

Memorandum

To: Catherine Witherspoon
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From: Kevin Reilly, D.V.M., M.P.V.M.
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Subject: REQUEST OF REVIEW OF DRAFT REPORT ON INDOOR AIR POLLUTION

Thank you for the opportunity to provide input to the Air Resources Board (ARB) on its Report to the California Legislature: *INDOOR AIR POLLUTION IN CALIFORNIA (Draft for Public Review, June 2004)*. The Department of Health Services (DHS) acknowledges the tremendous effort of ARB in completing this report required under Assembly Bill 1173, Keeley, Chapter 987, Statutes of 2002).

DHS staff are highly supportive of the recommendations of the ARB report. We have prepared a compilation of comments directed to Ms. Peggy Jenkins, Manager, Indoor Exposure Assessment Section (see attached), and will be happy to work directly with ARB staff on the scope, analysis, and organization of the text for finalization of the report for submission to the Legislature. This report identifies crucial opportunities to promote cost-effective reduction in the environmental health impacts of indoor air pollution. Among the many excellent options outlined are several we would especially like to work closely with ARB: reducing chemical emissions from buildings products and other materials, and implementation of recommendations to help solve indoor air quality problems in public schools. We would also propose that ARB and DHS jointly sponsor a "policy charrette." i.e., a meeting among stakeholders to develop detailed policy proposals to support the options outlined in this report.

DHS and ARB share a long history in recognizing and addressing indoor air pollution as an important public health issue. In 1982, the California Legislature (AB 3200, Tanner) mandated DHS to "conduct and promote the coordination of research, investigations, experiments, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, and control of indoor pollution" (Health and Safety Code Section 105400 et seq.). In the same year, the Department established the first-in-the-nation State Indoor Air Quality Program. ARB established its Indoor Exposure Assessment Program in

1986, under legislative mandate (AB 3052, Tanner) to assess indoor exposures (as well as outdoor exposures) when conducting risk assessments for their Toxic Air Contaminants Program (H&SC Section 39660.5). Our departments have been working together on numerous indoor air pollution risk reduction projects, including environmental tobacco smoke, volatile organic compounds, lead, radon, and indoor moisture and mold. Most recently, our departments collaborated on the California Portable Classroom Study and its report to the Legislature.

We share your hope that this report will advance policies and actions to better protect the health of Californians through improved indoor air quality.

Attachment

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Memorandum

Date: August 19, 2004

To: Ms. Peggy Jenkins, MS
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Subject: REVIEW OF DRAFT REPORT ON INDOOR AIR POLLUTION

This memo includes a compilation of Department staff comments on the Report to the California Legislature: *INDOOR AIR POLLUTION IN CALIFORNIA (Draft for Public Review, June 2004)*. These comments were provided by staff in the Indoor Air Quality Section of the Environmental Health Laboratory Branch, the Environmental Health Investigations Branch, and the Childhood Lead Poisoning Prevention Branch. Herein are consolidated our major comments and an attachment that contains more detailed editorial suggestions and minor comments.

OVERALL

We are highly supportive of the report overall. It addresses the broad scope of indoor air pollution in a comprehensive and sophisticated manner. The report's recommendations are well crafted and effective, and we look forward to working with ARB in unified support for these actions. The report identifies effective options for reducing indoor air pollution, and it notably highlights programs for "reduction at the source." Like preventative care in public health, source reduction is generally the most cost effective option, compared to secondary approaches.

However, staff is concerned that the report is too long and technical to serve its intended audience: the Legislature, its staff, and the public-at-large. It is our view that the report should be shortened, less technically detailed, and organized with greater focus on the options for reducing indoor air pollution health impacts. At the same time, we believe that the report should more detailed in its recommendations and give clearer direction to the Legislature on what *they* can do to address these issues. To this end, we propose that ARB and DHS jointly

sponsor a “policy charrette.” i.e., a meeting among stakeholders to develop detailed policy proposals to support the options outlined in this report.

We concur with the overall framework of the report, and the topics included are appropriate. The report’s comprehensive reference to California-specific research is valuable, however it leads to unevenness in the level of detail amount topics and adds unnecessarily to the report’s length. To the degree that extensive analyses, literature reviews, and scientific references are required, these would be better made available in appendices.

