

# Summary of Public Comments and ARB Responses on the June 2004 Draft Report for AB1173 – Indoor Air Pollution in California

The ARB received comments from 65 individuals and organizations. Commentors included industry stakeholders, environmental groups, government agencies, and a few private citizens. Similar comments were sometimes received from more than one organization. ARB staff considered the comments and revised the draft report as needed. As a result, the November 2004 draft report is more accurate, balanced, and complete than the preceding version. Section I includes major comments that were incorporated into the report. They are listed by topic. Section II contains paraphrased comments that were not incorporated into the report, with a response as to why they were not incorporated. They are listed alphabetically by the name of the commenting organization or individual. Minor comments such as word changes, elements of style, etc. are not addressed here.

## I. CHANGES MADE TO JUNE 2004 VERSION OF DRAFT REPORT

### LACKS BEST SCIENTIFIC INFORMATION

**Comment:** The report was criticized for not providing the best scientific information (it is biased), and for providing an uneven level of detail on various pollutants. Some commentors were generally critical of the report but offered no specific information or other references to support their statements.

**Response:** The report was based on current, relevant scientific literature, most often articles published in the peer reviewed literature or government reports that have undergone some type of review.

Additionally, several revisions were made that address this comment.

- The section on biological contaminants was expanded considerably.
- Biological contaminants were added to the prioritization tables and mitigation options.
- Exposure and risk estimates and cost estimates for radon were added for California.
- Section 2.2.5 on nitrogen dioxide was expanded to better reflect the body of literature currently available on this important pollutant.
- Additions and changes were made to sections on lead and mercury for increased accuracy.
- The distinction between volatile organic chemicals, toxic air contaminants, and hazardous air pollutants was made.
- Caveats to various statements were added throughout the report. Examples include: conclusions are those of the authors cited, changes in product reformulation have occurred since some of the older studies, the substrate for an emission test may not represent realistic conditions, reported results are for a small sample size, etc.

## PRIORITIZATION

**Comment:** Many comments indicated the prioritization table should be changed for a variety of reasons. Several argued that VOCs account for 1 – 5% of the risk and cost impact, so should be rated a much lower priority. Others indicated that ETS should be a higher priority, or that biological contaminants and radon should be added to the prioritization.

**Response:** A quantitative prioritization was not undertaken because such an effort is beyond the scope of this report. Such an effort would be an appropriate step prior to taking action under a program to address indoor sources; a detailed prioritization based on quantified criteria would be needed.

The cost estimates primarily reflect the availability of cost information and the length of a time a given pollutant, such as ETS and radon, has been studied. Because of the lack of key cost data for most indoor pollutants, the cost estimates do not necessarily reflect the actual extent of exposure and risk in California, nor does it account for current information and trends in the scientific literature on exposure and risk. Thus, cost information was considered but was not a determining factor in the prioritization of sources.

Specific changes to the prioritization section are itemized as follows:

- The prioritization of source categories for mitigation was divided into two tables, high priority and medium priority.
- Sources are listed in alphabetical order to indicate there is no prioritization within a given group.
- Biological contaminants and radon were added to the high priority table.
- A column was added to the tables to indicate whether direct state authority currently exists for any agency to implement mitigation actions for the purpose of improved indoor air quality.
- Discussion was expanded to better describe the factors considered when ranking the pollutants.

## SOURCES AND HEALTH EFFECTS

**Comment:** For Table ES-1 and Table 2.1, *Sources and Potential Health Effects of Major Indoor Air Pollutants*, some readers assumed that all of the listed pollutants were emitted by all of the associated sources and caused all of the listed health effects, and requested edits to remedy apparent inaccuracies. Some commentors also suggested the addition of other pollutants to this table.

**Response:** A footnote was added to indicate that when multiple pollutants are listed in a group, each pollutant may not cause all of the health effects listed in the third column. Staff also made other revisions to Tables ES-1 and 2.1 including alphabetizing the pollutants. Asbestos, lead, and ozone were added to the table.

## **BENEFITS ASSOCIATED WITH PRODUCTS**

**Comment:** Products and appliances are designed with safety in mind to improve quality of life. They are safe, meet a variety of standards, and have public health benefits. Acknowledging this would provide some balance to the report. For example, cleaning products can eliminate disease vectors. Some building materials are approved by CHPS and listed on their website as low-emitting products. Appliances meet a variety of emission standards.

**Response:** Throughout the report statements were added regarding the benefits of many products and appliances. Manufacturers are acknowledged for their efforts in reformulating products to reduce impacts on human health. Discussion was added regarding the importance of cleaning products for reducing exposure to biological contaminants. It is stated that many products meet Section 01350 emission requirements, and a website is provided that reflects the extent of progress made in this area of emission control. Voluntary safety standards imposed by industry, such as those for emissions from appliances, are included.

