

Pediatric Environmental Health: Introduction & Regional Resource

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PEHSU

Pediatric Environmental
Health Specialty Units

Outline



- Children's health and environmental exposures
- Children are not small adults
- Exposure characterization/
exposure history
- PEHSU: your regional
resource
- PEHSU regional statistics

What is Environmental Health?

Economic

Psychosocial

Genetic

Environment

Diet

Air

Water

Built/Physical

Disease Burden

Child health problems linked to environment

- Acute poisoning – pesticides, CO, lamp oil, cleaning agents
- Asthma-ETS, Outdoor Air Pollutants: particulates, sulfur dioxide, ozone, mold
- Neurodevelopmental disorders: Lead, PCBs, Mercury, Pesticides, CO Synthetic chemicals
- Reproductive/Endocrine disorders: Perchlorate, DDT, Phthalates, Bisphenol A
- Pesticides, Radon, EMFs, Solvents, Synthetic Chemicals
- Obesity: Built/Physical Environment





Children are Not Small Adults

- May receive higher doses of environmental contaminants
 - Breathe more air per kg of body weight
 - Drink more fluids per kg of body weight
 - Eat more food per kg of body weight
 - Diet often differs from that of adults
 - Larger skin surface in proportion to their body volume
- May respond to contaminants differently
 - Children are developing with dynamic organ systems
 - Latency

Behavioral factors that may ↑ exposure



- Crawl on the floor
- Are closer to the ground
- Put things in their mouths
- Ingest inappropriate things such as dirt, paint chips or magnets
- Spend more time outdoors and are outside at different times than adults
- Limited or no hazard avoidance

Environmental releases

Transport, dilution, transformation

Environmental concentrations contacted by people

However....

Exposure \neq disease

Importance of Environmental history



Case 1

- Family with 14 yo son
- Contamination was discovered under their home following sale of adjacent property
- Soil and groundwater/drinking water contaminated
- Family outdoor cat & dog died from cancer in past 2 yrs

Family Concerns

Health implications?

Medical testing recommended?

Environmental Health History

- Where do they live?
 - Rural home exposures – well water, CO, radon, agriculture
 - Urban – close to industrial area, dirt/dust, mold, traffic
- Where do they play?
 - School yard, friends' homes. . .
- Is anyone else/friend sick?
 - Kids playing in the same area/location with symptoms?
- Parental Occupations/Hobbies?
 - Radiator shop, pesticide applicator
 - Pottery, stained-glass windows
- Smoking/Pets
- Dietary: fish, supplements; Alternative therapy: chelation



Exposure Intensity

- Contaminant concentration in a matrix
 - Water, air, soil, dust, wipe samples
- Duration and frequency of exposure, or amount ingested
 - Minutes, hrs, days, weeks, months, yrs
- Contaminant inherent toxicity
 - Dose to target organ, latency, timing, etc
- Routes of Exposure
 - Inhalation
 - Ingestion
 - Skin Absorption
 - Bite or sting

Case Environmental Exposure History

- Rural, park-like setting, 16 yrs in the home
- No family members symptomatic
- Parental occupations, hobbies, smoking, pets, dietary factors, etc. non-contributory

Case Environmental Contaminants

BTEX and PAHs exposures

- Benzo-a-pyrene in well water
 - low, variable (seasonal) concentrations
0.2 & 0 PPB (no other PAHs)
 - MCL 2 PPB-not risk based
- Air samples collected in living room
 - Benzene 1.2 ppb (ACGIH 500 ppb)
 - Toluene 4.1 ppb (ACGIH 20,000 ppb)

BTEX, PAH Toxicity

- BTEX (benzene, toluene, ethylbenzene, and xylene) gasoline fingerprint (focus benzene)
 - Blood disorders including aplastic anemia and leukemia (cancer of blood forming organs)
- Benzo-a-pyrene (PAHs)
 - Probable lung, skin and bladder carcinogen in occupationally exposed (2A IARC), smokers

