



2006

Children's Environmental Health
Recognition Award



The Home & Human Health Emerging Issues

Jerome A. Paulson, MD, FAAP

Professor of Pediatrics & Public Health

George Washington University

Medical Director for National & Global Affairs

Director, Mid-Atlantic Center for Children's Health & the
Environment

Child Health Advocacy Institute

Children's National Medical Center



Child Health
Advocacy Institute

Mid-Atlantic Center for Children's Health & the Environment - MACCHE

www.childrensnational.org

Dr Paulson has **NO** conflicts of interest to declare.



- This material was developed by the Mid-Atlantic Center for Children's health & the Environment and funded under the cooperative agreement award number 1U61TS000118-03 from the Agency for Toxic Substances and Disease Registry (ATSDR).
- Acknowledgement: The U.S. Environmental Protection Agency (EPA) supports the PEHSU by providing funds to ATSDR under Inter-Agency Agreement number DW-75-92301301-0. Neither EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications.



VISION



Child Health
AdvocacyInstitute

Mid-Atlantic Center for Children's Health & the Environment - MACCHE

www.childrensnational.org

MACCHE – A Resource for the Region



- One of 10 Pediatric Environmental Health Specialty Units (PEHSUs) in the US
- Serve DE, PA, MA, VA, WV, and DC
- Source of Education
- Source of Information



PEHSU Regions



What Kinds of Problems does MACCHE Deal With?



- Lead poisoning
- Pesticide exposures
- Sick building problems
- Water pollution
- Air pollution
- Job related exposures in adolescents
- Volatile Organic Compounds
- Exposure to hazardous waste sites
- Environmentally related asthma
- Agricultural pollutants
- Solvents
- Carbon monoxide
- Arsenic
- Mercury

MACCHE – Contact Information



- www.childrensnational.org/MACCHE
- macche@childrensnational.org
- 202-471-4829
- 866-622-2341



Objectives



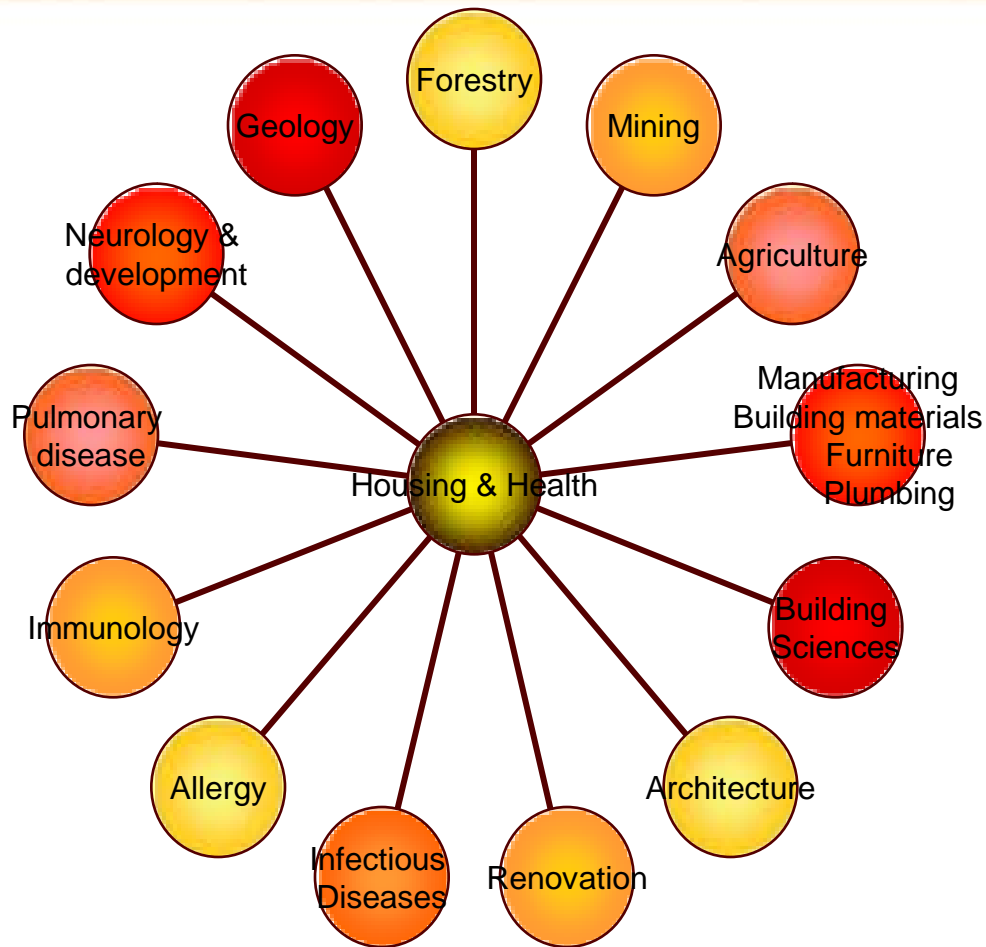
- Upon completion of this activity, the participant should be able to:
 - Recognize the impact of the home environment on the health of children.
 - Incorporate that information into patient evaluations.
 - Integrate the information into care management plans for patients..



