

# **“BPA, Phthalates, and Other Emerging Contaminants: How to Protect Children”**

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# Issues to Explore

- Environmental Health Past and Present
- Children's Environmental Health
- Contaminants of Special Concern to Children's Health
- Potential Sources and Routes of Exposure to Harmful Contaminants
- Reducing Exposures to Contaminants
- The Future of Children's Environmental Health.



# Environmental Health

- The study of biological, chemical, and physical agents in the environment and the diseases and injuries they cause.
  - ❖ Agents may be solids, liquids or gases and from natural or man-made sources.
- Environmental health focuses on wellness and not merely the absence of disease.



# Environmental Health – Past and Present

- A century ago, environmental health focused on medical interventions and improving sanitation to reduce infectious disease.
  - ❖ The success of these programs and interventions reduced the risk of infectious disease significantly.
- Today, environmental health is viewed more broadly, and includes the environment we create for ourselves and our children, both individually and as a community.



# Children's Environmental Health

- Focuses on chemical contaminants and the health effects resulting from exposure during childhood.
  - ❖ "Childhood" is regarded as the period from conception through adolescence.
- The importance of biological and physical hazards, such as food- and water-borne pathogens and radiation, should not be underestimated.



# Children's Environmental Health

- According to the World Health Organization (WHO), "Children under 5 years of age make up about 10% of the global population, but over 40% of the environmental disease burden falls on this group.
- The environmental hazards that children face are determined, in part, by the geographic location where the child is raised, family income and education level, and cultural factors of the community.





# Risks Around the World

- WHO's three categories of environmental health risks to children:
  - ❖ **Basic** risks are unhealthy housing, unsafe water supply, lack of sanitation, indoor air pollution, and leaded gasoline.
  - ❖ **Modern** risks are chronic respiratory illness and asthma, injuries from vehicle accidents, toxic chemicals, and neurodevelopmental and behavioral effects.
  - ❖ **Emerging** risks are endocrine disruptors, environmental allergens, and UV radiation.



# Environmental Risks for American Children

- Decreasing children's exposures to both common and emerging environmental contaminants is a public health priority.
- The type and magnitude of risks facing children in the U.S. are unique.





# Special Concerns for Children

- “Children are not little adults”
- Reasons why environmental contaminants may have a different effect on children compared to adults include:
  - ❖ Exposures may be different due to unique behaviors and intake.
  - ❖ An environmental chemical may affect children differently than adults because children are still developing and
  - ❖ Children have more future years.



Source: [lifestyleaccelerator.com](http://lifestyleaccelerator.com)



# Children Have Unique Behaviors

- As children pass rapidly through developmental phases, their activity patterns and behaviors change.
- Newborns spend prolonged periods of time in a single environment and are unable to voluntarily decrease exposure to environmental hazards.



<http://www.wallpaperez.net/wallpaper/children/s/Playing-jumping-rope-716.jpg>





# Children Have Unique Behaviors

- Toddlers are more mobile and spend more time on floors, carpets, and grass.
- Behaviors such as pica, crawling, and oral exploratory activity increase ingestion of contaminants.
- Children can experience greater exposure to pesticide residues from grass, lead dusts from floors, and volatile organic compounds (VOCs) from carpeting.