Exposure Considerations

- Chemicals of concern known
- AIR & WATER exposure data for substances of concern
- Good understanding of Routes of Exposure
- Limited understanding Duration of exposure
- Have some reference values
- Toxicity literature developed from occupational and other sources

***Information sufficient for development of an informative health risk message for the family

BTEX PAH Case Conclusion

- Both properties remediated
 - 955 tons of contaminated soil removed
- Family initially used bottled water, shower filters. Later connected to city water

Health Risk Message to Family

- Risk Communication: Benzene associated with blood disorders including aplastic anemia/leukemia
- Recommended Family Medical Evaluation
 - Annual complete blood testing to screen for development of abnormalities in blood cells

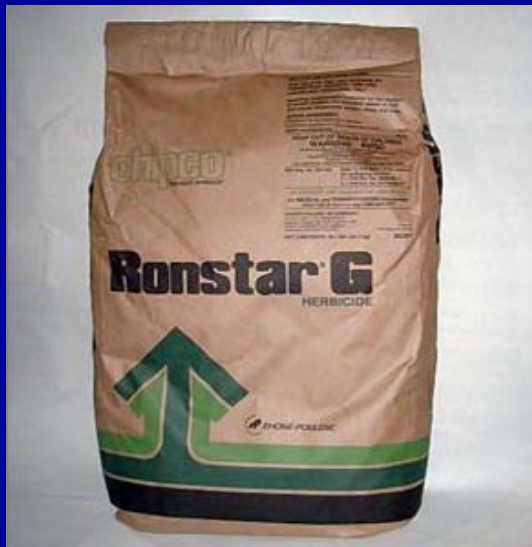
Case 2 Herbicide exposure

- Family (11 & 12 yo sons) exposed to herbicides after commercial residential application
- Dust entered townhouse via open below ground window & two fresh air intakes
- Casoron (4% dichlorbenil) & Ronstar G (2% oxadiazon)
- No inert ingredient info from manufacturer



Symptoms

- Boys entered home after school. One son went to basement and immediately felt dizzy and started coughing.
- Mom noted strong chemical odor later
- All occupants described feeling dizzy, developing sore and burning throats, cough, and a chemical taste in the mouth on that day
- Chemical taste in the mouth and sore throat continued for a few days



Family Questions

- Any chronic health concerns from the an incident of acute symptomatic pesticide exposure?
- Pesticide dust clean-up plan?



WSDA Investigation

- Wipe samples 17 and 22 d post application
- Oxadiazon detected in small quantities in all samples: higher concentrations found inside and exterior air intakes
- Dichlobenil detected in low quantities on the air intakes. Not detected on the window sill, storage shelves, or the room heater filter
- Several citations issued

Measurement Cost <\$50/sample (self-collection)

- Lead and other heavy metals in paint, soil, water, household dust, spices, etc
- Drinking water contaminants: nitrates, other heavy metals, microbiological contamination
- Radon in air





Measurement Cost
\$50 - \$200/sample

- Organic chemicals in water (gasoline, heating oil fingerprints)
- Pesticides or pesticide residues in/on water, food, grass, toys
- Community exposures to industrial emissions

Measurement Cost: Expensive \geq \$200



- Lead air, wipe clearance sampling
- Particulates, organic contaminants (gasoline) in air
- Mercury contamination
- Indoor mold
- Asbestos bulk, post remediation clearance sampling
- Chemical identity unknown \gg \$200