## **DOSE - RESPONSE RELATIONSHIP**

**Comment:** Several comments focused on the failure of the report to establish a causal link between the low levels of VOCs found indoors and an adverse health effect. The dose-response concept is missing. Low concentrations do not equal high risk. Compare indoor concentrations to guideline values or health bench marks. The hazard is determined by exposure.

**Response:** A brief explanation of dose-response relationships between chemicals and health effects was contributed by OEHHA and added to the report. The report reflects that low levels of chemicals may not always cause a health effect. Guideline values such as chronic RELs, Prop 65 no significant risk levels, and EPA RfC levels were added as appropriate throughout the document. Additional literature was cited regarding the impacts of VOCs on occupants.

## **CANCER**

**Comment:** Table 2.4, *Common Carcinogenic Indoor Air Pollutants*, prompted a variety of comments...it should be revised.

**Response:** This table is now based on the cancer status designation of the International Agency for Research on Cancer (IARC). Some pollutants were added, while others were deleted. The status change for di-2-ethylhexylphthalate to Group 3 is reflected in the table.

**Comment:** The calculation of a possible 230 excess cancers due to indoor pollutants received comment. There was concern that this is an upper bound estimate, not an

average. Caveats should be included to indicate this should not be interpreted as predictions of actual disease incidence.

**Response:** The section on cancer estimates includes a statement that the risk estimates were derived using 95% upper-bound cancer potency factors, which is standard risk assessment practice methodology used by the California Office of Environmental Health Hazard Assessment, and the utility of this estimation method. It was also emphasized that the exposure portion of the calculation was based on values measured in California. Additional caveats were added.

## **TERPENES**

**Comment:** Wording should be revised to clarify that terpenes do not cause the effects noted.

**Response:** Text associated with terpenes was substantially reworded to remedy inappropriate wording regarding their direct effects. However, isoprene and terpenes are reactive compounds, and research is currently being conducted to better define their reactions with oxidative compounds in indoor environments and to characterize the reaction products, some of which cause irritant effects or other impacts. The need for further research is now highlighted in the document. Additional caveats were added.

## **CARPET**

**Comment:** Some readers interpreted statements about carpet dust to implicate carpet as a source of pollutants that actually had a primary origin from another source.

**Response:** Statements about carpet dust were changed to clarify that the carpet was not the original source of dust and related pollutants. Soft or porous interior surfaces have the potential to attract and re-emit particles. Statements about good cleaning practices for carpet were also added. To clarify VOC emissions associated with carpet, "new carpet assembly" was used to reflect that emissions also are derived from carpet pad and adhesives.

## **CONSUMER PRODUCTS**

**Comment:** Discussion of the ARB Consumer Products Program should be expanded. Multiple claims were made that the program has resulted in reducing toxic components of consumer products. Consumer products are much safer than they used to be.

**Response:** Several paragraphs were added to further explain the ARB Consumer Products Program, the categories of products it regulates, the approach to regulation, and the extent of reduced emissions as a result of the program.

## **COST ESTIMATES**

**Comment:** Cost estimates were criticized for various reasons. Generally, commentors suggested that more pollutants should be included, such as radon, biologicals, infectious disease, and lead.

**Response:** Costs for radon impacts (lung cancer) were added. The costs of health effects from some indoor biological pollutants were already included in the Section 3 cost estimates. However, those estimates do not include the costs of structural and material damage, liability/insurance, and health effects on the general population because little if any data are available to make such estimates. Other biological pollutants, such as Legionella, are potentially a major concern in California, but the data on diagnosed cases and those cases related to indoor air contamination rather than drinking water contamination are very limited. Infectious disease can be transmitted in a variety of ways (e.g. personal contact, ingestion of contaminated food) in addition to transmittal through indoor air, and it is not possible to separate disease caused solely by air transmission. It is acknowledged that the costs of infectious disease are substantial.

Lead was not included in the cost estimates because indoor lead exposure is primarily via hand-to-mouth activity, contamination of food, and contamination of drinking water, rather than via inhalation of indoor air. Consequently, effective mitigation measures do not usually focus on controlling airborne lead, except during construction and repair activities in buildings, which are already regulated in California by Cal/OSHA and the State Contractors' Licensing Board.

## **INFILTRATION OF OUTDOOR AIR**

**Comment:** There was concern about the infiltration of outdoor pollutants to the indoor environment. Infiltration of diesel PM can affect EJ communities. Infiltration of ozone can affect indoor chemical reactivity, therefore outdoor ozone should be more heavily regulated.