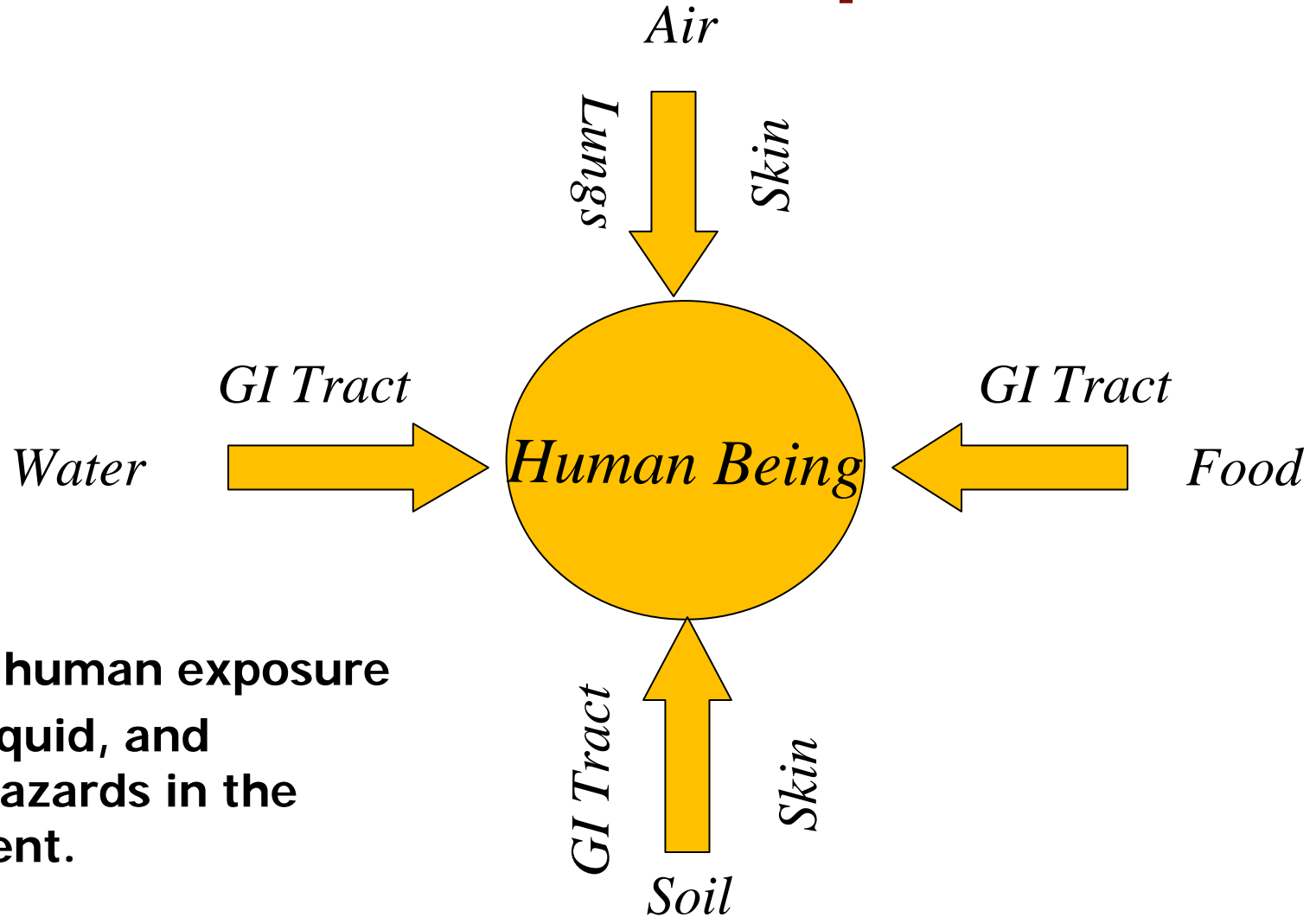
<http://thechildrensgiftshop.com>



[www.ehow.co.uk](http://www.ehow.co.uk)



# Routes of Human Exposure



Routes of human exposure to solid, liquid, and gaseous hazards in the environment.



# Exposure of Children

- Children eat, drink, and breathe more per pound of body weight than do adults.
- Therefore, in proportion to body weight, children are more exposed than adults to contaminants in air, food, water, and soil.



[www.oss.sa.gov.au](http://www.oss.sa.gov.au)



[eduprofile-luise.blogspot.com](http://eduprofile-luise.blogspot.com)



# Food and Drink Consumption

- According to the National Research Council (NRC), children eat more calories and drink more water than adults.
- Children one through 5 years of age eat 3 to 4 times as much food per pound of body weight as do average American adults.



[www.dreamstime.com](http://www.dreamstime.com)



[www.parents.com](http://www.parents.com)



# Food and Drink Consumption

- Certain foods, such as breast milk, fruit juice, fruit, and cow's milk, are consumed more frequently by children.
- The Agency for Toxic Substances and Disease Registry (ATSDR) reported that children in the first 6 months of life drink seven times as much water per pound as average adults do.



[www.slvhealth.org](http://www.slvhealth.org)



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# Air Intake

- Pound for pound of body weight, children breathe more air than do adults.
  - ❖ A resting infant takes in twice as much air as a resting adult based on body weight.
- Children have different breathing zones and are closer to the floor than adults, where heavier airborne contaminants accumulate.
  - ❖ A 6-month old child will inhale twice the amount of radon as an adult.