Visions of Housing & Health



Fields of Study Related to Housing & Health



New Building - Existing Building



- New
 - Siting issues
 - Building materials
 - Removal of waste
 - Design issues
 - Lighting
 - Ventilation
- Existing
 - Cleaning
 - Maintenance
 - Renovation





Report on the WHO technical meeting on quantifying disease from inadequate housing

Bonn, Germany, 28-30 November, 2005

http://www.euro.who.int/Document/HOH/EBD_Bonn_Report.pdf



**Child Health
Advocacy Institute**

Mid-Atlantic Center for Children's Health & the Environment - MACCHE

www.childrensnational.org

Sufficient Evidence (WHO, 2005)



- **PHYSICAL FACTORS:**
 - Cold indoor temperatures and winter excess mortality
 - Heat and related temperatures and winter excess mortality
 - Energy efficiency of housing and health
 - Radon exposure in dwellings and cancer
 - Neighborhood and building noise and related health effects
- **SOCIAL FACTORS:**
 - Multifamily housing, high-rise housing, housing quality and mental health
- **CHEMICAL FACTORS:**
 - ETS exposure in dwellings and respiratory and allergic effects
 - Lead-related health effects
- **BIOLOGICAL FACTORS:**
 - Humidity and mold in dwellings and related health effects
 - Hygrothermal conditions and house dust mite exposure



Some Evidence (WHO, 2005)



- **PHYSICAL FACTORS:**
 - Ventilation in the dwelling and respiratory and allergic effects
- **CHEMICAL FACTORS:**
 - VOCs and respiratory, cardiovascular and allergic effects
- **BIOLOGICAL FACTORS:**
 - Cockroaches and rodents in dwellings and respiratory and allergic effects
 - Cats, dogs and mites in dwellings and respiratory and allergic effects
 - Pets and mites and respiratory, allergic or asthmatic effects
- **BUILDING FACTORS:**
 - Sanitation and hygiene conditions and related physical health effects
- **SOCIAL FACTORS:**
 - Social conditions of housing and fear/fear of crime
 - Poverty and social exclusion and related health effects
 - Crowding and related health effects
 - Social factors/social climate and mental health



Insufficient Evidence (WHO, 2005)



- Lighting conditions in the dwelling and mental and other health effects
- Particulate matter in indoor air and respiratory and allergic effects