Testing Not Recommend When

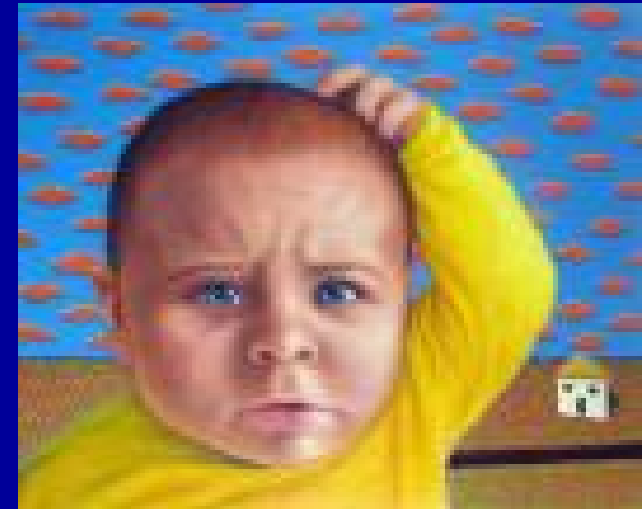
- Limited, no published literature
- Consensus reference levels not established for children
- Laboratory methods not standardized
- Analysis not available commercially

Because

- Once results exist, pressure to develop a health risk message
- Health risk message development difficult without reference values and literature

Exposure Reference Values

- ATSDR Toxicological Profiles
 - International (WHO, IARC)
 - National & State Air
 - OSHA, ACGIH, EPA, etc
 - Air 1, 8, 24 hr standards
 - National & State Water
 - National & State Other
 - Food (lead in ceramics), Soil, Dust (indoor HUD)
 - Food (fish) consumption advisories



Case 2: Herbicide Exposure

Considerations

- Some chemicals identified
 - Inert ingredients not disclosed
- Wipe samples confirm residential contamination
- Good understanding of Routes of Exposure (inhalation, ingestion, absorption)
- Know duration of exposure



Herbicide Exposure Considerations

- Food reference values, crop PPE and reentry info
 - Have fairly good literature base on these substances from occupational and other sources
- ***Pretty good info for development of a health risk message for the family

Health Conclusions

Acute irritant toxicity to oxadiazon & dichlobenil - now resolved

Subchronic-chronic implications?

Child 1: New episodes hives & worsening allergic rhinitis

Evidence review: neither classified as skin sensitizer, no human case reports of this type of symptomatology

Chronic toxicity primarily liver/kidney/blood chemistry changes
(animal studies)

Dichlobenil = Possible human carcinogen

Oxadiazon = Likely human carcinogen

Risk message: Blood tests for kidney/liver function and blood chemistry = normal, reassuring. Negligible influence on cancer risk given brief exposure (non chronic). No evidence of influence of these active ingredients on allergic disease – Inerts??

Clean-Up Recommendations

- Label external furnace/air intakes and prohibit application near intakes
- Use HEPA vacuum to minimize airborne dust
 - Avoid dry sweeping. Use a dry rag as necessary
 - Avoid use of water (may activate residual chemicals)
- PPE
 - Chemical resistant gloves
 - Long sleeved shirt and long pants
 - No respiratory protection warranted
- Furnace duct cleaning NOT recommended
 - For peace of mind, owner may choose to have ducts cleaned

NW Pediatric Environmental Health Specialty Unit

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Pediatric Environmental Health Specialty Units

- “PEHSU”
- medical information and advice on environmental conditions that influence children’s health.
- Sponsored by the US EPA and CDC- ATSDR



National PEHSU Network

- Each PEHSU represents a region of the EPA
- academic research institutions
- International PEHSUs



PEHSU SERVICES



- Consultation on the prevention, diagnosis, management, and treatment of environmentally-related health effects in children
- Training for clinicians on pediatric environmental medicine
- Expert advice for government, non-profit agencies, families, community groups and the media



PEHSU Experts:

- Pediatricians & Occ/Env Physicians
- Toxicologists
- Epidemiologists
- Exposure Scientists
- Others