# Dermal Exposure

- Children have higher skin surface area to body weight ratios and greater contact with their surroundings.
- Children may absorb through their skin a larger dose of a pollutant than an adult based on body weight.





# Transplacental Exposure

- Fetuses can be exposed to toxicants and are very susceptible to harmful effects.
- Teratogenic chemicals that get into a pregnant woman's body can cross the placenta and may even concentrate in fetal tissue.





# Children are Developing

- From birth through childhood, children differ from adults in their ability to absorb, metabolize, and excrete contaminants.
  - ❖ During infancy, kidneys and other organs don't have adult capabilities for removing toxins from the body.
- Physiological and biochemical differences between children and adults can effect on how environmental contaminants act on the body.
  - ❖ Infants need time to develop the cellular proteins and functions that often protect an adult from toxic exposures.



# Children Have More Future Years

- Environmental contaminants may pose a greater risk to children than adults because children have more “future years” to develop diseases with long latency periods.
- Diseases requiring chronic exposure are likely to have more serious impacts when children are exposed throughout their lifetime beginning at an early age.



# Chemicals of Special Concern to Children's Health

- Classes of chemicals that may have potential impact on children's health:
  - ❖ Pesticides
  - ❖ Volatile Organic Compounds (VOCs)
  - ❖ Polycyclic aromatic hydrocarbons (PAHs)
  - ❖ Bisphenol A
  - ❖ Phthalates
- Originate from natural and man-made sources



# Pesticides

- Pesticides are used to control unwanted insects, rodents, weeds and other pests.
- Pesticides are routinely used indoors and outdoors in commercial and residential settings.
- Include disinfectants and pet shampoos.





# Pesticides and Children's Health

- Pesticide exposure primarily affects the nervous system.
- The extent and type of the adverse health effect depends on:
  - ❖ The type of pesticide
  - ❖ The amount taken into the body,
  - ❖ The frequency and duration of the contact.





# Pesticides and Children's Health

- Very high exposure can cause:
  - ❖ paralysis,
  - ❖ tremors and convulsions,
  - ❖ loss of consciousness and death.
- Lower, longer lasting exposures can affect other organs such as the liver and kidneys and may promote development of cancer.



[www.quali-pro.com](http://www.quali-pro.com)



[www.ca.uky.edu](http://www.ca.uky.edu)



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# How Children are Exposed to Pesticides

- Indoor or outdoor application of pesticides to structures and premises.
- By entering a recently treated area.
- Consumption of contaminated food and water.



[www.3seasonsonline.com](http://www.3seasonsonline.com)



[www.lyndist.com](http://www.lyndist.com)



# Ways to Reduce Exposure to Pesticides

- Use Integrated Pest Management
- Read and follow label instructions for proper use of pesticides.
- Wash fruits and vegetables before eating them.
- Avoid treated areas during and after treatment.
- Remove shoes at the door to avoid tracking in soil and dust.
- Store pesticides in safe containers out of the reach of children.



# Volatile Organic Compounds (VOCs)

- A group of chemicals that easily evaporate.
- Commonly found in paints and glues, second-hand smoke, fuels, industrial solvents, and consumer products.
- Found at low levels in homes and the environment in air, water, soil, dust and food.
- Most VOCs are readily broken down by microorganisms and sunlight.





# VOCs and Children's Health

- The effects of VOCs on children's health depends on:
  - ❖ The chemical.
  - ❖ The level of exposure and
  - ❖ The length of time exposed.
- Exposure to high concentrations of VOCs can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders, and impaired memory.
- Long-term exposures to high levels of some VOCs, such as benzene, can cause cancer.



# How Children are Exposed to VOCs

- Exposure may come through breathing, eating and drinking, and through direct skin contact.
- EPA studies show VOC levels inside homes are often 2-5 times higher than ambient levels.



[www.ekbdc.com](http://www.ekbdc.com)



[www.aprilair.com](http://www.aprilair.com)



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# Ways to Reduce Exposure to VOCs



- Keep children away from ETS.
- Keep children away from stored gasoline, especially in enclosed areas.
- Don't allow car to idle in the garage even with the door open.
- Follow ventilation and usage instructions for paints, varnishes, strippers, glues, and hobby products.
- Remodel, paint, replace carpet, and refinish surfaces during summer months.
- Store VOCs outside the home.
- Buy paints and other products with low VOC content.



