

**Overview of Potential Issues
Related to
Indoor Air & Environmental Quality
in the
Child Care/Day Care
Microenvironment**

APHA 2014, Maternal and Child Health Section: Session #42908

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**Occupational AND Non-occupational
Indoor Environments**

NOTE:

Our schools and day care/child care centers
can be viewed as special cases,
As they represent occupational settings for staff...

(teachers/professors, principals, physical education instructors,
coaches, administrators, nurses and clinic assistants, custodians)

Exposure Agent Categories

1. Biological agents
2. Chemical agents
3. Physical agents
4. Radiological agents
5. Social stressors: job decisions control, job demands, social support, time of day and/or schedule worked (shifts)

Important! Remember: mixtures of agents likely present!

Also, these agents in indoor microenvironments:

- May be in particle (biological and/or chemical in nature) or gas phase;
- Reactions on various surfaces can occur--byproducts are pollutants.

New area of scientific research = indoor air chemistry, with potential effects upon exposure, e.g., irritancy, asthma symptoms, neurological symptoms.

Role of Human Behaviors Indoors

- Operations and maintenance activities, in particular indoor cleaning; impacts differ by methods used....
Think! Sweep or mop (dry VS wet); dusting; varnishing; etc
- Use of various products indoors (besides cleaning)
For example, personal care products; teaching products like arts and crafts supplies; air fresheners; candles; incense
- Interior finish materials and furnishings selected
- Cooking and heating, especially space heating

Summary: Illness After Indoor Exposure

Acute Outcomes due to Acute Exposures: **Symptoms**

- Irritation of mucous membranes of the eyes, nose and throat, and of skin, i.e., **contact dermatitis and eczema**
 - This is different—common chemical sense—than two of our five senses, taste and smell (e.g., odor thresholds for VOCs, which are lower than known health sensitization and/or symptom thresholds)
- Respiratory illnesses and/or diseases with complex, multi-factor etiologies like **asthma, flu, etc** (e.g., cough, chest tightness, wheeze, shortness of breathe; runny nose, headache, etc.)

Summary: Illness and Diseases After Indoor Exposures

Chronic Outcomes due to Chronic Exposures

- More serious skin issues (eruptions, rashes, melanomas)
- Various cancers (lung, kidney, liver, bladder, prostate, etc)
- Lung diseases from dust, fibers (e.g., asbestosis)
- Repetitive stress disorders (e.g., carpal tunnel syndrome in wrists = peripheral nerve entrapment syndrome, "tennis elbow")
- Cardiovascular and neurological diseases
- Hearing loss, which is irreversible

NOTE:

"Sick building syndrome" ≠ "building related illness"

Biological Exposure Agents (bacteria, virus, fungi/mold)

To exist and grow indoors (I)—naturally are outdoors (O)—two factors are required for measures $I > O$:

1. Source of moisture!

- Leaks: under sinks, roofs, around windows and doors, concrete sub-surface, outer walls;
- Spills of water, juices, soda, coffee, tea

2. Source of food = cellulose-based materials!

- A building's construction and interior finish materials, and each room's furnishings

Also, heat (air temperature) plays a role (think about humidity definition).

Chemical Exposure Agents

- Organic chemicals, e.g., many volatile and semi-volatile toxic air contaminants / hazardous air pollutants (VOCs and SVOCs)
- Persistent organic chemicals, in several categories
- Heavy metals: lead, mercury, etc.
- Particles, of varying size ranges (PM₁₀, PM_{2.5}, PM_{0.1})
- Nitrogen oxides (NO_x, NO₂), sulfur oxides (SO₂)
- Carbon dioxide (CO₂)

WHY? Think about sources indoors, and outdoors, influencing indoor concentrations....

NOTE:

The presence, and levels, of these agents found indoors depends on their various sources—indoors and outdoors—as well as the design of the interior spaces and possible presence of "sinks" like carpets.... WHY?

VOCs, toxic and odorous

- Prevention = specifying or purchasing alternative interior finish materials, furniture, cleaning compounds, teaching tools, and personal care products
- Mitigation =
 - Lower air concentrations with adequate ventilation from maintained mechanical HVAC systems
 - Teachers can reduce or prevent occupant exposure by knowing when, how, and in what quantity cleaning and personal care products should be used

9

Polychlorinated Biphenyls (PCBs)

A persistent organic pollutant...