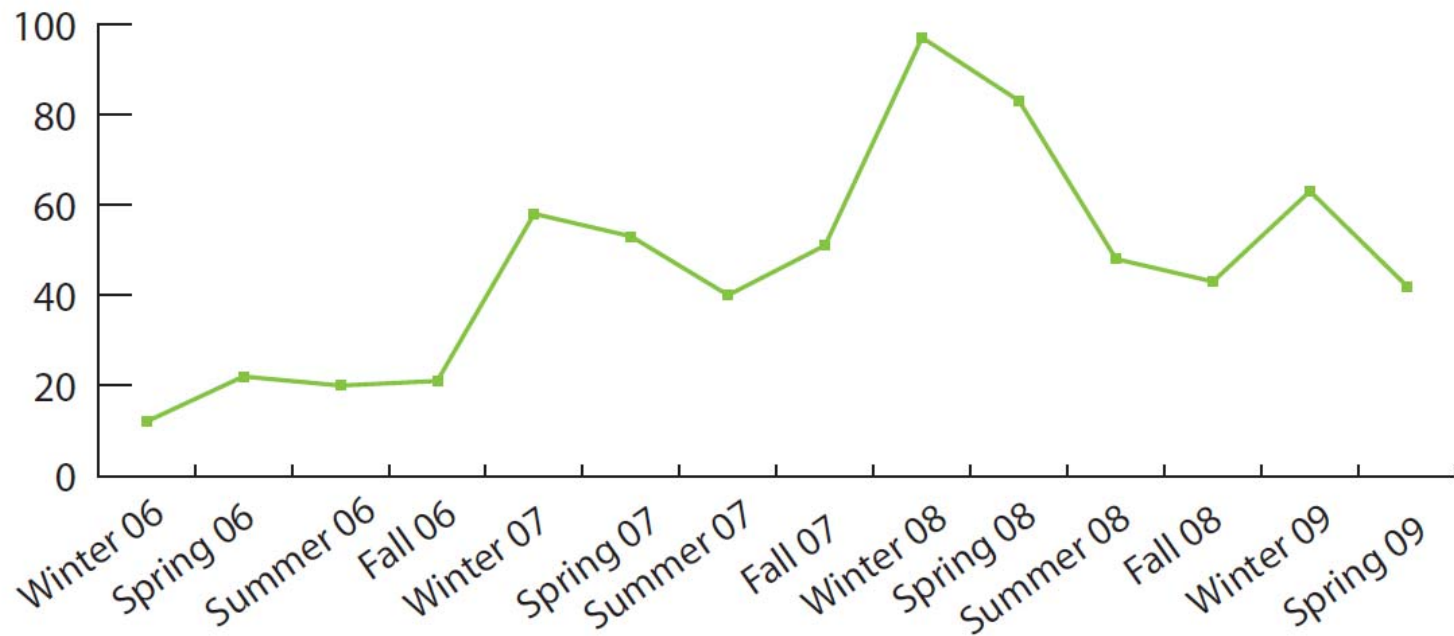




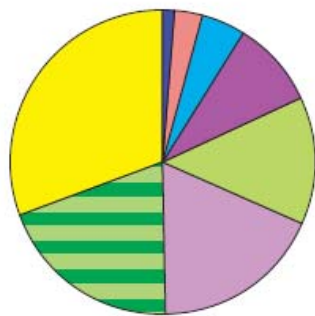
- Created in response to growing concern about environmental health


- Database established in 2006
 - Who?
 - What?
 - Where?