Housing & Human Health



- Radon
- Lead
- Mold
- Pesticides in the home



Radon

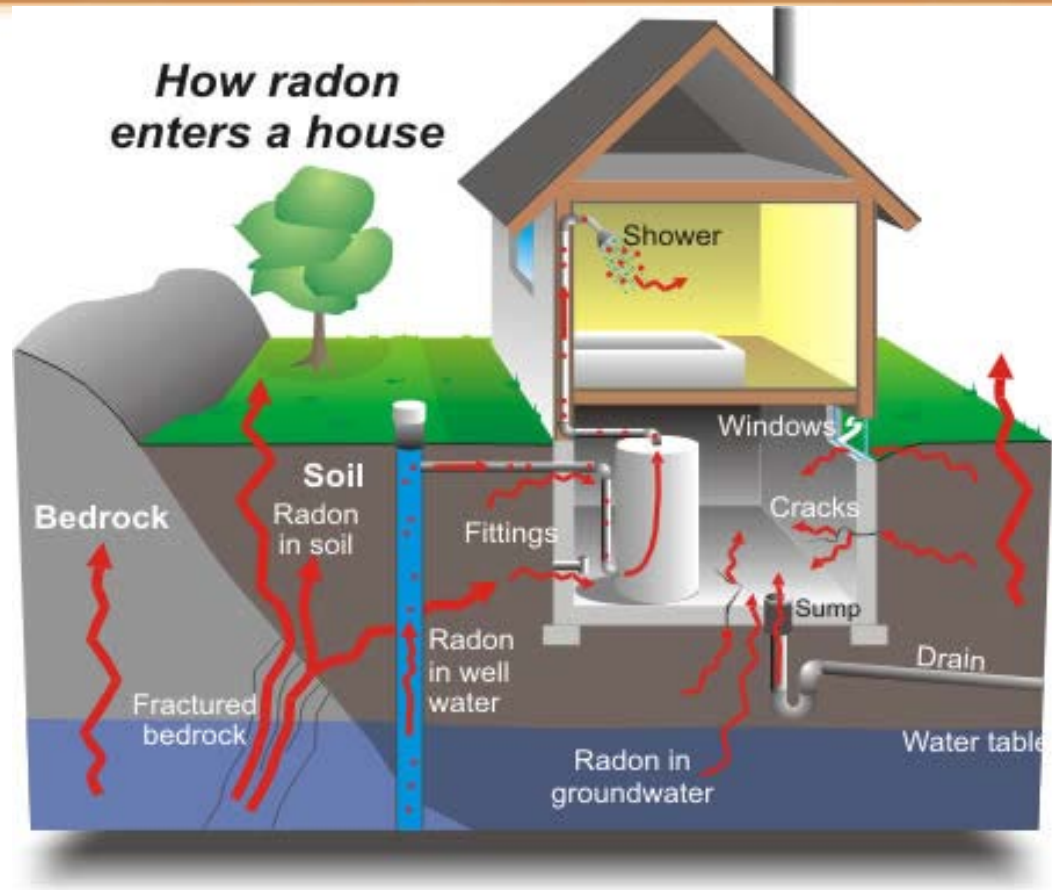


Child Health
AdvocacyInstitute

Mid-Atlantic Center for Children's Health & the Environment - MACCHE

www.childrensnational.org

How Radon Enters a House



http://geopanorama.rncan.gc.ca/whitehorse/radon_e.php?p=1



Radon as Health Hazard



- Radon chemically inert and electrically uncharged
- Radioactive
- Decay produces radon progeny
- Inhaled into the lungs attached to dust
- Emit alpha radiation
- Disrupts DNA of these lung cells
- Exposure to alpha radiation may lead to development of cancer



Radon as Health Hazard



- Radon clearly associated with lung cancer in miners
- Exposed to much higher concentration of radon than in homes
- Many smokers, most males and exposed to dust and other hazards



Radon as Health Hazard



- Committee of National Academy of Sciences estimates 15,400 or 21,800 cases of lung cancer per year in the United States can be attributed to radon among ever-smokers and never-smokers together.
- Most of the radon-related lung-cancers occur among ever-smokers

http://books.nap.edu/openbook.php?record_id=5499&page=R1

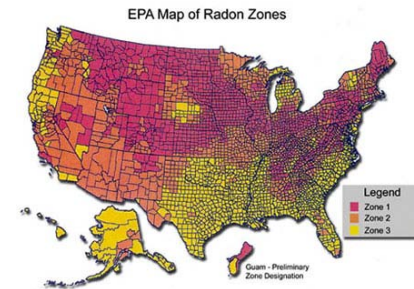


Radon & Homes



- Issue varies in different parts of country
- How to build to limit radon incursion?
- How to monitor home over time as basement floors and walls change?
- Cost-effective amelioration methodologies?
- Delaware – generally low risk
- DE Division of Public Health

