What is known about portable classrooms and mold?

http://www.arb.ca.gov/research/indoor/pcs/pcs.htm

CA Air Resources Board

California Portable Classrooms Study

This page updated April 6, 2007

The Air Resources Board (ARB) and Department of Health Services (DHS) completed a comprehensive study of the environmental health conditions in portable (relocatable) classrooms. This study investigated classrooms in kindergarten through 12th grade public schools and included a large representative sample. A number of environmental problems were found in classrooms throughout California. The Report to the California Legislature: Environmental Health Conditions in California's Portable Classrooms has been submitted to the Legislature, and is available for download below:

Final Report to the Legislature, November 2004

http://www.arb.ca.gov/research/indoor/pcs/leg_rpt/leg_rpt.htm

Other related documents are also available.

Highlights of the Report to the Legislature

http://www.arb.ca.gov/research/indoor/pcs/leg_rpt/pcs_r2l_hi.pdf

ENVIRONMENTAL HEALTH CONDITIONS

in CALIFORNIA'S PORTABLE CLASSROOMS

November 2004

The Air Resources Board (ARB) and Department of Health Services (DHS) recently completed a comprehensive study of the environmental health conditions in portable (relocatable) classrooms, as required under California legislation (AB 2872, Shelly, 2000). This study investigated classrooms in kindergarten through 12th grade public schools and included a large representative sample: two portable classrooms and one traditional classroom were evaluated at several hundred schools throughout the state. A number of environmental problems were found in classrooms throughout California. This fact sheet briefly summarizes the findings and recommendations of the study. For the full report, please visit http://www.arb.ca.gov/research/indoor/pcs.pcs.htm.

California Environmental Protection Agency

Air Resources Board

Arnold Schwarzenegger, Governor

Environmental Health Conditions in California's Portable Classrooms

http://www.arb.ca.gov/research/indoor/pcs/pcs.htm

Key Findings

The report identifies and addresses a number of environmental problems that were frequently found in classrooms throughout California. These problems were found in both portable (relocatable) and traditional (site-built) classrooms; however, some of the problems were found more frequently in portable classrooms.

The primary problems identified in the PCS study include:

f Inadequate ventilation with outdoor air.

Substandard amounts of outdoor air were

measured in classrooms during 40 percent of

class hours, and seriously deficient ventilation

was found 10 percent of the time. The causes

included teachers turning off HVAC (heating,

ventilating, and air-conditioning systems)

because of excessive noise; closed or blocked

outdoor air dampers; off cycling of the HVAC;

inadequate HVAC capacity; and other factors.

f Classroom noise too high. About one-half of

the classrooms exceeded 55 decibels, the level

used by many communities in the state for their

outdoor nuisance regulations, and most

exceeded the current "best practices" guideline

of 45 decibels. Major noise sources are

primarily noisy HVAC equipment, noisy lighting, and noise from nearby outdoor activities.

f Poor thermal comfort. Temperature and humidity levels were outside the range given by professional standards for thermal comfort in about one-fourth of the classrooms. Causes appeared to be related to improper HVAC system control and/or inadequate capacity.

f Indoor formaldehyde levels. In 4 percent of the classrooms, air concentrations of formaldehyde exceeded the guideline level for preventing acute eye, nose and throat irritation. Nearly all classrooms exceeded formaldehyde guidelines for preventing long-term health effects, including cancer. These findings are largely due to the widespread use of formaldehyde-containing building materials and furnishings, and inadequate ventilation.

f Moisture problems. Water stains, excess wall moisture, and other indicators of potential mold were found in about one-third of classrooms. Investigators found visible mold in about 3% of classrooms; and musty odors were reported by 69% of teachers. These conditions are often attributable to inadequate maintenance.

f Toxic residues in floor dust. Lead, arsenic, and numerous pesticide residues were measured in classroom floor dust. These residues are a concern because they can be inhaled, ingested, or absorbed through the skin by children, especially very young children who sit on the floor and put their hands in their mouths. The source is generally tracked in dirt

from outside, and pesticides applied indoors or

near the building.

f Inadequate

lighting. In about

one-third of the

classrooms, room

lighting was below

the level given by

professional

guidelines.