Quarterly Contact Data



Role of Client




 Clinicians, 31%


 Gov. & Public Health Agencies, 20%

 Parents, 19%

 Media, 14%

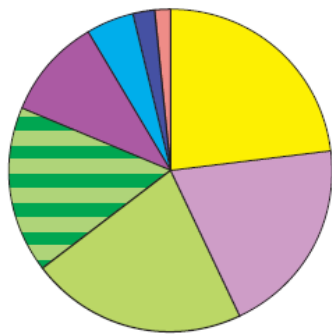
 Other, 10%

 Students/Trainees, 5%

 Unknown, 3%

 Academic Community, 1%

Substances of Concern



Metals, 23%

Plastics, 20%

Indoor Air Quality, 16%

Pesticides, 10%

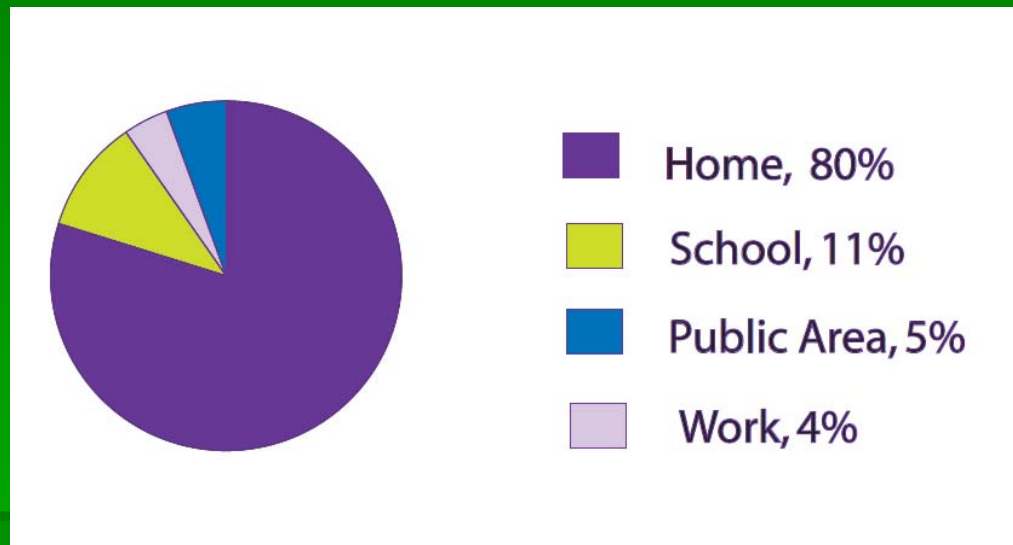
Organic Solvents, 6%

House Hold Products, 2%

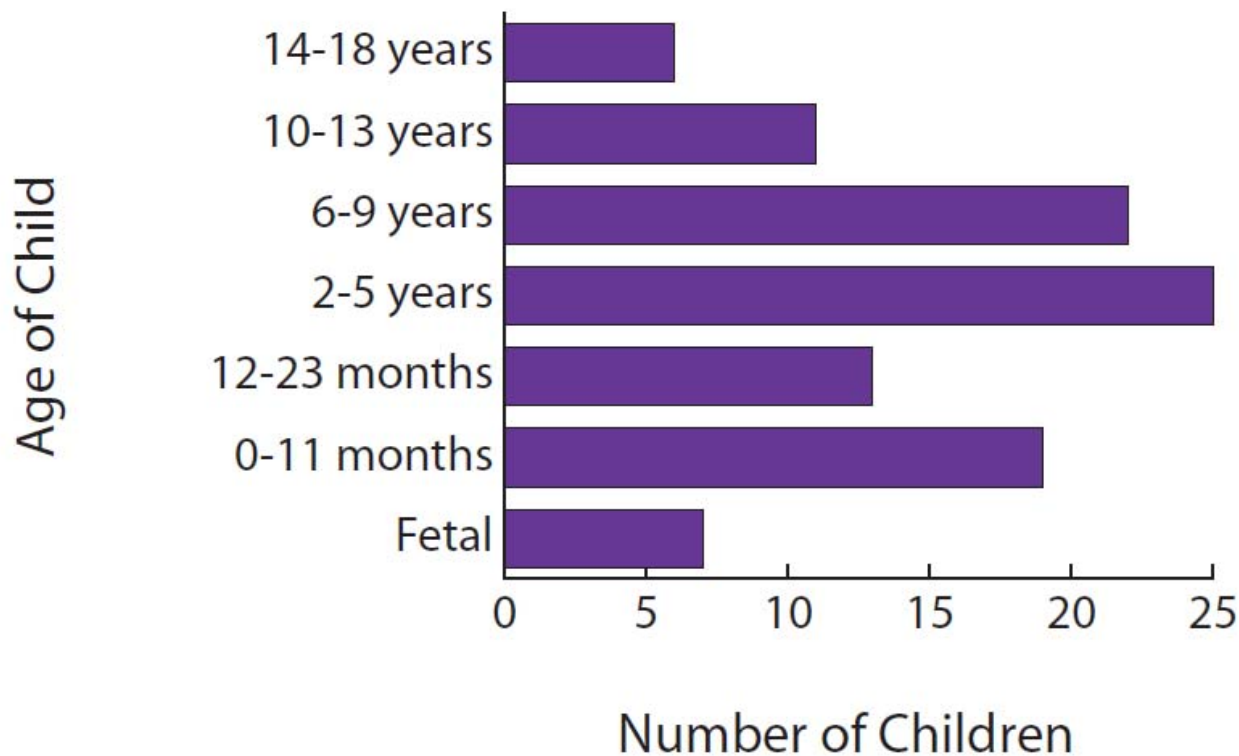
Outdoor Air Quality, 2%

Other, 21% (Electromagnetic Fields, Artificial Turf, melamine)