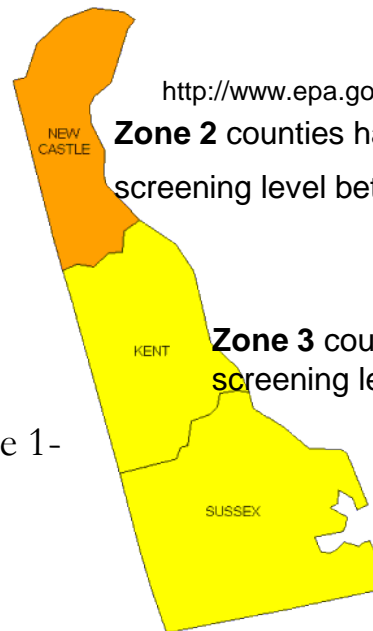
Radon Office
417 Federal Street, Dover, DE 19901
Phone (302) 744-4546 or DE Helpline 1-800-464-4357
E-Mail: dhssinfo@state.de.us



<http://www.epa.gov/radon/zonemap.html#more%20about%20the%20map>

Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L (**orange zones**)

Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L (**yellow zones**)



Lead



It is 2012!

**Why are we still
talking about lead????**



Child Health
AdvocacyInstitute

Mid-Atlantic Center for Children's Health & the Environment - MACCHE

www.childrensnational.org

Scope of the Problem



- An issue with pre-1978 housing
- Have the potential to eradicate childhood lead poisoning
 - “...an estimated 25% of the nation's housing (equivalent to 24 million housing units) had significant lead-based paint hazards in the form of deteriorated paint, dust lead, or bare soil lead.” (Jacobs, et al. 2002. Environ Health Perspect 110:A599-A606)



Impact of Lead on the Body



- Function of
 - Age of child
 - GI absorption
 - Amount ingested
 - Length of time of exposure
 - Peak BLL vs. cumulative