**Response:** Language was added to further highlight the impact of outdoor air quality on indoor air quality, particularly in the PM section. ARB generally concurs with the statements regarding the importance of outdoor air, and has an extensive regulatory program to address vehicular emissions, including diesel vehicles, and other outdoor sources of pollution. However, the report remains focused on indoor source contributions to health risk.

## **PARTICULATE MATTER**

**Comment:** There was concern that diesel PM is not highlighted as an indoor air pollutant – specifically as an indoor toxic air contaminant, carcinogen, and asthma

aggravator. Issue taken with the fact that the report does not include any mitigation strategies to reduce exposure to diesel PM in homes.

**Response:** ARB has an entire program dedicated to reducing diesel PM at the source, which is the most effective way to reduce exposure and risk. The purpose of the AB 1173 report is to focus on indoor sources and emissions. However, language was added to Section 2.2.1 to specify some of the types of sources of outdoor PM that can infiltrate indoors.

**Comment:** General comment that one reviewer found it difficult to keep track of whether references to PM were to ambient PM or indoor PM.

**Response:** The addition of “ambient” or “indoor” was added prior to “PM” throughout Section 2.2.1 to help clarify this issue.

**Comment:** The statement that indoor PM is equivalent to outdoor PM and therefore epidemiological studies of PM exposure based on outdoor monitoring are directly relevant to indoor PM exposure needs to be further qualified. Also recommended citing the ARB/OEHHA 2002 PM document as a useful reference for the health effects of PM.

**Response:** Additional discussion and clarification was added to Section 2.2.1. The heterogeneity of both indoor and ambient PM is discussed in the report, as well as uncertainties associated with PM sources and health effects. The OEHHA/ARB 2002 PM report is referenced.

**Comment:** There is a need for increased research on the health effects of indoor-generated particles, especially fine particles and ultrafine particles, some of which are generated by indoor air chemical reactions between ozone and common indoor air contaminants.

**Response:** ARB agrees with this statement. The report cites the need for future research regarding the health effects of indoor-generated PM and the products of indoor reactivity, in several areas. ARB also has included a project in this year’s research plan to begin to study the health impacts of indoor-generated PM.

**Comment:** The report states that candles are a significant source of indoor PM, but does not provide any data to back this allegation. Such an assertion should not be made unless data are provided regarding how much indoor PM is actually contributed by candles as compared to other sources.

**Response:** Quantitative data can be found in the PM section which provide mass emission rates for candles in addition to measured indoor PM concentrations resulting from candle burning. The values of 4.3 – 1173  $\mu\text{g}/\text{m}^3$  are modeled values for candles – not incense. This correction was made in the report. The indoor PM concentration levels can be compared to other indoor PM concentration levels resulting from other indoor activities, such as cooking, in the preceding paragraph.

**Comment:** The report notes that candles produce 200-3600 µg/hour of PM. Although there may be candles that produce this amount, a more meaningful measurement would be the airborne concentration (in mg/m<sup>3</sup>) of PM in a room while a candle is being burned.

**Response:** The sentence stating that modeled concentrations ranged from 4.3 – 1173 µg/m<sup>3</sup> is based on candle mass emission rates, not incense mass emission rates. This change was made in the report. Indoor room concentrations based solely on candle burning are not available in the peer-reviewed literature.

## **STANDARDS AND GUIDELINES**

**Comment:** The chapter on standards and guidelines is confusing. It contains some superfluous information, and is lacking information industry thinks should be included.

**Response:** A variety of new information was added to this section including clarification that ANSI has developed emission standards for gas appliances. Information was also added on mechanical ventilation standards for new homes in Washington State and Minnesota State, gas fireplace standards in Canada, and current CPUC testing requirements for gas appliances. Sub-headings were used to clarify the information and some information was reduced. However, time constraints prohibited a more extensive revision to this section.

## **FEASIBILITY OF OPTIONS**

**Comment:** The legislation required that the feasibility of mitigation options be included in the report. Some comments stated the report does not adequately address the feasibility of implementing mitigation options.

**Response:** For both prioritization and mitigation options, we added specifics regarding the feasibility of implementation where possible. The report cites several examples of low-emitting alternative products to indicate alternatives are possible. Detailed assessment of feasibility of specific actions within each option is not appropriate for this report. Aspects of detailed feasibility would be addressed if specific options are pursued in the future.

## **II. SUMMARY OF COMMENTS NOT IMPLEMENTED, WITH ARB RESPONSE**

- 1. Comment:** Add costs associated with infectious disease. Americans are sick more than 4 billion days each year and as a result spend more than \$950 billion on direct medical costs. Eliminate the contribution from SBS until a better causal link is established.