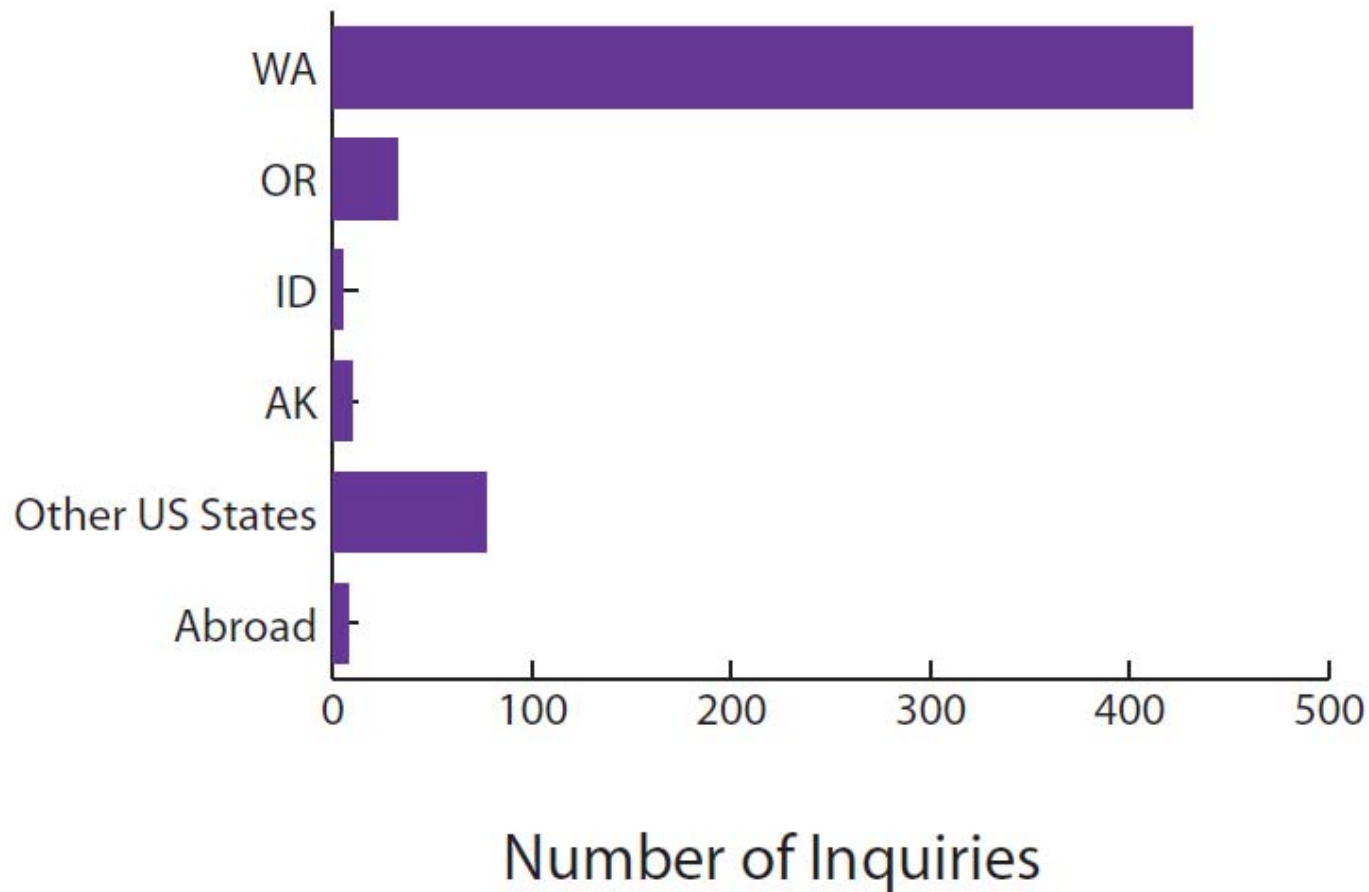
Setting of Concern



Age range of children concerned



Geographic distribution of inquiries



PEHSU Projects



- International PEH
- Factsheets

Vietnam

- Long term goal: Establish PEH capacity in Vietnam
- Identify and engage key PEH leaders and interested parties
- PEH training



Survey says...

- Knowledge and training in PEH was very limited among pediatricians in Vietnam
- Formal survey reveals: 75% of 141 survey respondents reported no specific PEH training.
- 82% reported the role of environmental factors in child health is very important
- 62% of questionnaire respondents were very interested in more training on PEH

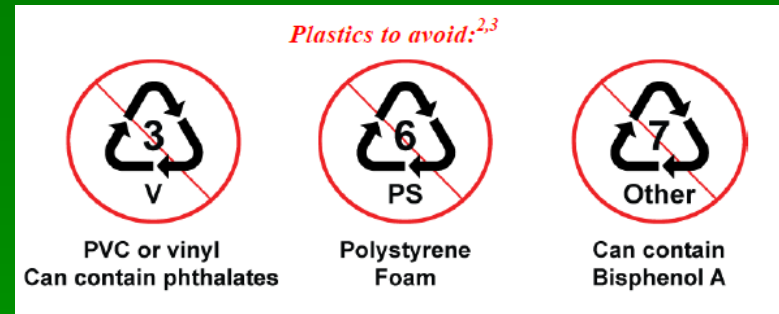
Next steps

- Develop a training program to support children's environmental health academic leadership in Vietnam
- Identify opportunities for data collection on children's environmental health indicators in Vietnam

Factsheets

- Translate research into relevant information for clinicians and patients