Executive Summary

The Executive Summary is currently a 21-page comprehensive and miniaturized version of the report. It would better serve the intended audience to have the Executive Summary limited to two or three pages. It should contain a succinct overview of the principle issues relevant to understanding indoor air pollution and its health risks, and the majority of the text should stress the risk reduction options. As currently written, Chapter 8 (Summary) could serve as the basis of a shortened Executive Summary.

Chapter 2. Health Impacts, Sources, and Concentrations of Indoor Air Pollutants

The issues of this Chapter are complex, and justifiably, this is the report’s longest Chapter. However, it is organized in a manner that makes it more difficult to understand. It might be better to split it into two separate chapters “sources and concentrations” and “health effects.” These are separate topics, and it would be helpful to first give a clear understanding of what indoor air pollutants are, where they come from, and why the report categorized them the way it does (Traditional, Toxic Air Contaminants, Other). Much of the public policy opportunities to address indoor air pollution risks are determined more by the nature of the source than the health effects (as per Chapter 5).

Arguably, much of the information included on specific health effects could be omitted (or moved to appendices) with the aim to present the key findings of recent literature much more succinctly. The intended audience is likely to be overwhelmed and confused by the level of detail – and a technical audience can find better summaries elsewhere. However, if the current length is retained, the readers would benefit from having a 1-2 page summary of key points at the end of the long chapter.

Chapter 3. Costs of Indoor Air Pollutants

The estimation of the societal costs associated with indoor air pollution gives some perspective to the scope of this problem, but it also creates greater confusion, as this report neither includes comparison to other environmental risks or to the costs to reduce indoor air pollution. To technical readers, these estimates include many assumptions that remain open to debate, and the comparisons should include uncertainly ranges for the estimates. Furthermore, these estimates are likely to confuse the non-technical reader by suggesting a

degree of accuracy that the literature does not support. While these analyses are important, they suffer from the problems of “apples-and-oranges” comparison. It is questionable how meaningful comparisons are between “costs” of premature deaths and medical costs of morbidity. Instead, it may be sufficient to separately compare mortality and medical costs among pollutant source/endpoints, and then put these in context of the costs to reduce indoor pollution risks.

Chapter 4. Existing Regulations, Guidelines, and Practices

This Chapter would benefit from having the material re-organized and condensed. We found it very difficult to follow the text among the sub-sections. It is not made clear what the differences are among the major headings (e.g., guidelines and emissions limits), and the minor headings seem to overlap. Consider a Table approach used in ASHRAE 62-2001 (see Tables B-1 and B-2).

There is a crucial omission of the State’s Environmentally Preferable Product (EPP) database. The authors should include discussion of this effort and how it might be used to support several of the report’s recommendations (e.g., listing of low-emitting building products). Refer to the Division of the State Architect (DSA) for details.

Chapter 5. Methods to Prevent and Reduce Indoor Air Pollutants

This Chapter is succinct and written at an appropriate level for the report’s audience. In editing the report to a more manageable length, this chapter could be shortened by the omission of more detailed sub-sections.

Chapter 6. Prioritization of Sources and Pollutants Based on Exposure and Adverse Impacts

The Chapter speaks directly to policy makers by identifying priorities for indoor air pollution control options. While we agree with the basic prioritization, its justification needs to be made more evident.

Chapter 7. Options to Mitigate Indoor Air Pollution

The 10 items under Section 7.1 (General Mitigation Options) contain the essence of this report’s objective: to inform policy makers of their options to most cost-effectively reduce health risks from indoor air pollution. The detailed estimates of indoor air pollution in California in Chapter 3 beg to be matched with cost estimates for mitigation options. While we recognize that this is not readily calculated (nor was it mandated by the Legislature), qualitative estimates would be appropriate. Relative to the health impacts, it is important to let policy markers know where the biggest “bang” for the buck is going to be derived. To this end, the report should include greater detail regarding step-by-step elements for indoor air pollution risk reduction programs. Section 7.2 (Solutions for Schools) is too long, relative to Section

7.1. As it is taken directly from the *California Portable Classrooms Study: Report to the Legislature*, it would be sufficient to summarize those recommendations (and include the details in an appendix).

