Washington State Department of Health
Division of Environmental Health
School Indoor Air Quality Monitoring Project

Washington Resource Conservation Manager (RCM) Meeting
July 19, 2007
Washington Middle School
Olympia, Washington

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Outline

- DOH School EH&S/IAQ Program: What we do
- Authority and other IAQ Provisions/Guidelines/References
- EPA Tools for Schools Model
- Why is good IAQ so important in schools?
- Sources/types of air contaminants
- School IAQ monitoring project
- Sampling parameters/Reference values
- Next Steps
DOH School Environmental Health & Safety/Indoor Air Quality Program

Provide technical support & training to
- Local Health Jurisdictions (LHJs)
- Schools
- The public

Authority
RCW 43.20.050(2)(c) SBOH…Adopt rules controlling public health related to environmental conditions including but not limited to heating, lighting, ventilation, sanitary facilities, cleanliness and space in all types of public facilities including but not limited to food service establishments, schools, institutions, …
Chapter 246-366 WAC
Primary and Secondary Schools

- 030 Site Approval
- 040 Plan Review & Inspections
- 050 Buildings
- 060 Plumbing, Water Supply, & Fixtures
- 070 Sewage Disposal
- 080 Ventilation
- 090 Heating
- 100 Temperature Control
- 110 Sound Control
- 120 Lighting
- 130 Food Handling
- 140 Safety
K-12 Health & Safety Guide

A: General Procedures
B: Building Maintenance & Operation
C: General Safety
D: Plumbing, Water Supply, & Fixtures
E: Sewage Disposal
F: Indoor Air Quality
G: HVAC – Preventative Maintenance
H: Sound Control
I: Lighting
J: Food Service
K: Science Classrooms & Laboratories
L: Career & Technical Education
M: Blood borne Pathogens & Exposure Control Plan
N: Playgrounds
O: Animals in Schools
P: Emergency & Disaster Preparedness
Q: Pesticide Use in School
R: Visual & Performing Arts Education
S: Athletics
Other key IAQ reference documents

- School Indoor Air Quality Best Management Practices Manual (DOH and OSPI)
- Responding to Indoor Air Quality in our Schools (DOH and OSPI)
- EPA’s Tools for Schools Model
- EPA’s HealthySEAT
Schools in all 39 counties in the state receive food service inspections, construction plan review and complaint response from their local health jurisdiction.

Nine identified Local Health Jurisdictions have school programs with periodic routine inspections, serving a total of 36.3 % of the state’s school students.

*Based on October 2004 state enrollment data provided by Office of Superintendent for Public Instruction*
Why is good IAQ in schools important?

• Improved student concentration & performance
• Improved attendance
• Reduced asthma incidences
• Reduced # of allergic reactions
• Reduced incidences of chemical sensitivities
• Reduced incidences of respiratory problems
Sources of Air Contaminants in Schools

- Science laboratories
- Chemical storage/supply rooms
- Building materials
- Buses/cars
- “Air fresheners”
- Cleaning products
- Personal hygiene products
- Re-entrainment of exhaust air

- Highways/Roads
- Industries
- Agriculture
- Copiers/laminators
- Carpets/rugs
- Stuffed animals
- Upholstered furniture
- People
- Animals
Types of Air Contaminants found in Schools

- Particulates (dust)
- Lab chemicals
- Cleaning products
- Ozone
- Formaldehyde
- Glass fibers
- Pollens
- Lead
- Radon
- Mercury
- Pesticides
- Other VOCs
- Molds/spores
- Combustion byproducts
- Dust mites
- Asbestos
Where are the fresh air intakes?
Air Intake

Exhaust
Most portable classrooms suffer from lack of outside air
Ensure ventilation air is “clean”
Combustion By-Products
Un-vented laminators
90 % of schools use un-vented photocopierson
CO Alarm?
Carpets can contain huge amounts of allergens and asthma triggers.
Ditch the old couches
Asthma Trigger Reservoirs

Non-district furniture, rugs, blankets, pillows
Chemical Storage in Labs

Can you see the dozens of chemical bottles?
Strong sources can easily overwhelm ventilation
Why Collect IAQ Data???