**Commentor: Access Business Group  
Consumer Specialty Products Association**

**Response:** We acknowledge the magnitude of the health impacts and costs of infectious disease in the U.S. However, infectious diseases can be transmitted through routes such as personal contact, and shared food and utensils among families. It is not feasible in this document to identify the portion of infectious disease that is solely attributable to indoor air quality. SBS is a documented syndrome with documented costs, associated with indoor air and certain building characteristics, despite the fact that the causative agents have not been explicitly identified.

- 2. Comment:** Eliminate “VOCs” in Table ES-3 and other places. The term is overly broad and should be replaced by specific compounds or categories.

**Commentor: Access Business Group**

**Response:** Chemicals in the “VOC” category are too numerous to list individually. Consideration would be given to individual compounds if any actions are developed to mitigate this group.

- 3. Comment:** Provide an ongoing scientific research advisory panel to provide continuing review of the project.

**Commentor: Access Business Group**

**Response:** The legislation did not require an ongoing advisory panel. This is a single report, and a peer review panel has been appointed to review and comment on the report, as required in the legislation. If the Legislature recommends such a panel at a future time, for future activities, one would be implemented.

- 4. Comment:** Information should be included about the State of Washington purchase specifications, U.S. EPA purchase specifications, and the Greenguard Certification Program.

**Commentor: Air Quality Sciences**

**Response:** A summary of the Greenguard program was added to Section 4. The EPA Environmentally Preferable Purchasing program (EPP) was not included because it focuses on recycled materials and does little to address indoor air quality. The Washington state specifications for state building and purchases were not included because the California State Sustainable Building Task Force and CHPS specifications are more pertinent for California, and they are more health-protective and comprehensive than the Washington specifications.

5. **Comment:** Phthalates in indoor air do not pose a substantial health risk or cancer risk and should be removed from the report. Di-2-ethylhexylphthalate is currently not classified as to its carcinogenicity.

**Commentor:** American Chemistry Council Phthalate Esters Panel  
Carpet and Rug Institute

**Response:** Table 2.4 was revised to reflect the current IARC status and status as a TAC. However, there was not ample time for a full toxicological review of the many phthalate isomers in indoor air. Phthalates remain in the report in Sections 2.1.2 and 2.3.11. A complete evaluation of their prevalence in indoor air and any health impacts would be undertaken prior to any recommendations regarding these chemicals.

6. **Comment:** Few citations on exposures to CO and NO<sub>2</sub> in California are discussed, and the representativeness of the studies is not discussed.

**Commentor:** American Gas Association

**Response:** The discussion of key California studies of NO<sub>2</sub> exposure was expanded in the report. Only one large California exposure study of CO has been conducted (Wilson *et al.*, 1993), and it was already included in the report. Several of the studies discussed (e.g. Wilson *et al.*, Spengler *et al.*) were quite comprehensive and involved large sample sizes.

7. **Comment:** Combustion was not adequately justified as a source of indoor pollutants. For example, concentrations measured in the study by Wilson *et al.* (1993) are clearly driven by outdoor levels. It is impossible for ARB to justify aggressive actions on combustion sources relative to other indoor air quality concerns.

**Commentor:** American Gas Association  
Sempra Energy Utilities

**Response:** Outdoor sources of CO and NO<sub>2</sub> are important, but the highest indoor levels are usually due to indoor sources. Several investigators have confirmed that indoor combustion sources have a large influence on indoor NO<sub>2</sub> concentrations (Spengler *et al.*, 1994b; Pitts *et al.*, 1989; Wilson *et al.*, 1986; Wilson *et al.*, 1993). Wilson *et al.* (1993) found that an average of 5% of the study homes in each utility service area had indoor CO levels that exceeded the California 8-hour standard of 9 ppm, vs. 3% for outdoor air. Fortman *et al.* (2001) measured indoor NO<sub>2</sub> levels of 400 ppb while making a fried chicken dinner, and levels above 400 ppb during a cycle of automatic oven cleaning with a gas stove. Other pollutants that pose potential health risks, such as PM, aldehydes, and moisture, are also produced by indoor combustion sources.

8. **Comment:** The ARB should provide an analysis for their recommendations to document the impact on improved air quality, and include supporting data on actual

combustion appliance emission rates and background CO concentrations from other sources. For example, what would be the quantitative benefit of banning unvented domestic gas ranges?