Attachment

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Page 6

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Attachment

**Detailed Comments by DHS Staff on ARB Indoor Air Pollution Report
(Draft for Public Review, June 2004)**

August 16, 2004

The following comments are directed to improve or correct the text in specific sub-sections. Such comments do not necessarily indicate support for retaining these specific sub-Sections as the report is shortened.

AUTHORS (p. vi)

It seems confusing to list a person (Peggy Jenkins) as both a principal author and a reviewer.

ABBREVIATIONS AND SYMBOLS (p. xi)

Use consistent nomenclature: PM₁₀ and PM_{2.5} or PM₁₀ and PM_{2.5}

Chapter 1. Introduction & Background

1.1 Indoor Pollution...

Insert the second paragraph (except its last sentence) after the first sentence of the first paragraph, and append that last sentence (“A number of other states...”) to the end.

It should be made clear that The Rule of 1000 is a heuristic. “Thus, reducing indoor emissions by a given amount ~~could~~ **might be anticipated to have...**”

1.3 Children’s Health...

The last bullet doesn’t fit into the introduction (and it is not well supported by the literature).

The final paragraph is also out of place in this Chapter.

Children are more susceptible to lead not because it is deposited more readily in bone (in fact on a percentage basis less of the absorbed lead ends up in bone than in adults). Instead, lead is more readily absorbed from the GI tract, and the developing CNS is more susceptible to damage.

1.4 Environmental Justice...

Third paragraph (p 26). Discussion about asthma prevalence among minority groups would be better included in Section 2.1.1.

Last paragraph is weak, and discussion of pending regulation out of place here. Recommend it is deleted.

Chapter 2. Health Impacts, Sources, and Concentrations of Indoor Air Pollutants

2.1.1 Asthma

“Biological agents are clearly associated with these diseases...” There are no citations here to direct one to numerous studies showing this association. This statement needs to be supported by some studies. Suggest dropping “clearly” from “clearly associated.”

“The recent rise in asthma incidence...” Double check to make sure this isn’t asthma *prevalence*.

Table 2.1

- For potential health effects where **“worsening of asthma”** is used, recommend substitution with “aggravated asthma and decreased lung function” which is less vague.
- In column for Organic Chemicals/Potential Health Effects, **“...headaches; at high levels; loss of coordination;...”** recommend replacing semicolon with colon after “levels.”
- In column for Potential Health Effects of ETS, add “asthma development in preschool children.”
- In Pollutant column for Biological Agents, add “viruses” to parenthetical list, perhaps after fungi.
- Typo??? Biological Agent sources **“wet or moist structures; furnishings”** – shouldn’t the semicolon be replaced with “or”?

Page 29.

“...while 11.9% of Californians, or 3.9 million people,...” This should somehow incorporate the year, 2001 because this estimate was based on 2001 survey results.

“The reason for the higher prevalence rate in California is not known, ...” It is suggested that this sentence be reworded. An alternative is the following: “California also has higher rates of asthma mortality than the nation as a whole. The reasons for these elevated rates in California are unknown at this time.”

“Children have been particularly hard-hit;” Does this reference increase in asthma prevalence? If so based on checking the article by Mannino *et al.*, add in the word, “prevalence” after “asthma.”

Add word: “Asthma is **one of** the leading causes of school absenteeism, etc.”

“However, in California prevalence is highest in American Indians, etc.”

Recommend deleting this sentence. Instead, describe asthma hospitalizations and mortality rate disparities since prevalence is discussed extensively. There were some sampling issues with CHIS and to state this sentence as written would inaccurately represent the true picture of asthma in California. An alternative is the following:

“Every year about 40,000 Californians are hospitalized and about 500 Californians die because of asthma. Asthma hospitalization and mortality rates are higher among African-Americans compared to other racial groups. Further, hospitalization rates among children are much higher than other age groups.”

