CHPS Technical session: Deep Dive into IEQ, Resiliency and Zero Energy Schools
Stephany Mason, CHPS
Ralph DiNola, NBI
CHPS – IEQ
...IAQ Deep Dive
Designing Contaminants Out of Healthy, High-Performance Schools
What is INDOOR ENVIRONMENTAL QUALITY

IEQ Supports CHPS Core Mission

- Improved occupant health
- Improved academic outcomes
- Reduced student absenteeism
- Reduced teacher absenteeism
- Improved teacher retention
Thermal Comfort

Studies on Thermal Comfort and Productivity

- 2% Reduction in Productivity for Every 1° C (1.8° F) Rise Above Comfort Zone
- Lower Temperatures Affect Productivity and Increase Errors
IEQ: ACOUSTICS

- Background Noise
- Reverberation Time
- Sound Isolation
- Verification Protocol
Acoustic Comfort

• Critical to Learning
• Background Noise & Reverberation Rates Affect Speech Intelligibility
• Students in a School in Airport Flight Path Performed up to 20% Lower on Reading Tests
Lighting Quality

• Studies on Lighting Show
  – Quality affects mood, behavior and ability to concentrate
  – Daylighting affects speed and performance on standardized tests
  – Outside views affect occupant’s ability to stay focused
IEQ: LIGHTING

Daylighting

- Glare Protection
  Prerequisite
- Daylight Availability
  - Multiple Point in Time
  - Spatial Daylight
    Saturation (sDS) – LM-83
- Classrooms
- Support Spaces
Electric Lighting Performance

- Color Rendering Index $\geq 80$
- RoHS compliant
- LED performance
  - Achieve an initial efficacy of at least 50 lumens/watt
  - Maintain 70% of Initial Light Output after 50,000 hours
Indoor Air Quality (IAQ)

IAQ comprised of:
• Ventilation Rate
• Chemical Contaminant Control
• Biological Contaminant Control
• Particulate Contaminant Control
IAQ

- 1 in 10 asthma
- Poor IAQ can cause verbal, motor and behavioral disabilities.

Source: NE Lung Assoc. & American Journal of Respiratory and Critical Care Medicine
“[We have] clear evidence of the significant impact of the built environment on pupils’ learning progression”

Building and Environment
November 2012
“A holistic, multi-level analysis identifying the impact of classroom design on pupils’ learning”

Connecting Conditions to Outcomes

School Design
- Site
- Orientation
- Envelope
- HVAC
- Acoustics
- Lighting
- Products*

Building Performance Characteristics
- Indoor Air Quality
- Ventilation
- Noise
- Lighting
- Thermal Comfort
- Moisture

Modifying Factors
- Seasons
- Time
- Operations
- Maintenance
- Cleaning
- Occupant Behavior
- Budget

Outcomes
- Student Learning
- Student Health
- Teacher Health
- Teacher Satisfaction

Courtesy of National Clearinghouse for Educational Facilities and National Academy Press
Indoor Air Quality
Healthy Kids Go to School
NE-CHPS CRITERIA

Integration – 8.4%
Operations & Metrics – 9.2%

Design:
• Indoor Environmental Quality – 31%
• Energy – 26%
• Water – 8.4%
• Site – 8.8%
• Materials & Waste Management – 7.6%
## INTEGRATION - SYSTEMS APPROACH

### BUILDING SYSTEMS
1. HVAC
2. Lighting
3. Interior Finishes
4. Envelope
5. Site
6. ...
7. ...
8. ...

### PROJECT TEAMS
1. Owner Representatives
2. Design Consultants
3. Construction Representatives
4. School Occupants
OPERATIONS & METRICS

- Facility Staff & Occupant Training
- Systems Maintenance Plan
- Indoor Environmental Management Plan
- Green Cleaning
- Integrated Pest Management
- Anti-Idling Measures
- Performance Benchmarking beyond Energy – Includes IAQ
INDOOR ENVIRONMENTAL QUALITY

INDOOR AIR QUALITY

- **HVAC Design** - ASHRAE 62.1
- **HVAC Filtration** – require MERV 13; credit for MERV 15
- **Pollutant Source Control** – Walk-off mats, EPEAT Electronic devices, chemicals storage, CO monitors
- **Moisture Management** – Outdoors, indoors, and in HVAC
- **Construction IAQ Management** – option for IAQ testing
- **Post Construction IAQ** – HEPA filter vacuuming
- **Low Emitting Materials** – PreRequisites for Paints/Coatings, Flooring, and Composite Wood; Addresses VOCs
- **Low Radon**
- **Thermal Comfort** – ASHRAE 55 (incl. RH)
- **Mercury Reduction**
Examples of IAQ Management

• Design
  – Walk-off Mats at Entrances
  – Air Intakes Away from Drop-Offs

• Maintenance
  – Cleaning Chemicals
  – Water Intrusion

• Operations
  – Smoking Areas Away from Doors and Windows
  – Policies on use of Scented Grooming Products
CHPS Programs and Resources

Current offerings

- Project Recognition Programs
- Training Opportunities
- School District Program
- CHPS Membership
- PreFab Classrooms Scorecard
- Product Database
- Operations Report Card
High Performance Product Database

• Includes Low Emitting Materials other environmental attributes such as EPDS and HPDs
• Help project teams find products that fulfill requirements of CHPS Criteria
• Educate consumers about the environmental impacts of product selection
Conclusions

• Estimate 80-90% Costs of a Building Associated with Worker Salaries Compared to Only 3% Associated with Owning and Maintaining the Building

• Absenteeism and Teacher Attrition Reduce District’s Operating Budget

• Although the Cost of Green Construction is Perceived to be High, Studies Found No Significant Difference in Cost

• Cost Poor Performing Schools to the Society are Significant
  – Higher Drop-out Rate
  – Higher Poverty Rate
  – Higher Incarceration Rate
QUESTIONS?

Stephany I. Mason, PHD, LEED AP
CHPS Technical Director
smason@chps.net

Thank you!