- PEHSU network review
- What does a provider need to know?
- In as few pages as possible

Plastics



- Bisphenol A and Phthalates
 - Health care providers: Guide for counseling families with questions about plastics
 - Consumers: Guide to choosing safer plastics

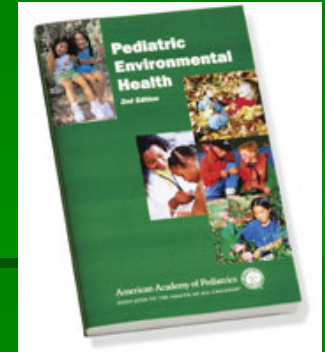


More Factsheets

- Melamine
- Wildfires:
acute and
recovery stages
- Floods and
Hurricanes:
returning
afterword
- Flame Retardants



Resources



- National PEHSU website www.pehsu.net
- Pediatric Environmental Health Toolkit (CME)
http://www.atsdr.cdc.gov/emes/health_professionals/pediatrics.html
- American Academy of Pediatrics. Handbook of Pediatric Environmental Health (most recent 2nd edition November 2003)
- *Environmental Health Perspectives* – NIEHS sponsored peer reviewed monthly. Section on children's health. Free online access.
<http://ehp.niehs.nih.gov/>

EPA Children's Environmental Health Excellence Award recipient 2007



Contact us!



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