**Commentor: American Gas Association**

**Response:** A detailed analysis of the benefits and costs of specific mitigation options is beyond the scope of this report. However, a number of studies have shown reduced combustion pollutants with use of good exhaust fans and other measures. For example, Tsongas and Hager (1994) have shown that the cleaning and tuning of gas stoves in multi-family homes can substantially reduce the CO concentrations above a gas stove. Fortmann *et al.* (2001) found that there appears to be a substantial effect of the range hood exhaust fan in reducing the indoor pollutant concentrations of CO, NO, and NO<sub>2</sub>, with or without side shields on the range hood.

9. **Comment:** The IOM book, *Clearing the Air: Asthma and Indoor Air Exposures*, was used without regard to concentrations involved relative to NO<sub>2</sub> as an asthma trigger and with the committee's caveats. The Committee provides recommendations for mitigation and prevention, but it did not recommend banning unvented gas cooking appliances. The book also states, "the committee did not identify any studies that addressed whether lowering indoor NO<sub>2</sub> levels had an effect on asthma outcomes."

Delete the comments regarding removal of gas-fired cooking appliances from homes.

**Commentor: American Gas Association  
Sempra Energy Utilities**

**Response:** We have added to our mitigation option on building codes to clarify our suggestion regarding unvented combustion devices and exhaust ventilation, which would include electric stoves and ovens. The IOM reference was not focused on examining mitigation, but rather on identifying associations of indoor pollutants and health impacts. Studies published after publication of the IOM report have further substantiated the relationship of NO<sub>2</sub> and asthma exacerbation, including at relatively low NO<sub>2</sub> levels. One study (Pilotto *et al.*, 2003) found reduced asthma symptoms in a school after removal of an NO<sub>2</sub> source. These studies are discussed in the revised report.

10. **Comment:** Fatal CO incidents should not be covered in this report. They are clearly associated with episodic events involving major mechanical failures or misuse of these systems. They do not represent normal conditions under which Californians work and play.

**Commentor: American Gas Association**

**Response:** Such fatal incidents are well documented and clearly have impacts on human health and the California economy. It is an indoor air quality issue

because it is the extreme result of inadequate maintenance of appliances, failure of appliances, misuse of appliances, and other causes. CO poisoning also can be caused by backdrafting of combustion appliance fumes, which can result from a variety of factors such as tight building construction, improper installation of appliances, and indoor-outdoor pressure changes due to wind and weather.

- 11. Comment:** The ARB data regarding CO poisonings is incorrect because it omits CO from automobiles and portable gasoline powered equipment. NCHS data for California shows a declining trend in CO fatalities to 25 statewide for all sources in 1998. This can be compared to 53 in 1978. Attribution of declining CO poisoning due to increased use of CO alarms and appliance testing is unfounded because any such affects cannot be discriminated from the declining trend.

Revise the death rate assumptions and resulting costs for CO poisoning deaths.

**Commentor: American Gas Association  
Sempra Energy Utilities**

**Response:** The estimate of total CO mortality cases for California, as summarized in Section 2, includes all categories of accidental poisoning cases and is taken from a California study that included detailed review of coroners' reports. The cost estimates in Section 3 include only appliance-related causes (indoor combustion appliances and the hibachi grills as shown in Fig. 2.2) because the other categories may often be in an outdoor or occupational setting.

CPSC (1997) analyses of national data from 1990-1994 indicate that there was not a significant decline in accidental, non-vehicle causes of fatal CO poisoning. CPSC (2003) analyses indicates that some of the apparent decline by 2000 in accidental, non-vehicle CO deaths may be due to changes in the coding system for poisonings.

This report's statements on use of CO alarms and safety testing are clearly suggestions rather than attributions. The CPSC (1997) has made similar statements regarding the increased use of CO alarms and increased public awareness.

- 12. Comment:** The interpretation of data by Linn *et al.* (2000) is flawed for several reasons. There are problems with using the stated conclusions for further action.

**Commentor: American Gas Association**

**Response:** The conclusions of Linn et al (2000) are those of the authors. However, this is just one of a number of studies that have identified a clear relationship of CO levels to heart and cardiovascular health effects. Any actions to be taken would not be taken based on a single study, but rather on the body of the most relevant information available.

**13. Comment:** The discussion of guidelines and testing procedures for combustion appliances is selective, incomplete, and confusing. For example, references to the Build America program do not provide enough information on whether its recommendations are broadly used or technically supported.

**Commentor: American Gas Association**

**Response:** The report now includes clarification that ANSI has developed emission standards for gas appliances. Information was also added to update the description of CPUC testing requirements for gas appliances, on mechanical ventilation standards for new homes in Washington State and Minnesota State, and on gas fireplace standards in Canada. The ARB report lists Build America in Section 4 as one of several groups of high performance builders that are pro-actively addressing ventilation and combustion safety in homes. It does not imply that their approach is a widespread practice yet. Combustion safety testing, including tests for excessive depressurization, are widely used by state low-income and other weatherization programs and radon mitigation programs throughout the U.S.