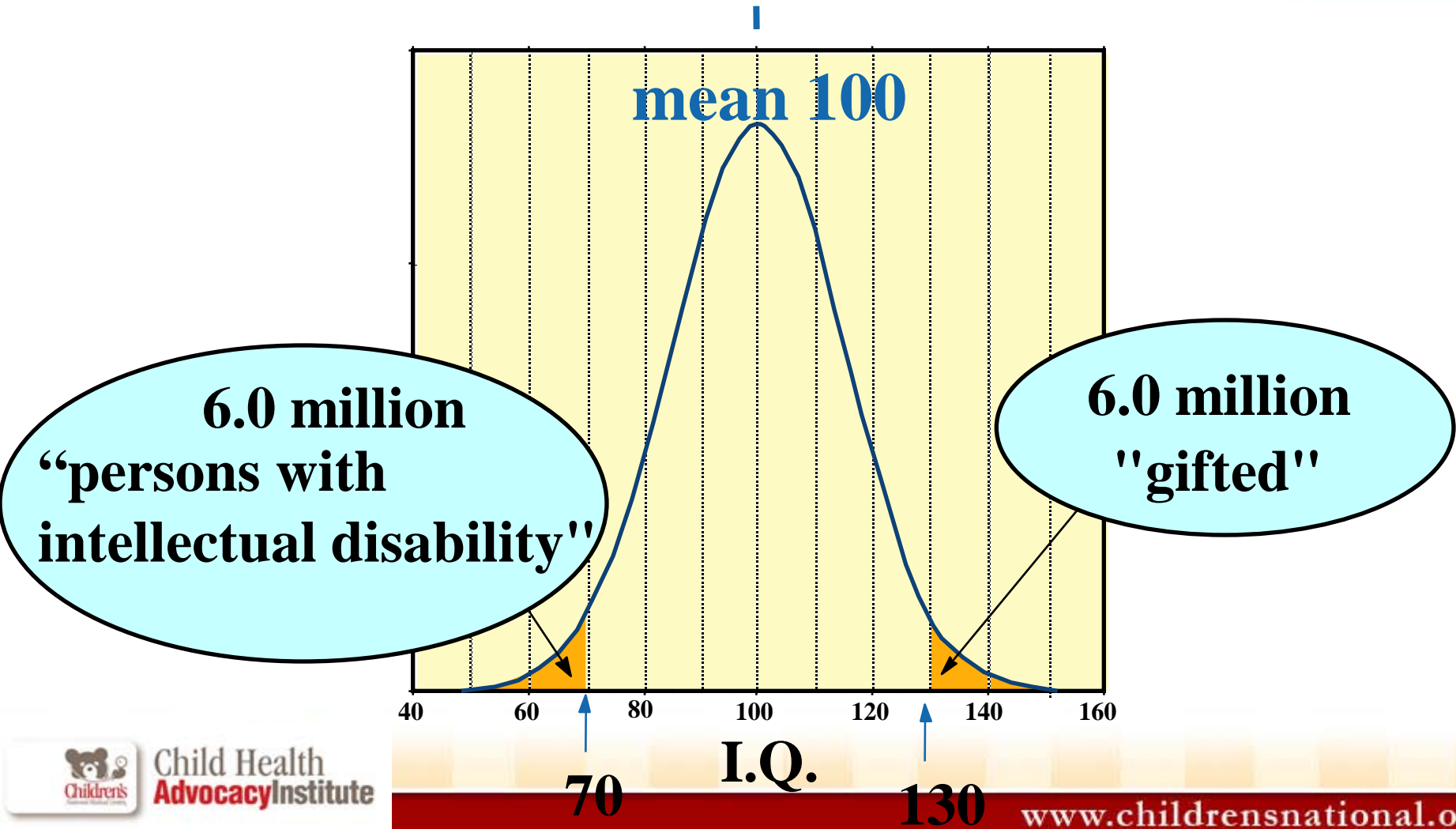
Impact of Lead on the Body



- Blood lead levels in children $< 10 \mu\text{g}/\text{dL}$
 - Learning disabilities
 - Hyperactivity
 - Aggression and other behavior problems
 - Decreased IQ
 - Decreased linear growth
- New CDC Reference Value for lead $5 \mu\text{g}/\text{dL}$



