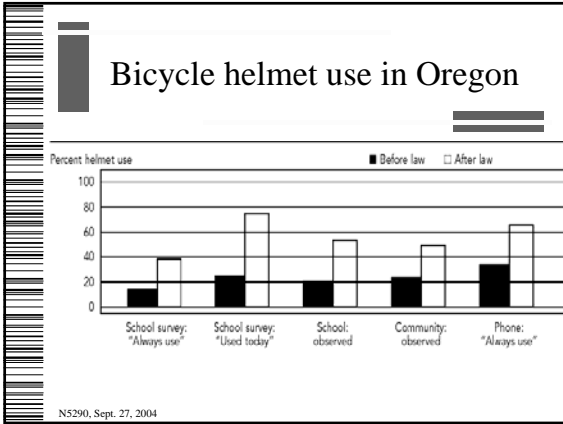
- ♦ How do you think this risk will be perceived?
  - Average traveller?
  - Transplant recipient with suppressed immune system?
- ♦ How will you shape the message?

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## Vulnerable populations: children

- ♦ toxicants may disrupt and cause permanent damage to the developing nervous, immune, and respiratory systems of young children.
- ♦ skin, respiratory, & GI absorption of toxic materials is greater than that of adults.
- ♦ normal exploratory behavior increases opportunities to ingest toxicants such as lead-based paint.
- ♦ diets differ in their exposure to residues on foods such as fruits.
- ♦ Children accumulate exposure throughout a lifetime.

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### Active protection

In 1918, 13 people drowned in rip currents in a single day at San Diego's Ocean Beach, garnering local and national news attention. Beach attendance that day was estimated at 5,000. City officials cited inadequate lifeguard protection as a cause of the tragedy, and as a result, initiated a municipal lifeguard service. The ocean conditions have changed little since then. San Diego's local leaders view the 17 miles of oceanfront shoreline, which include Ocean Beach, as a safely managed tourist attraction due to the presence of lifeguards. Despite an average estimated annual attendance of 15 million people and over 7,000 rescues at the major lifeguarded beaches, the average number of drownings in areas under lifeguard protection is between zero and one annually.

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### If instructed to boil water, you should boil it for:

- ♦ 30 seconds
- ♦ 1 minute
- ♦ 3 minutes
- ♦ 5 minutes
- ♦ 1 hour

Answer: EPA and the Centers for Disease Control issued a joint policy statement that bringing water to a rolling boil for 1 minute will kill all known waterborne pathogens, including *Giardia* and *Cryptosporidium*. Note: If you live at high altitudes (above 6,000 feet), you should boil water for 3 minutes because water boils at a lower temperature at high elevations.

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### How many Americans will develop skin cancer in a lifetime?

- ♦ One in five
- ♦ One in ten
- ♦ One in a hundred
- ♦ One in a thousand

Answer: Currently, one in five Americans develops skin cancer during their lifetime. More than one million people are diagnosed with this disease each year, making it the most widespread form of cancer in the US.

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### The Great Lakes contain what % of the nation's and world's freshwater supply?

- ♦ 25; 5
- ♦ 50; 10
- ♦ 90; 20
- ♦ 100 of both - that's why they're GREAT

Answer: The five Great Lakes- Erie, Huron, Michigan, Ontario, and Superior- are the largest surface freshwater source on the Earth. They contain more than 90 percent of the nation's freshwater supply and more than 20 percent of the world's.

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### If your skin burns in ten minutes, what SPF sunblock should you use if you plan to be outside for 5 hours?

- ♦ SPF 4
- ♦ SPF 15
- ♦ SPF 30
- ♦ Just stay inside

Answer: If your skin burns in ten minutes, and you use SPF 30, you should be able to stay in the sun for 300 minutes (5 hours) without burning (length of time for your skin to redden x SPF = length of time you're protected). Overexposure to the sun not only causes sunburn, but can also cause eye damage premature wrinkling, skin cancer, and damage to your immune system

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## How did old New York City subway cars land in the Atlantic Ocean?

- ◆ The "F" line ends on Coney Island
- ◆ To create calamity movie scene
- ◆ Put there to create artificial reefs
- ◆ Free car wash

Answer: Old New York City subway cars were put into the Atlantic Ocean to act as artificial reefs. Reefs provide a home for fish and other ocean wildlife. Dives by the EPA Mid-Atlantic Region Dive Team have confirmed that the cars are still intact, well covered by growth, and surrounded by fish such as flounder, tog, and shark.

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## If you drive 20,000 miles/year + gas is \$2.25/gal., how much will you save if you drive a hybrid instead of a large SUV?

- ◆ \$100
- ◆ \$500
- ◆ \$1100
- ◆ \$2400

Answer: One company's 2004 fuel economy stats: the largest SUV averages 14 miles per gallon. Driving 20,000 miles with gas at \$2.25/gallon will cost \$3,214. The hybrid averages 55 miles per gallon. The cost to drive the hybrid is \$818, an annual savings of \$2,396. The SUV driver will also cause over ten additional tons of greenhouse gas emissions in the year of driving.

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## Which creates more pollution, the average car or the average home?

- ◆ average car
- ◆ average home
- ◆ about the same

Answer: The average home creates more pollution than the average car. One inexpensive and energy efficient way you can cut your home-related pollution is to replace old light bulbs and fixtures with Energy Star qualified lighting. Changing just five bulbs will save an estimated \$60 per year. If every American household did this, together we'd keep more than one trillion pounds of greenhouse gases out of our air.

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