Properly installed

daylighting can

help.

Dirty air filters can reduce airflow.

Environmental Health Conditions in California's Portable Classrooms

Key Recommendations

Sixteen recommendations are discussed in the report. These can be grouped into four general approaches needed to remedy and prevent the problems found in California public schools:

• Direct and assist schools to comply with State regulations, especially workplace regulations (Cal/OSHA) related to building operation and maintenance;

• Develop and promote "Best Practices" for design, construction, operation, and maintenance of school facilities;

• Improve support (both funding and training) for school facilities and staff;

• Establish needed guidelines and standards for school environmental health that are specifically protective of children.

The recommendations are split between Group 1 ("high priority, high benefit" actions) that can be achieved in the near term at relatively low cost, and Group 2, also priority issues, but requiring a longer timeframe and/or more substantial resources.

The Group 1 recommendations ("high priority, high benefit" actions) are:

1. Schools, districts, and the state should ensure

that all school buildings meet all relevant

state regulations, especially the Cal/OSHA

workplace regulations regarding ventilation, sanitation and water intrusion, and illness and injury prevention.

2. Schools and school districts should conduct “self-assessments’ of basic health and safety conditions. This approach has been successfully piloted by the Los Angeles Unified School District in their Facility Self-inspection Program (included in the report and available on the web).

3. The State should require schools to develop indoor environmental quality management plans. The U.S. Environmental Protection Agency’s IAQ Tools for Schools Program provides guidance and free kits to accomplish this.

4. The State should establish a policy to incorporate “Best Practices” into the design, construction, operations, and maintenance of new California schools, especially the measures developed by the Collaborative for High Performance Schools (CHPS). The CHPS Best Practices Manuals provide broad guidance for measures that will improve schools while also saving energy and reducing long-term costs.

5. State-level review, by the Division of the State Architect, of the designs for new schools should be expanded to include elements such as ventilation systems and building materials, in addition to current elements such as fire and life-safety provisions.

6. Classrooms, especially portables, should be sited correctly, away from busy roadways, and with proper drainage.

7. The State should implement an interim new classroom requirement for maximum noise levels at 45 decibels, unoccupied, until a specially convened task force can determine an appropriate level for California schools (see Group 2 recommendations below).

Water leaks in roofs and near HVAC units are common causes of moisture and mold problems.

Environmental Health Conditions in California's Portable Classrooms

Group 2 recommendations (longer timeframe and/or more substantial resources) specify that:

8. The State and school districts should assure stable, long-term funding mechanisms and sources for both construction and preventive maintenance; currently funding fluctuates from year to year, especially for the Deferred Maintenance Program.

9. The State should develop and offer focused training programs for school facility managers, custodial staff, and teachers, in cooperation with interested organizations; those closest to the classrooms often are not aware of current "best practices" for operation and maintenance of classrooms. A concerted, ongoing training program could go far to improve conditions in classrooms.

10. Integrated Pest Management Programs should be implemented at all schools.

11. Older portable classrooms should be retired when they become unserviceable or do

not provide an adequate learning environment for children.

12. The State and school districts should develop and require full new building commissioning procedures.

13. The State should improve its school facilities database, as there are currently no complete databases on the condition, location, or even number, of school buildings.

14. The State should convene a task force of experts to develop a California indoor noise guideline or standard for K-12 schools.

15. The State should develop chemical exposure guidelines or standards for classrooms that are protective of children and teachers.

16. Portable classrooms should be re-designed from the ground up. Several groups are producing new prototypes that use an integrated “whole building” approach; these should be supported through the demonstration phase to evaluate design changes that provide substantive improvements over older portables.

Vehicle traffic near classrooms can lead to exposure to harmful air pollutants.

For more information, go on-line to http://www.arb.ca.gov/research/indoor/pcs/pcs.htm.

See especially Appendix VI for specific guidance to schools.