- Past and/or current sources: industrial, commercial
- Accumulate in fatty tissue → go up food chain...
- “Sinks” = electronic ballasts of lighting fixtures, and caulking along windows/window frames, etc.
- Prevention =
 - Specify available newer, safer fixtures and fluorescent bulbs—with no mercury—in new construction (read labels)
- Mitigation in existing, older schools =
 - Retrofits, replacement, with disposal as hazardous waste

10

Bisphenol A (BPA), and Phthalates (e.g., DEHP, DBP, DEP, DINP, BBzP)

- Sources
 - Soft, flexible plastic-based products, e.g., pacifiers, toys
 - Personal care products, e.g., nail polish, hair spray
- Hormone (endocrine) disruptors, carcinogens
- Prevention =
 - Buy alternative products (read labels!)
 - NOTE: Science now evolving on alternatives (BPC, BPF)
- Mitigation =
 - Minimize child’s mouthing of toys and other plastic products, which can be dirty—chemical + biological agent exposure—and if swallowed can cause choking

11

Pesticides

Mixtures with active and inactive ingredients

- Regulations and/or IPM policy at state or school district level for schools, but if teachers bring in...
- Prevention =
 - Use of non-toxic or least toxic products, IPM methods
 - Proper storage, preferably not on school grounds
- Mitigation =
 - Reduce occupant exposure by knowing when, how, and in what quantity to use products, and proper notification to teachers and parents (**risk communication**)
 - Ventilation with particle filtration to lower impact from outdoors, e.g., if in an agricultural area or near garden

12

Physical Exposure Agents (& Factors)

- Asbestos fibers-- if loose, not bound!
- **Light** (artificial—fluorescent or incandescent—or natural day lighting)
- **Temperature (T) and relative humidity (RH%)**
- **Noise: loudness (dB(A)), frequency (annoyance)**
- **Physical stressors:**
 - Vibrations
 - Forces: weight, bending, twisting repetition

Asbestos

- A natural occurring substance, six types
- Regulations/guidelines driven by **hazards of potential occupational exposure to friable form**
→ respiratory illness & lung cancer
- **Sources/"Sinks" in older buildings =**
 - Structural insulation, "cottage cheese" ceilings
- **Prevention =**
 - Do not disturb if known or suspected to contain asbestos in bound (non-friable) form!
- **Mitigation =**
 - If friable asbestos observed, relocate occupants + professional removal with containment procedures

14

Light

(fluorescent lighting, daylighting, skylighting)

- **Issues:** eye health; and, is there a link with learning and performance?
- **Guidelines:** IENSA (2000) = 50 ft-candles for low contrast materials, 30 ft-candles for high contrast
- **Prevention and Mitigation =**
 - Specify in new construction, or as a retrofit in existing classrooms, energy-efficient lighting options as economically feasible including fixtures without PCBs and fluorescent bulbs without mercury.
 - Maintain acceptable quantity and quality of lighting indoors = proper operation/maintenance, and rapid replacement of broken or exhausted fixtures and bulbs

15

Noise

(A-weighted decibels, frequency)

- **Sources =**
 - **People;** TVs, radios, HVAC systems, lighting fixtures, various outdoor influences
- **Regulations/guidelines: indoor background levels**
- **Role of interior finish materials: noise reduction coefficients, reverberation times**
- **Prevention and Mitigation =**
 - Do not yell at children, or among adults, for control
 - Maintain the HVAC and lighting systems
 - Do not allow construction activities during occupied hours in adjacent room (indoors) or outdoor area

16

Outdoors: Considerations Concerning Playground Equipment

- **Sandboxes:**
 - Sand or dirt (proximity to older buildings with peeling or exposed lead paint, thus releasing chips or a sweet dust)
 - Wood enclosure
 - Pressure treated with pesticide **chromated copper arsenate (CCA)?**
- **Play sets:**
 - CCA-treated wood, or plastics, or metal swings (can get hot in late spring and summer!)
- **Surface materials:**
 - Asphalt vs. grassy fields vs. rubberized ground mats
- **Regulations: voluntary agreements, phase-out CCA**

**Thank you for your attention
and attendance at this panel!**

Any questions?

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