**14. Comment:** ASHRAE Standard 62.2 is characterized incorrectly.

**Commentor: American Gas Association**

**Response:** We have ordered the latest version and will update the discussion in the final report as needed.

**15. Comment:** References cited on combustion issues in the report are not readily available.

**Commentor: American Gas Association**

**Response:** The referenced citations include enough information to obtain the references from the publisher. We can provide citations, upon request, if the materials are not protected by copyrights.

**16. Comment:** The time reportedly spent indoors at home is inaccurate.

**Commentor: Association of Home Appliance Manufacturers  
Whirlpool**

**Response:** The data come from a random, population based California survey conducted in the late 1980's. The average estimate has been confirmed in subsequent surveys and field studies, including a national activity pattern study conducted in the 1990s. AHAM's calculated average time indoors does not consider people who work at home, part-time workers, weekends, holidays, and trends toward more time using computers.

**17. Comment:** Appliance re-design is not needed; rather, increased public education and professional training are needed.

**Commentor: Association of Home Appliance Manufacturers  
Gas Appliance Manufacturers Association  
Whirlpool**

**Response:** Increased public education and professional training are necessary to reduce problems associated with the misuse and improper maintenance of consumer appliances—this was one of the draft report's recommendations. However, changes in appliance design should also be considered because public and professional education may have only a minimal effect, and reducing emissions is the most certain way to reduce exposures.

**18. Comment:** The report should treat separately the misuse of outdoor cooking appliances such as grills and hibachis, and subtract their contribution to the estimates of CO poisoning.

**Commentor: Association of Home Appliance Manufacturers**

**Response:** These appliances contribute to CO poisoning cases in California. Recommended mitigation options for improved public education and professional training would address this problem.

**19. Comment:** The report should recognize the intermittent use of gas ranges, stoves, and ovens.

**Commentor: Association of Home Appliance Manufacturers**

**Response:** The indoor concentration data summarized in the report reflect the range of typical uses of cooking appliances in homes. These appliances are sometimes appropriately used for extended periods, e.g., baking and roasting, and are sometimes used inappropriately for heating the home or for hobby activities. All such uses contribute to the pollutant levels measured in indoor studies to the extent the sources are used during those studies.

**20. Comment:** Air pollutant levels in homes are not connected directly with deleterious effects; ARB needs to do a field survey to obtain baseline data set.

**Commentor: Association of Home Appliance Manufacturers**

**Response:** The report compared indoor pollutant levels to health-based criteria for long and/or short term effects, where sufficient data for California buildings were available. As indicated in Section 2 and Table 2.7, formaldehyde and some VOCs sometimes exceed acceptable cancer risk levels (and occasionally irritant effect levels) in some homes in California. Similarly, PM, CO, and NO<sub>2</sub> levels sometimes exceed health-based standard levels.

**21. Comment:** Reflect the CPSC review of the air-free CO standard for gas stoves and ranges, and the importance of outdoor air quality on indoor CO and NO<sub>2</sub>.

**Commentor: Association of Home Appliance Manufacturers**

**Response:** Please provide a copy of the CPSC memo, or the web site.

Malfunctioning, unvented, or poorly vented combustion appliances also produce indoor NO<sub>2</sub>, PM, aldehydes, and water vapor, which can increase the risk of acute and chronic health effects. A CO standard does not address these potential health risks. Also, it is not clear that the ANSI standard for air-free CO is as protective as the ARB's IAQ guideline for CO. Outdoor sources of CO and NO<sub>2</sub> are important, but the highest indoor levels are usually due to indoor sources. As indicated above, Wilson *et al.* (1993) also found that an average of 5% of the homes in each utility service area had indoor CO levels that exceeded the California 8-hour standard of 9 ppm, vs. 3% for outdoor air.

**22. Comment:** Disagree that humidifiers are a common source of biological agents.

**Commentor: Association of Home Appliance Manufacturers**

**Response:** One study that found substantial biological agents emitted from some types of humidifiers is Tyndall *et al.*, Home Humidifiers as a Potential Source of Exposure to Microbial Pathogens, Endotoxins, and Allergens, INDOOR AIR, 1995. Other references have identified the contribution of humidifiers to humidifier lung, hypersensitivity pneumonitis, and other impacts. These include Ohnishi *et al.*, Humidifier Lung: Possible contribution of endotoxin-induced lung injury, INTERNAL MEDICINE, 2002; Alvarez-Fernandez *et al.*, Hypersensitivity pneumonitis due to an ultrasonic humidifier, ALLERGY, 1998; and Suda *et al.*, Hypersensitivity pneumonitis associated with home ultrasonic humidifiers, CHEST, 1995. Cool mist and ultrasonic humidifiers readily aerosolize bacteria and endotoxin. Lack of proper maintenance for appliances that involve water reservoirs, drain pans, or condensing coils is a well-known problem in residences, schools, and other nonresidential buildings.