Normal IQ Distribution



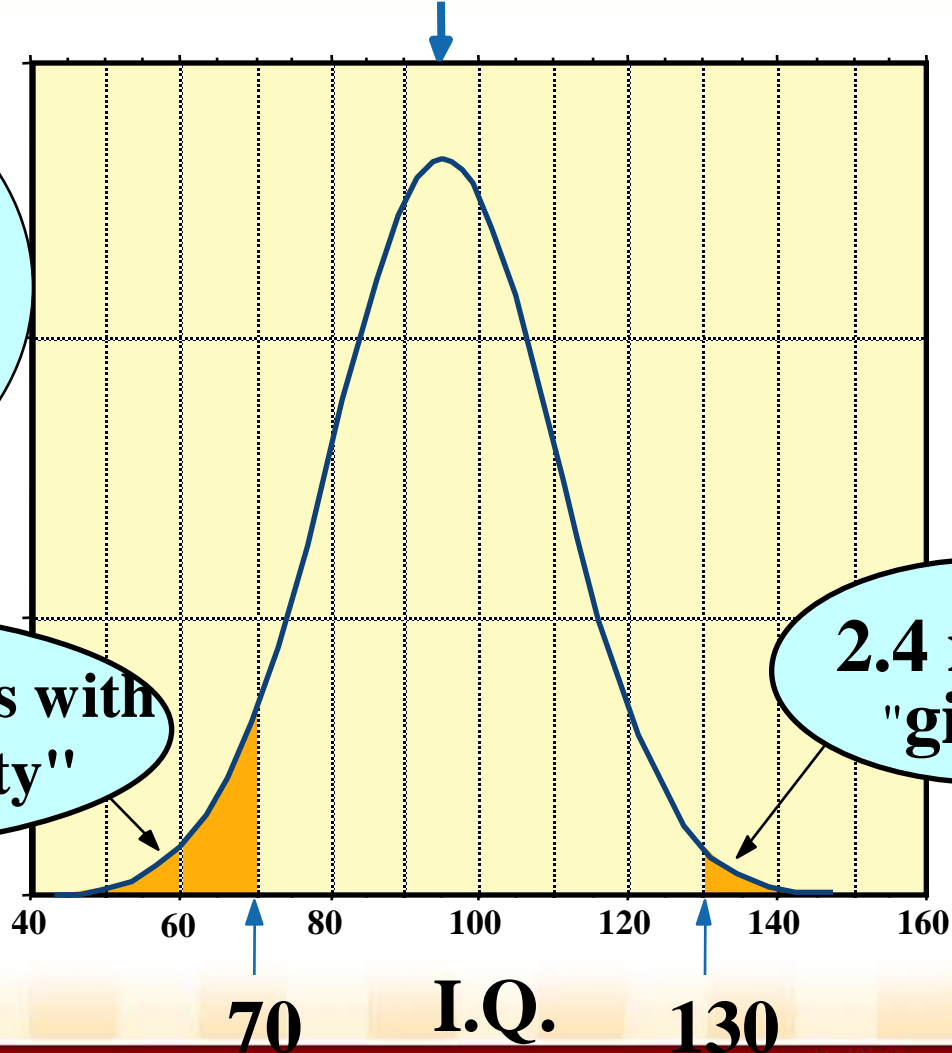
Effects of a 5 Point Decrease in Mean IQ

mean 95



57% INCREASE
IN
“Persons with Intellectual disabilities”

9.4 million “persons with intellectual disability”



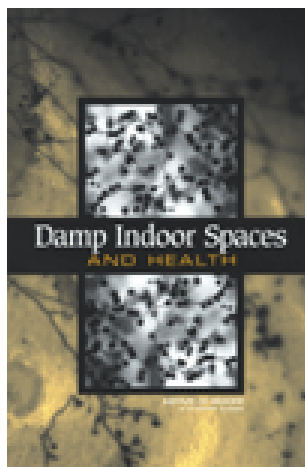
2.4 million "gifted"

Lead & Homes



- Primary Prevention the Only Appropriate Solution
 - Screening of children (secondary prevention) may have been appropriate in the past
 - Making housing lead-safe is appropriate now and in the future
 - Immoral & unethical to use children to identify substandard housing
 - What legal mechanisms do we need to screen homes and make dangerous homes lead-safe?





Damp Indoor Spaces and Health

Institute of Medicine
National Academy of Sciences

http://books.nap.edu/catalog.php?record_id=11011

What happens in damp buildings?