- Identification and documentation of trends
- Proactive identification of health threats
- Policy development and implementation
- Assessment of intervention success
Bottom Line ~

“Children learn better and faculty perform better in a healthy indoor environment.”
School IAQ Monitoring Project:

➢ **Background:**

- CDC Environmental Public Health Tracking grant ~
  - 2004 ~ IAQ monitoring pilot project, three school districts.
  - 2006 ~ 5 monitoring stations.
  - 2007 ~ 12 additional stations purchased
    - High quality equipment
    - Consistency
    - Ease of use
School IAQ Monitoring Project

Current Vision

- School District
- ESD
- DOH
IAQ Sampling Parameters

- Carbon Dioxide
- Carbon Monoxide
- Particulates (6 particle sizes)
  - 0.3, 0.5, 1.0, 2.0, 5.0, 10 (units in micrometers)
- Temperature
- Relative Humidity
Significance of Sampling Parameters

- **Carbon Dioxide**: A bi-product of respiration, can accumulate in building spaces if sufficient amounts of fresh outdoor air is not brought into and distributed throughout the building. Carbon dioxide is a surrogate for indoor pollutants that may cause occupants to become drowsy, get headaches, or function at lower activity levels. It is a good indicator of the adequacy of ventilation.

- **Carbon Monoxide**: An odorless, colorless and toxic gas. At lower levels of exposure, CO causes mild effects that are often mistaken for the flu. These symptoms include headaches, dizziness, disorientation, nausea and fatigue. At higher levels, CO exposure can result in death.
- Carbon Dioxide -

$CO_2$ used to *estimate* the ventilation rate

*If $CO_2$ builds up: so does everything else!*
Significance of Sampling Parameters

- **Particulates**: Particulate matter is the term used for a mixture of solid particles and liquid droplets found in the air. Coarse particles (larger than 2.5 micrometers) come from a variety of sources including windblown dust and grinding operations. Fine particles (less than 2.5 micrometers) often come from fuel combustion, power plants, and diesel buses and trucks.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ASHRAE</th>
<th>OSHA PEL *</th>
<th>ACGIH TLV **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>30% - 60 %</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Temperature</td>
<td>68 - 75 (winter)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>73 - 79 (summer)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>1,000 ppm</td>
<td>5,000 ppm</td>
<td>5,000 ppm</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>9 ppm</td>
<td>50 ppm</td>
<td>25 ppm</td>
</tr>
<tr>
<td>Ozone</td>
<td>N/A</td>
<td>0.1 ppm</td>
<td>0.05 ppm</td>
</tr>
<tr>
<td>Particulates</td>
<td>N/A</td>
<td>15 mg/m³ (total)</td>
<td>10 mg/m³ (total)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 mg/m³ (resp.)</td>
<td>3 mg/m³ (resp.)</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>N/A</td>
<td>0.75 ppm</td>
<td>0.3 ppm</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>N/A</td>
<td>5 ppm</td>
<td>3 ppm</td>
</tr>
</tbody>
</table>

* Occupational Safety and Health Administration Permissible Exposure Limit -- this level is a time-weighted average and is an enforceable standard that must not be exceeded during any eight-hour work shift of a 40-hour work week.

** American Conference of Governmental Industrial Hygienists Threshold Limit Value -- this level is a recommended time-weighted average upper limit exposure concentration for a normal eight to 10-hour workday and a 40-hour work week.