“Although the causes for the observed increase in asthma prevalence, etc.” After “asthma prevalence,” add hospitalizations, and mortality.

Page 30

First paragraph, third sentence. Sentence as written is confusing; alternative suggestion: **“Airway responses [what type of responses/symptoms?] occur at high levels of NO₂ (400-700 ppb); these levels can occur in poorly ventilated kitchens using gas appliances.”** This statement also needs a reference/citation.

First paragraph, last sentence addresses some studies of asthma exacerbation from outdoor PM exposure. Are there any studies of asthma relative to indoor PM exposure? If not, this should be stated explicitly.

Page 31

Last paragraph in Section 2.1.1. More recent data is available. Suggest adding the following sentence after the Rosenman reference: “From 1993 through mid-2003, 3,188 cases of work-related asthma were identified from Doctor’s First Report of Occupational Injury or Illness (DFR) in California. See *California Asthma Facts, Volume 2, Issue 2* “Work-Related Asthma” August 2004.” This fact sheet will be available on the following website within the month: www.californiabreathing.org. Note: The added data are not specific to cleaning products.

2.1.2 Cancer

Second paragraph, last sentence. **“Since people spend the majority of their time indoors, moderate and high concentrations of indoor pollutants generally translate to elevated risk.”** This statement is vague, unsubstantiated and may needlessly arouse fear in those who read it. While this statement may be true for certain contaminants, it is unnecessarily inflammatory, and implies that all indoor contaminants are carcinogenic and lead to increased risk for cancer. It is **strongly** recommended that this statement be deleted.

Table 2.4

****Formaldehyde has been recently (June 15, 2004) reclassified by IARC as a Group I, known human carcinogen.****

Figure 2.1

_Add a definition of “TAC” within the border of the figure so that the figure can stand alone, without the naïve reader having to search the text for a definition of this abbreviation.

2.1.3 Irritant Effects

General comment - first two paragraphs would be stronger if pollutant (formaldehyde, terpene, ozone) concentrations levels sufficient to cause irritation were included.

2.2.1 PM

As a general comment, one reviewer found it difficult to keep track of whether statements in the report were referring to ambient or indoor PM.

First paragraph (fifth line from the bottom). It would be more accurate to say that "PM_{2.5} may be a **better** indicator..." since it seems likely there a "best" indicator that has yet to be determined.

Second paragraph: "**A substantial portion of indoor particles originate outdoors from outdoor sources.**" It would be helpful to have a citation for this statement, particularly if a specific point estimate or range of percentages can be provided.

Second paragraph, last sentence: "...**these components may contribute to serious health effects such as cancer and developmental effects.**" This statement is overly broad, inflammatory, and unless it can be referenced, should be deleted.

2.2.1.1. Mortality

Last sentence in only paragraph: Meta-analysis should be briefly explained for the average reader.

2.2.1.2 Morbidity

First bullet, third sentence: "COPD" needs to be spelled out or defined, especially as it is not included in the acronym list.

Second bullet (Respiratory symptoms), second paragraph, third sentence: Recommend rewrite: "**Disease states such as asthma and chronic bronchitis can adversely affect normal particle clearance or removal from the lungs and airways...**"

Next to last paragraph, last two sentences are speculative and should be deleted.

Table 2.5 (p 41)

Author name misspelled (twice): "Samet 2000."

2.2.3 Indoor and Personal PM Concentrations (p 43, fourth paragraph)

"...BASE study provides information on PM levels inside medium and large office buildings." According to EPA protocols, only large buildings were recruited for study. Add reference for BASE PM measurements- "LE Burton, JR Girman, SE Womble, "Airborne Particulate Matter Within 100 Randomly Selected Office Buildings in the United States (BASE)," *Proceedings of Healthy Building 2000*, I, pp. 157-162, (2000)"

2.2.4 CO

Figure 2.2 - Needs a legend defining difference between solid and checkered horizontal bars.

2.2.4.1 Mortality

Second paragraph – Recommend a table to highlight the type of indoor combustion appliances responsible for CO mortality rather than just the text. This is an important point that would be good to set off in a readily visible table format. It would also be a good complement to Figure 2.2.