**23. Comment:** Disagree that range hoods are not used in homes.

**Commentor: Association of Home Appliance Manufacturers**

**Response:** The California activity pattern study results (Phillips *et al.*, 1991) support this statement that range hoods are not used often, as do the results of other studies in the U.S.

**24. Comment:** Products used to clean, polish, maintain, resurface, or refinish interior surface materials should be included in the category of building materials and products. These consumer and commercial cleaning products should be elevated to a higher place on the prioritized list.

**Commentor: Building Ecology Research Group**

**Response:** These products largely fall within the definition of consumer products under ARB's Consumer Products Program, and a few may be considered architectural coatings. Please see Section 4.3.11.

**25. Comment:** The report should take a stronger position regarding the actions that should be taken to protect the citizens of California from indoor air pollution.

**Commentor: Building Ecology Research Group**

**Response:** Thank you for your comment. We believe that we are proposing very solid solutions that would protect Californians from indoor pollution.

**26. Comment:** Delete the reference to controversial ASHRAE standard as possibly being a basis for future state building standards.

**Commentor: California Building Industry Association**

**Response:** ASHRAE consensus standards have historically been considered in developing building ventilation regulations for California and other states, and they cannot be ignored in future standards development efforts.

**27. Comment:** The report may be too long and technical to reach the intended audience (legislature and public-at-large). It has uneven level of detail that adds unnecessarily to the report length. The chapter on existing regulations, guidelines, and practices should be condensed.

**Commentor: California Department of Health Services, EHLB**

**Response:** We agree that the report is technical and lengthy; however, the mandate for review by a scientific review panel requires a fairly comprehensive, somewhat technical report. The Executive Summary covers all aspects of the report; the body of the report provides the citations and background that support and explain the Executive Summary.

**28. Comment:** In Table ES-1, cancer should not be listed as the first health effect for some of the pollutants.

**Commentor: California Office of Environmental Health Hazard Assessment**

**Response:** For the organic chemicals, cancer is the most likely impact at low exposure levels, and the most common basis for identifying TACs. Those VOCs are not normally found indoors at levels above the acute RELs.

**29. Comment:** Under absenteeism cite the Southern California Children's Health Study that describes the association of increased school absenteeism with PM.

**Commentor: California Office of Environmental Health Hazard Assessment**

**Response:** This data was not included in the report. While PM10 was correlated with non-illness-related absences, there was no significant correlation with illness-related absences (musculo-skeletal injury or social reasons most often caused the absences).

**30. Comment:** Suggest the deletion of several sentences in page 38 middle paragraph as they are speculative by implying that indoor PM is more toxic than outdoor PM - by suggesting that fresh indoor PM is smaller and thus penetrates deeper into the lung (size and deposition are not linearly related), by suggesting that indoor PM is more reactive because it is freshly made (there is common exposure to freshly made PM in outdoor environments), and noting that multiple exposures to many chemicals occurs both indoors and outdoors (therefore stating this for the indoor environment is irrelevant when comparing it to the outdoor environment).

**Commentor: California Office of Environmental Health Hazard Assessment**

**Response:** The report did not state that fresh indoor PM penetrates deeper into the lung than larger sizes of PM. The indoor mix of toxics and respiratory pollutants in the indoor mix is almost certainly different than in outdoor air due to the many indoor-specific PM sources and is mixed in a somewhat confined space. So, it is likely that there may be significant synergistic effects indoors that do not occur outdoors, and vice-versa. In general, the possibilities mentioned in this paragraph are offered as plausible explanations regarding the results of the Long *et al.* (2001) study, which indicated that indoor PM may have been more toxic than ambient PM in that case. A sentence was added to the end of the paragraph indicating that additional research is needed in this area.

**31. Comment:** Recommendation to average activity data so that both adults and children are reported to spend about 90% of their time indoors.

**Commentor: California Integrated Waste Management Board**

**Response:** Activity data was reported in a standard format that coincides with other ARB reports and with the relevant published paper. We do not combine time spent inside vehicles with time spent indoors because the major pollutants inside vehicles are from tailpipe emissions. Also, unlike buildings, most vehicles have very high air exchange rates.

**32. Comment:** The legislation required that the feasibility of mitigation options be included in the report. The report does not adequately address the feasibility of supplying large quantities of composite wood products with phenol-formaldehyde (PF) resin.