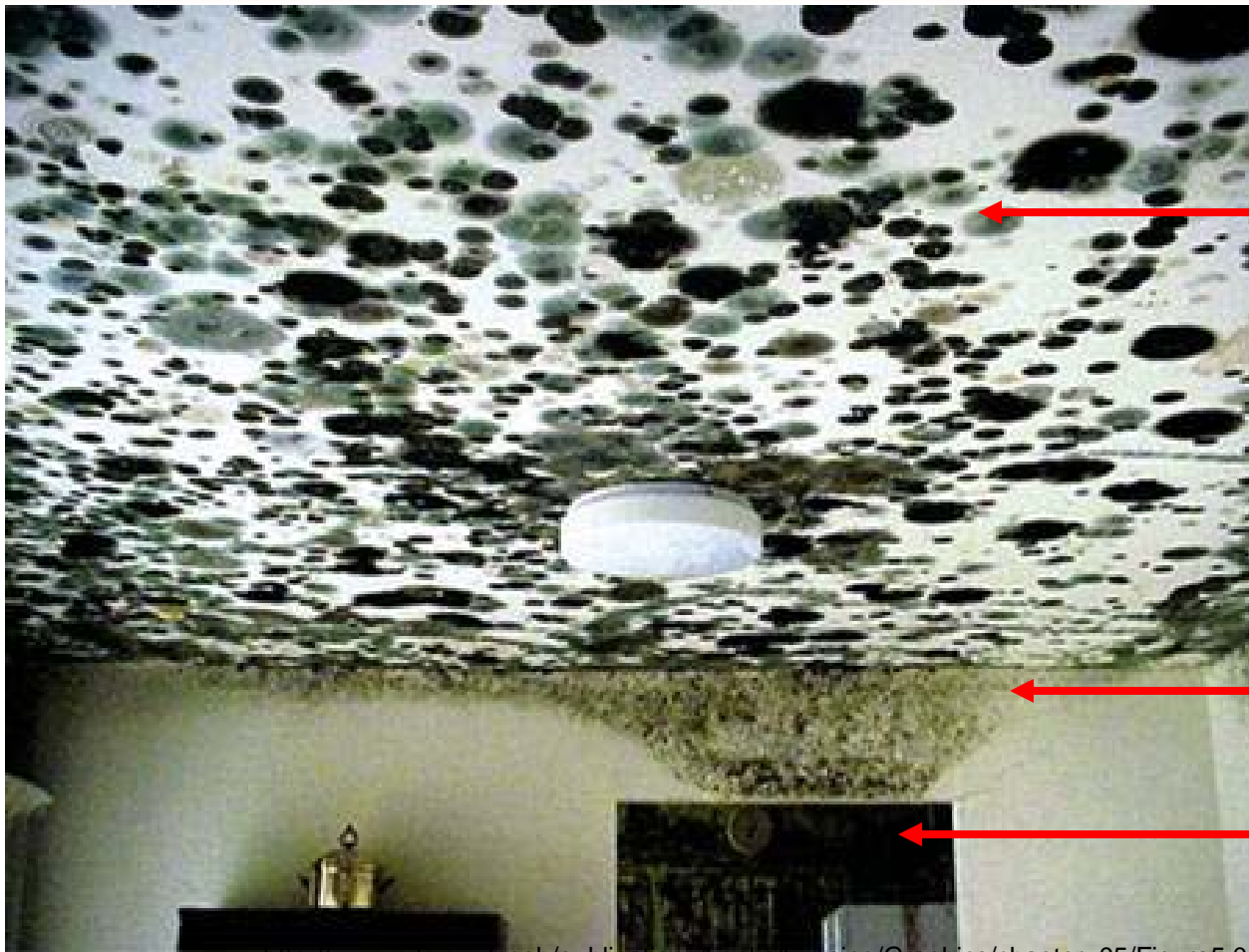


- May get increased growth of mold – fungus – mildew
 - Different terms meaning the same thing
 - All indoor space has some mold
 - Mold and products of mold
- May get increased bacterial growth
 - Bacteria and products of bacteria
 - All indoor space has some bacteria
- May get increased dust mites
 - All indoor space, except the most dry or very cold, have some dust mites
- May get release of degradation products from break down of building materials



MOLD

Environmental Mold Exposure



Ceiling
heavily
contaminated
with mold

Wall

Door

http://www.cdc.gov/nceh/publications/books/housing/Graphics/chapter_05/Figure5.01.jpg



Child Health
Advocacy Institute

Mid-Atlantic Center for Children's Health & the Environment - MACCHE

www.childrensnational.org

Indoor factors supporting mold growth



- Nutrition - building materials
- Moisture - leaking roofs or pipes, condensation on or water intrusion through, walls or basements
- Inadequate and/or poorly maintained ventilation systems that
 - May not provide enough air for dilution and/or dehumidification
 - May contain sources of mold and/or disperse mold spores into the occupants' breathing zone





MOLD & DISEASE



Four ways that fungi can cause disease in humans (and animals)