2.3.1 Formaldehyde

Although this is an important chemical, there seem to be too many pages specifically dedicated to formaldehyde, relative to other organic chemicals.

2.3.1.2 Sources of Formaldehyde

Inconsistent formatting for citing references. The third paragraph states that “In a recent study funded by the California Intergrated Management Board (CIWMB) (Alevantis, 2003)...” There is no mention of the entity that actually conducted the study. On the contrary, in Section 2.3.2.2 (page 56) the study by Hodgson (1999) is cited and the funding entity is not mentioned in the text.

2.3.1.3 Indoor Formaldehyde Concentrations

P 53, first paragraph: Add reference to EPA BASE VOC measurements- “JR Girman, GE Hadwen, LE Burton, et al., “Individual Volatile Organic Compound Prevalence and Concentrations in 56 Buildings of the Building Assessment Survey and Evaluation (BASE) Study, ”*Proceedings of Indoor Air 1999*, II, pp. 460-465, (1999).”

P 53, fourth paragraph: The comparison of classroom (children) and office (adult worker) exposures is a bit of a stretch and, moreover, beside the point. The conclusion that exposures are higher in California children (classrooms) than most adults (working in the large office buildings) is based on measurements were taken at different times and places (BASE: 1994-98; PCS: 2002), different numbers of samples, and using different sampling methods and protocols (e.g., duration). In addition, almost all BASE buildings were mechanically ventilated (not true for schools). The most salient point to be made is buried in the last sentence: “elevated exposures are associated with specific sources and conditions.”

2.3.2.1 Health Effects of VOCs

The sentence “Many of the VOCs found in indoor air in California are carcinogenic” is misleading. It should be re-written to take into consideration levels and duration of exposures. Just because trace levels of those chemicals are carcinogenic, does it support the sentence as written?

2.3.2.2 Sources And Emissions of VOCs

Include the results from the DHS/CIWMB study on Building Material Emissions (i.e., Tables 27 and 28).

p 58, third para, line one. "Girman et al. (1999) identified VOCs in public **and private** buildings,..." BASE included both public and private buildings.

2.3.3.3. ETS Concentrations

Table 2.8 - Needs definition of "RSP" included in the table.

2.3.4 Biological Contaminants

General impression – Compared to other sections of this report there is very little detail or data from recent studies provided in the indoor biological section. With the release of the Institute of Medicine's report "Damp Indoor Spaces and Health," it would be more appropriate to rewrite this section than to change individual sentences. Recommend adding subsections on dust mites, endotoxins, legionellosis, and hypersensitivity pneumonitis, in addition to the solitary subsection on mold.

2.3.4.1 Health Effects of Biological Contaminants

second bullet (hypersensitivity reactions) first sentence: "Many biological agents can provoke a hypersensitivity ~~immunological~~ response in individuals who are genetically predisposed to developing allergic disorders. Allergic rhinitis (hay fever) and allergic asthma are the most common examples of hypersensitivity responses to biological contaminants. Allergens associated with fungal spores, ~~microbial products~~, house dust mites, cockroaches, dog and cat dander, and pollen are frequently found indoors. When high concentrations of these allergens are present indoors they can trigger allergic responses or asthma exacerbation."

Third bullet (toxic responses): The first sentence is problematic as human inhalation of mycotoxins in non-agricultural indoor environments has not been proven to show the health effects listed here. There is significantly more evidence for the role of endotoxins in indoor environments. If this section cannot be completely rewritten, consider the following as an alternative: "Many individuals in persistently damp or moldy buildings report symptoms such as headache, memory difficulties, vomiting, diarrhea, and increased frequency of cold/flu illnesses that do not appear to be caused by allergic or infectious mechanisms. The causes of such symptoms have not been identified but potential links to biological toxin exposure to endotoxins (a component of the outer membrane of Gram-negative bacteria) or mycotoxins (fungal toxins produced as secondary metabolites). However, the health impact of biological toxin inhalation exposure in indoor environments is not well-understood and is a new field of research."