# Polycyclic Aromatic Hydrocarbons

- Polycyclic Aromatic Hydrocarbons (PAHs) are a group of chemicals formed by incomplete combustion of organic materials.

- ❖ Fossil fuels
- ❖ Municipal and industrial waste
- ❖ Wood
- ❖ Tobacco
- ❖ Meat



[www.health.com](http://www.health.com)

- PAHs are produced by natural events and human activities and are found throughout the environment in water, soil, and air.



# PAHs and Children's Health

- Some PAHs, either individually or in mixtures with others, can cause adverse health effects such as:
  - ❖ Cellular mutations and cancer
  - ❖ Respiratory effects and immune system depression
  - ❖ Skin disorders.
  - ❖ Animal studies show that PAHs can cause developmental effects and changes in kidney and liver function.
- Of the more than 100 chemicals classified as PAHs, only a few have been subject to intensive scientific study.



# PAHs and Children's Health

- Health effects resulting from PAH exposure will depend on:
  - ❖ Duration and frequency of exposure
  - ❖ Quantity of PAH present and
  - ❖ Whether exposure occurs by inhalation, ingestion or dermal contact.
- Benzo(a)pyrene is one PAH which has been studied extensively and is considered a potent carcinogen at low doses.



# How Children are Exposed to PAHs

- Exposure most likely results from PAHs present in air, either as vapors or attached to dust particles.
- Although PAHs can travel long distances in the environment, concentrations of PAHs in air are higher near the source, such as traffic congestion, waste incineration, asphalt roads, and residential wood burning.
- In the home, ETS, wood fire smoke, and food are common sources of exposure.



# Ways to Reduce Exposure to PAHs

- Avoid smoke from wood fires from home heating or recreational uses.
- Avoid exposure to auto exhaust and high traffic congestion areas.
- Avoid asphalt road construction and tar roofing operations.
- Avoid exposure to ETS.
- Prepare foods by slower cooking over low heat, rather than by charring or grilling food.
- Avoid skin contact with soot.





# Bisphenol A (BPA)

- BPA is a chemical commonly used in polycarbonate plastics, which are rigid, impact-resistant plastics used in industry and consumer products.
  - ❖ Hard plastic beverage bottles
  - ❖ Reusable cups
  - ❖ Sports equipment
  - ❖ Medical devices
  - ❖ CDs
  - ❖ Toys
- BPA is part of the material used to coat the inside walls of some food cans and water supply pipes.



# BPA and Children's Health

- BPA can disrupt the endocrine system by acting like a hormone or changing the way hormones act.
- Animal studies show that high doses of BPA may affect:
  - ❖ sperm count,
  - ❖ fetal development, and
  - ❖ obesity.



# How Children are Exposed to BPAs

- Most children are exposed by eating and drinking food and water that has been stored for extended periods of time in materials made from BPA.
- Studies show that BPA moves from heated and damaged plastic bottles into water and infant formula.
- BPA is commonly detected at low concentrations in both indoor and outdoor air, in surface water, and in house dust.



# Ways to Reduce Exposure to BPAs

- Choose baby bottles, water bottles, children's cups, and drinking glasses that are made from glass or from plastics that don't contain BPA.
  - ❖ Plastics containing BPA will normally have a recycling code number of 7, but not all #7 plastic contains BPA.
- Discard plastic containers that are scratched and cloudy.
- Heat and harsh detergents can damage the surface of plastics and result in the greater release of BPA.
  - ❖ Wash plastics by hand rather than in the dishwasher and don't use brushes that could scratch the surface.
  - ❖ Heat may be used to sterilize a bottle, but the sterilized bottle should be allowed to cool and dry before use.



[explore.outdoorsica.com](http://explore.outdoorsica.com)



# Ways to Reduce Exposure to BPAs

- Minimize the amount of time formula or water is stored in plastic containers before use.
- Heat formula or milk in a pan on the stove or in a glass or ceramic container in the microwave before pouring into a bottle for an infant.
- BPA has been detected in breast milk, but there is no indication that this exposure poses harm for a nursing infant.
  - ❖ Nursing mothers can reduce their infant's exposure to BPA by reducing their own exposure by avoiding hard plastic food containers and other packaging containing BPA.