- May be building related
 - Allergic or hypersensitivity reactions
 - Irritant reactions
 - Toxic reactions
- Not likely to be building related
 - Infections



Allergic reactions most common



- About 10% of the population has allergic antibodies to fungal antigens, and 5% have clinical illness
 - Allergic rhinitis (“hay fever”) or asthma
- Outdoor molds more abundant and important in airway allergic disease



Allergic Symptoms



- Nasal
 - Clear nasal discharge
 - Nasal congestion
 - Sneezing
 - Post-nasal drip with sore throat
 - Coughing
 - Hoarseness
 - Nasal obstruction
- Pulmonary
 - Asthma attacks in sensitized individuals
 - New onset of asthma



Molds & Volatile Organic Compounds



- Molds growth can → volatile organic compounds (VOCs) - alcohols, esters, aldehydes, and aromatic compounds
- VOC production varies with growth conditions



In higher concentrations, VOCs can be highly irritating



- Eye irritation and conjunctivitis
- Skin rashes
- Runny nose
- Laryngitis and hoarseness
- Cough
- Chest tightness
- Headache and fatigue



Mycotoxins



- Produced by some, not all molds
- Toxigenic species do not always produce mycotoxin - depends on various conditions
- Mycotoxins - large molecules
 - Not significantly volatile; i.e., don't "off gas"
 - Don't migrate through walls or floors



Exposure to Mycotoxins



- For inhalation must get fungal fragments or spores into air
- May cause skin irritation if contact fungi
- Can be toxic when ingested



Mold & Homes



- Issue varies in different parts of country
- How to build appropriately to control moisture?
- How to monitor home over time as the building envelope changes?
- How to repair home once moisture incursion has occurred?



Pesticide Exposure



Child Health
AdvocacyInstitute

Pesticides and Use



- Pesticide classification
 - By use: insecticides, fungicides, herbicides, and rodenticides, etc.
 - By chemical class: organophosphates, N-methyl carbamates, pyrethroids, triazines, and superwarfarins.
- 82% of US households report using pesticides
 - 3-4 different pesticides/home



Neurocognitive Impacts of Low-level Pesticide Exposure



- Growing body of evidence that low level, prenatal and early postnatal exposures to pesticides lead to adverse neurocognitive outcomes
 - Children not acutely toxic, no overt symptoms
 - At greater risk for development of learning disabilities, loss of IQ and attention problems
- Based on studies in Salinas Valley, CA (agricultural/outdoor use) and NY City (home/indoor use)



Neurocognitive Impacts of Low-level Pesticide Exposure



- Mothers chlorpyrifos metabolites in their urine and low activity of the enzyme paraoxonase (PON1), gave birth to infants with significantly reduced head circumferences compared with mothers with higher activity of PON1
- Children who have high chlorpyrifos exposure prenatally
 - increased risk of motor and cognitive development delay.
 - Significantly higher number of children manifested symptoms of inattention at age 3 years.
 - Decrease in FS IQ and working memory @ age 7



Neurocognitive Impacts of Low-level Pesticide Exposure



- In utero exposure to DDE significantly associated with lower scores on the Psychomotor Development Index (PDI) of the Bayley Scales of Infant Development (BSID-II) at 6 months and not at 12 and 24 months
- Increase in maternal serum DDT level associated BSID-II MDI at 12 and 24 months, respectively
- Significant inverse association between maternal serum DDT and the psychomotor development scores on the BSID-II at 6 and 12 months but not at 24 months



Other Concerns about Adverse Outcomes Related to Pesticide Exposure



- Number of ecologic and case-control studies have associated parental exposures or pesticide use in the home with childhood brain tumors, leukemias and lymphomas, and a number of other tumor types
- Birth defects studies have linked parental occupational pesticide exposure with cryptorchidism, orofacial clefts, limb reduction defects, and heart defects in their children



SUMMARY



- Housing influences health
- Somewhat different issues for new vs. existing housing
- Housing professionals & health care professionals have many areas where they can work together to improve individual and public health
- Need a holistic approach when dealing with housing issues in older homes





QUESTIONS?