N/A-Not Applicable or Not Established
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>8 hour</th>
<th>1 hour</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>9 ppm</td>
<td>35 ppm</td>
<td>N/A</td>
</tr>
<tr>
<td>Ozone</td>
<td>0.08 ppm</td>
<td>0.12 ppm</td>
<td>N/A</td>
</tr>
<tr>
<td>Particulates (PM 2.5)</td>
<td>35 ug/m³ (24 hour)</td>
<td>N/A</td>
<td>15 ug/m³</td>
</tr>
<tr>
<td>Particulates (PM 10)</td>
<td>150 ug/m³ (24 hour)</td>
<td></td>
<td>Revoked (Dec. 17, 2006)</td>
</tr>
<tr>
<td>Sulfur Oxides</td>
<td>0.14 ppm (24 hour)</td>
<td>N/A.0.5 ppm (2)</td>
<td>0.03 ppm</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>N/A</td>
<td>N/A</td>
<td>0.053 ppm</td>
</tr>
</tbody>
</table>

N/A-Not Applicable or Not Established
Other Health Comparison Values

- EPA RfCs
- ATSDR MRLs
- OSHA/WISHA PELs
- ACGIH TLVs
- Other workplace guidelines.
  (NIOSH RELs, ACGIH TLVs, AIHA WEELs)
- Ecology risk-based cleanup levels.
- EPA Region 3 and 9 PRGs.
- Indoor/outdoor background levels.
The relative sizes of the particles offer clues to the potential pollutant:
## Comfort Ranges

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>Winter $F^\circ$</th>
<th>Summer $F^\circ$</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>68.5 – 75.5</td>
<td>74.0 – 80.0</td>
</tr>
<tr>
<td>40%</td>
<td>68.0 – 75.0</td>
<td>73.5 – 80.0</td>
</tr>
<tr>
<td>50%</td>
<td>68.0 – 74.5</td>
<td>73.0 – 79.0</td>
</tr>
<tr>
<td>60%</td>
<td>67.5 – 74.0</td>
<td>73.0 – 78.5</td>
</tr>
</tbody>
</table>
Indoor Air Quality Monitoring Station

This instrument measures the following indoor air components:
- Carbon Monoxide (CO)
- Carbon Dioxide (CO2)
- Relative Humidity
- Temperature

Indoor Air Quality Monitoring Station

Provided by your School District and supported by the Washington State Department of Health

PLEASE DO NOT DISTURB – MONITORING IN PROGRESS

These are routine "baseline" measurements (not in response to any known problems)
Indoor Air Quality Monitoring Station

The indoor air quality in this school is being measured to ensure healthy, comfortable, and productive learning conditions for all.

For additional information, contact your Principal or Facility Manager.

The primary contact for this program is:

This monitoring equipment was provided by the

For assistance with the Fluke instruments and software, contact the Fluke Corp. at 1-888-44-FLUKE.
Indoor Air Quality Monitoring Station

This instrument measures the following indoor air components:
- Carbon Monoxide (CO)
- Carbon Dioxide (CO₂)
- Relative Humidity
- Temperature

Provided by your School District and supported by the Washington State Department of Health

This instrument measures six different sizes of particles in the air:
- 0.3 Micrometer
- 0.5 Micrometer
- 1.0 Micrometer
- 2.0 Micrometer
- 5.0 Micrometer
- 10.0 Micrometer

For comparison, the average human hair is about 70 micrometers in diameter.

PLEASE DO NOT DISTURB – MONITORING IN PROGRESS
These are routine “baseline” measurements (not in response to any known problems)
What’s Next?

- **DOH Activities:**
  - Finish documentation
  - Develop data management/analysis tools
  - Training
  - Equipment logistics
Is it possible to have energy efficient buildings and good IAQ?

Yes. Energy Efficiency and Good IAQ aren’t mutually exclusive.

The key is having a better understanding of what’s involved in achieving good IAQ, and incorporating that in the energy auditing process.

We want your input!!
Reduce Risk: Prevent IAQ problems *before* they begin!
Risk Management is the key to good indoor air quality!
Selected Indoor Air Quality References
For more information:

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