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Board Meeting Slide Presentation, Notes and Handout

http://www.arb.ca.gov/research/indoor/pcs/board072403.htm

Final Research Study Report

http://www.arb.ca.gov/research/indoor/pcs/pcs-fr/pcs-fr.htm

From CALIFORNIA PORTABLE CLASSROOMS STUDY

PROJECT EXECUTIVE SUMMARY (with respect to mold and moisture):

"With regard to moisture and mold indicators, over two-thirds (69%) of teachers in portable classrooms reported that they noticed musty odors at times. Less than half (43%) of these teachers reported current or previous leaks or floods in the room, the majority of the leaks coming from the roof (27% of all portables). Visible mold, either currently or previously, was reported by 11% of portable classroom teachers. For traditional classrooms, teachers reported the presence of musty odor less often (58%, $p < 0.01$), but they reported previous flooding significantly more often (47%, $p < 0.05$)." (p.8)

"In addition, portable
classrooms were again more likely to have a metal roof (28.5% versus 2.5%) and to have water stains on the floor (18.1% versus 2.0%); however, portable classrooms were more likely to have carpets, so would be more likely to have water stains on a carpeted floor."(p.11)

"The estimated distribution of the height of the foundation skirt for portable classrooms is as follows: 42.6% are less than 2” above the ground, 22.2% are from 2” to 12” above ground, and 35.2% are over 12”. Foundation skirts close to the ground have been reported to be more susceptible to surface water contact and wicking of water up wall materials, resulting in mold and moisture problems." (p. 12)

"The air filter for the HVAC unit in portable classrooms was more likely than traditionals to have a light or medium loading of dirt.

• During the Phase II inspections, portable classroom HVAC units were less likely to have clean condensate drain pans and lines (30.0 versus 56.7%), and were more likely to fail the “drain test” used by the inspector to test for blockage (58.5 versus 12.4%).

• Also, the air intake was blocked on the air handling units more often for portable classrooms than for traditional classrooms (10.8% versus 2.7%)."(p. 12)

"Most types of environmental complaints (roof leaks, air quality/odor, mold, temperature, noise) were reported more often for portable classrooms; an exception was plumbing leaks, which were more common in traditional classrooms."(p.20)

"HVAC filters in portable classrooms showed a higher percentage of

mildew or mold, dirtier condensate drain pans, clogged drains, and standing water."(p.21)

"Portables also

had relative humidity measurements above 60% more of the time than traditional classrooms;

such levels are not only uncomfortable, but can lead to increased moisture and mold problems,

increased dust mite populations (allergy and asthma triggers), and other problems." (p.22)

"Airborne pollens and spores (primarily fungi) were found at higher levels outdoors than

indoors, as expected. Typically indoor levels of fungi are elevated primarily in cases of extreme

mold or biological contamination. However, classroom wall, floor, and ceiling moisture

measurements indicated excess moisture in building materials in about 17% of the classrooms,

indicating potential mold problems in those locations. Traditional classrooms had excess wall,

floor, and ceiling moisture more often than portables, but portables were reported to experience

roof leaks more often, and over two-thirds of the teachers in portables reported musty odors at

times." (p.24)

"Conclusions

From the above discussions of significant results, it is clear that there are differences in

environmental factors between portable and traditional classrooms. Most importantly, some of

both types of classrooms exceeded many of the environmental standards and guidelines available

for judging the state of the environmental conditions in classrooms. Further analyses of this very

rich data base will likely reveal other factors that could prove useful for further identifying

sources and measures to be taken to reduce their potential effects." (p.25)

We have also developed a web page (http://www.arb.ca.gov/research/health/school/school.htm) for school administrators and others involved in school environmental health and air quality issues. It includes a short (two-page) advisory to schools on actions they can take now to improve the environmental conditions in their classrooms, plus many web links to steer them to useful information and checklists.

School Advisory

The Air Resources Board and Department of Health Services have developed recommendations to assist schools in reducing their indoor formaldehyde concentrations.

"Remedies for Reducing Formaldehyde in Schools"