# Phthalates (Plasticizers)

- Phthalates are a class of hormone-mimicking chemicals used in plastics and other materials to make them soft, flexible and resilient.
- Phthalates are used in consumer products such as vinyl flooring, adhesives, toothbrushes, cosmetics, aspirin, insecticides, nail polish, hair sprays, soaps and shampoos.



[www.medhelp.org](http://www.medhelp.org)



[www.vosizneias.com](http://www.vosizneias.com)



# Phthalates

- Phthalates are also used in PVC plastics used to make plastic bags, garden hoses, inflatable toys, blood-storage containers, medical tubing, and children's toys.
- Phthalates are not chemically bound to plastics and can be easily released into the environment resulting in widespread exposure.



[www.thedailygreen.com](http://www.thedailygreen.com)



[sci10bestq3bm.wikispaces](http://sci10bestq3bm.wikispaces)



# Phthalates and Children's Health

- Animal studies show phthalate exposure can produce adverse effects on the development of the reproductive system in male laboratory animals.
- Several studies have shown associations between phthalate exposures and human health, although no causal link has been established.
- The NIH concluded that reproductive risks from exposure to phthalate esters were minimal to negligible in most cases.



# Phthalates and Children's Health

- FDA and CDC data have not shown a cause and effect relationship between use of cosmetics and adverse health effects.
- The American Academy of Pediatrics published an article in 2008 concluding that infants exposed to infant care products (i.e. baby shampoo, baby lotion and baby powder) showed increased levels of phthalate metabolites in their urine.
  - ❖ Prompted FDA to survey infant/children cosmetic products to determine the levels of phthalates they contain.



# Phthalates and Children's Health

- EPA has established a "Chemicals of Concern" list to which phthalates are included.
- EPA is concerned about phthalates because of their toxicity and the pervasive human and environmental exposure to these chemicals.
  - ❖ Recent scientific attention has focused on whether the cumulative effect of several phthalates may multiply the reproductive effects in the individual exposed.



# How Children are Exposed to Phthalates

- Children, like adults, are exposed to phthalates by eating and drinking foods that have been in contact with containers and products containing phthalates.
- To a lesser extent exposure can occur from breathing in air that contains phthalate vapors or dust contaminated with phthalate particles.
- Young children may have a greater risk of being exposed to phthalate particles in dust because of their hand-to-mouth behavior.



# Ways to Reduce Exposure to Phthalates

- Read the ingredients label. You can identify phthalates in some products by their chemical names, or abbreviations:
  - ❖ **DBP** (di-n-butyl phthalate) and **DEP** (diethyl phthalate) are often found in personal care products, including nail polishes, deodorants, perfumes and cologne, aftershave lotions, shampoos, hair gels and hand lotions.
  - ❖ **DEHP** (di-(2-ethylhexyl) phthalate or Bis (2-ethylhexyl) phthalate) is used in PVC plastics, including some medical devices.
  - ❖ **BzBP** (benzylbutyl phthalate) is used in some flooring, car products and personal care products.
  - ❖ **DMP** (dimethyl phthalate) is used in insect repellent and some plastics.



# Ways to Reduce Exposure to Phthalates

- Be wary of the term "fragrance," which is used to denote a combination of compounds, possibly including phthalates, which are a subject of recent concern because of studies showing they can mimic certain hormones.
- Choose plastics with the recycling code 1, 2 or 5. Recycling codes 3 and 7 are more likely to contain phthalates.



# The Future of Environmental Health

- An ever-expanding population will require additional resources, produce more pollution, and pose new risks and present new challenges to protecting children's health.
- Familiar and emerging hazards will cause controversy and debate and require new research and innovation.



# Future Goals of Environmental Health

- Ensure an environment that will provide:
  - ❖ optimal public health and safety,
  - ❖ ecological well-being, and
  - ❖ quality of life for current and future generations.



# Future Expectations for Environmental Health

- We do not live in a risk-free society, and “zero-risk” is **NOT** a common goal for environmental health.
- Zero-risk is not a goal or standard because it is:
  - Unnecessary,
  - Economically impractical, and
  - Unattainable,
- The pursuit of zero-risk may create unfounded public concern when zero-risk is not attained.



# The Future of Children's Environmental Health

- Protecting children from environmental health risks begins at home.
- Individuals can take actions to make the environments where their children play, learn and live safer.
- Individuals must support efforts undertaken by organizations in the public and private sectors to improve risk assessment and provide a safe environment for children.



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Questions?



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