2.3.6 Lead

More emphasis should be given to the fact that exposure of young children (ages one to five causes most of the irreversible cognitive damage. Older ages and adults are less susceptible. This is not clearly brought out in the draft report. The decreases in IQ,

behavioral problems, and learning impairments mentioned in the report can generally be traced to this early childhood exposure.

The report should also make it more clear that these problems are often due to quite low-dose exposures.

Caulk is not a major source of exposure compared with paint, lead contaminated dust and soil, gasoline, pipes, and ceramic glazes.

2.3.6.1 Health Effects of Lead

The CDC's "lead safety level of 10 mcg/dL" applies only to some repeat blood testing and other actions currently carried out with respect to children; adult action levels are higher (25 mcg/dL). Further, 10mcg/dL is not considered "safe". There is no known safe lower limit for lead and preventive efforts are geared to making lead levels as low as possible. Current national average blood lead levels in children are approximately two mcg/dL

2.3.6.2 Sources of Lead

In addition to lead pipes installed in the 30's, lead solder in copper piping installed later (up to 1986) is also an important source of water contamination.

Lead dust is frequently brought into the household as a consequence of employment. There are numerous such occupations including home remodeling, furniture refinishing, manufacturing jobs (especially work with plastic), and working on bridges. This is a significantly more common source than vinyl miniblinds.

Mention might be made of lead in candies (and wrappers); exposure is rarely attributed to candle wicks.

Deteriorating interior lead paint is another major contributor to household dust levels, even without remodeling.

Chapter 3. Costs of Indoor Air Pollution

This chapter contains a valiant first effort to compare cost estimates. We defer to OEHHA staff in the critique of these sections.

Chapter 4. Existing Regulations, Guidelines, and Practices

This section needs to be re-organized and the material presented condensed. It is very difficult for the reader to follow the text. What is the difference between guidelines and emissions limits (Sections 4.2 and 4.3)? Consider a Table approach similar to Tables B-1 and B-2 of ASHRAE 62-2001 (see comment above under 4.2.2).

Include information on the State's Environmentally Preferable Product (EPP) database. Of import, the State Architect's Office (DSA) has recently decided to take all the standards that will be developed under EPP Database contract through regulation, and the Building Standards Commission has agreed to undertake this task. More accurate and up-to-date information can be provided by Panama Bartholomy (DSA).

4.2.2 ASHRAE

Cite Table B-2 of ASHRAE 62-2001..

4.3.3.2 Government Guidelines for Building Materials...Section 01350

The recently released DHS practice updating the IAQ portion of Section 01350 should be referenced. Also, it is worthwhile to include information about ongoing efforts by a private certification company (SCS) to use the DHS practice to certify products, e.g., <http://www.scs-certified.com/voc>

4.3.1.2 Government Guidelines for Consumer Products

Although all of the activities of the Sustainable Building Task Force fall under the Executive Order cited, the way that this activity is presented is misleading. There was nothing in the Executive Order for cleaning materials. Also, there has been very little activity for over a year on this issue, need full names subsequent to drafting of addendum to GS-37.

4.3.3.3 Professional and Industry Guidelines and Practices for Building Materials

Discuss CRI's newly released Green Label Plus Program.

4.4.3.4 Building Commissioning

DGS, in coordination with DOF, is about to launch an elaborate commissioning program that includes POE. Please contact Dan Burgoyne, DGS Sustainability Manager, for more information.

Section 4.4.1.4 (Weatherization Programs)

To be more complete and accurate, the following items should be added:

- Employ lead-safe work practices to reduce potential exposures to lead in paint, dust, and tracked-in soil as a means of protecting weatherization workers and occupants.

A new subsection in 4.4.1 (or elsewhere if it seems more appropriate--might work better in subsection 4.5.1):

Residential Lead-Safe Housing Standards

Disturbing lead contaminated residential paint, dust, and soil can create serious indoor air hazards for occupants and workers.

California's Housing Law was amended in 2002 to incorporate habitability standards for lead hazards. Civil Code Section 1941.1 and Health and Safety Code Sections

17920.10 and 17967 incorporate lead hazards into housing standards, define lead hazards, specify the agencies that have enforcement authority over residential lead hazards, and describe enforcement remedies.

Section 4.4.2.2

Line four, the word "contaminant" should be "contaminate".

Add sentence to bottom of the paragraph:

...CEQA appears to be much less. As described in subsection ### (see the paragraph above on Lead-Safe Housing Standards), California law sets standards for lead hazards in housing. By federal regulation (24 CFR Part 35, et al. "*Requirements for Notification, Evaluation, and Reduction of Lead-Based Paint Hazard in Federally Owned Residential Property and Housing Receiving Federal Assistance*; Final Rule, September 15, 1999) these standards apply to federally financed housing, regardless of ownership (public or private).

Add a final paragraph to subsection 4.5.1.3 (Construction Related....)

Health and Safety Code Section 105255 enjoins persons from engaging in lead-related construction work that creates a lead hazard and references the definition of "lead-related construction work" in CCR Title 17, section 35040 ("...any construction, alteration, painting, demolition, salvage, renovation, repair, or maintenance of any residential or public building, including preparation and cleanup, that, by using or disturbing lead-containing material or soil, may result in significant exposure of adults or children to lead.") This Section, along with Section 105256, provides enforcement remedies and penalties, including cease and desist orders, fines, and imprisonment.

Add 4.5.2.1 or elsewhere as appropriate:

According to a study published by the Department of Health Services in 1998 (<http://www.dhs.ca.gov/childlead/schools/sitemap.htm>), about 96 percent of California's public elementary schools and related on-site child care facilities have lead-containing paint, and about 4 percent have significant levels of lead in soil near school buildings. Improper maintenance, modernization, painting, and remodeling practices can create significant exposures to indoor airborne lead-based paint and soil contaminants. California's Lead-Safe Schools Project (http://socrates.berkeley.edu/~lohp/Projects/Lead-Safe_Schools/lead-safe_schools.html) provides guidance on reducing the risk of exposure to lead during these activities.

Chapter 6. Prioritization of Sources and Pollutants Based on Exposure and Adverse Impacts

First bullet – **Building Materials and furnishings**

The text should be edited to so it no longer (incorrectly) implies that formaldehyde is the most predominant compound of health concern. Although it is an important chemical,

other pollutants are important and are exceeded at least as frequently as formaldehyde (per Section 2.3 of this report, as well the DHS/CIWMB study).

Chapter 7. Options to Mitigate Indoor Air Pollution

7.1 General Mitigation Options

Each of these bullets could be fleshed out with more detailed recommendation. Like Section 7.2 (Solutions for Schools), more specific actions should be outlined.

Bullet two (emission limits): While it would be beneficial for limits to be established, something should also be said about how limits would be enforced. Would some government entity test products, too?

Bullet three (emissions testing): Ongoing funding of a state building material emission testing program will be needed, and the recommendation should be more explicit about what form such a program might take. It would be worthwhile addressing the issue of who would do the testing, since there are few firms currently performing this work. The case needs to be made that continuous testing of building materials is necessary to identify new and important chemicals emitted from products. The list of these chemicals should be examined by OEHHA/ARB so guidelines may be developed for those with important health and/or comfort effects.

Bullet five (IAQ standards or guidelines): It would be useful to address how these would specifically be implemented. We foresee benefits in a requirement for buildings to undergo a maintenance shakedown every few years, to make sure that ventilations systems are working properly. This might follow the form of elevator inspections, whereby professionals certify system performance on a routine basis.

Bullet seven (building codes): Unvented heating (gas-fired) appliances are currently banned; amending building code to ban unvented cooking (gas-fired) appliances is rather contentious.

Chapter 8. Summary

This Chapter would serve as the basis of the shortened Executive Summary this report needs.

Chapter 9. References

P. 64, line10: Shendell et al., 2004 is not listed in the references list. Which is it?

P 163: "Tsai FC and Waldman JM. 2004. The California Sierra Radon Study. California Department of Health Services, Environmental Health Laboratory Branch. **EHLB Report No. 173.**"

Section 10. Glossary

Add definition of “indoor air quality” and “indoor air pollution” for clarification because the bill asks for a report to the legislature on IAQ and the report title is IAP in California.

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