**Commentor: California Wood Industry Coalition (from Venable)**

**Response:** The report cites several examples of low-emitting alternative products. The examples serve to illustrate that alternative technologies are available and feasible. Large-scale feasibility would be assessed should any of

the mitigation options be considered for adoption in the future. Greater quantities of PF product could be provided over time if a strong market existed for the product.

- 33. Comment:** The bar graph depicting indoor formaldehyde concentrations is inappropriate. The residential concentrations in excess of 200 ppb are much higher than levels currently found. No data is included to demonstrate the significance of emission reductions by covering, laminating, or sealing composite wood.

**Commentor: California Wood Industry Coalition (from Venable)**

**Response:** Only a few studies have recently measured large-scale residential formaldehyde concentrations. Our estimates include the NHEXAS exposure study in Arizona, reported by Gordon *et al.*, in 1999. For reasons explained in Appendix 3, we feel this is a realistic maximum estimate of formaldehyde concentrations. The reduction in formaldehyde emissions when composite wood is laminated or coated is briefly described in Section 2.3.1.2.

- 34. Comment:** Recommendations in the report are in contrast to the Indoor Air Quality Guideline issued in August, 2004 that urges consumers to look for the Composite Panel Association and Hardwood Plywood and Veneer Association certification marks, indicative of product that meets formaldehyde emission restrictions.

**Commentor: California Wood Industry Coalition (from Venable)**

**Response:** The guideline directs consumers to use products with such stamps only if they need to use urea-formaldehyde (UF) resin products. The entire section of the guideline prior to that section clearly indicates that alternative materials, such as lumber, gypsum board, or PF-resin composite wood products, are preferred over UF-resin products.

- 35. Comment:** The report is totally silent on the public health effects that its mitigation strategies would garner. We believe that there would no benefits from the product substitution suggested in the report.

**Commentor: California Wood Industry Coalition (from Venable)**

**Response:** As found in extensive testing reported by Kelly *et al.* (1999), bare UF products emitted hundreds to over a thousand  $\mu\text{g}/\text{m}^2/\text{hr}$ , while bare PF products emitted less than 10  $\mu\text{g}/\text{m}^2/\text{hr}$ . Coated UF products fall in-between these two groups. Thus, because of this large difference in emissions, and because UF products are currently used primarily in indoor (interior) applications, there clearly would be a substantial exposure reduction in new and remodeled homes. However, the calculation of the explicit degree of health benefit can only be made for specific mitigation actions. If such actions are taken in the future, the exposure reduction and the percent of the population that would benefit would be calculated and considered.

**36. Comment:** ARB should review 5 papers related to carpet and PM and reflect the data and findings in these papers in the AB 1173 report.

**Commentor: Carpet and Rug Institute**

**Response:** ARB does not generally cite non-peer-reviewed scientific literature in technical reports unless some type of governmental or scientific review has occurred. The articles referenced were reviewed in order to further investigate the impact of carpet on indoor air quality (Berry, 2003a,b; Ryan, 2003; Lewis, 2003; Luedke, 2003). These articles included a mix of reviews of relevant published literature, independent modeling, and major findings from an academic/industry panel. This body of literature stresses that, when maintained properly through a combination of vacuuming and an extraction cleaning program, carpet does not negatively impact indoor air quality or pose a health threat to humans. Several papers state that dust loadings above 2 grams per square meter have the potential to release accumulated dust into the airborne environment, although these contributions to the indoor PM concentration loadings are small. ARB agrees that more aggressive carpet cleaning programs, though infrequent in homes, can reduce human exposure to carpet-entrained PM. ARB also notes that, especially for children, dermal and ingestion routes of exposure are most likely a larger contributor to total carpet dust PM exposure than inhalation.

**37. Comment:** By definition, Sick Building Syndrome (SBS), means that the illnesses experienced by occupants cannot be tied to a single source. "It [the report] also does not give the same detail on carpet that it does on the other things. Simply putting 'carpet' here in this context is irresponsible and inappropriate."

**Commentor: Carpet and Rug Institute**

**Response:** As stated in the report, Mendel (1993), Tenbrink *et al.*, (1998), and Apte and Daisey (1999) found consistent findings linking SBS symptoms with certain building characteristics and potential sources. The presence of carpet was one of those potential sources.

**38. Comment:** In a study cited by Delfino (2002) wheezing was related to house painting and carpet installation during the first year of life. "Did ALL of the homes where wheezing occur have new carpet? Did they ALL have new paint? ...This is an example of repetitive theme within this document for 'carpet' being put into a broad category that does not apply to ALL carpet."

**Commentor: Carpet and Rug Institute**

**Response:** The report cites findings as the authors listed them. Few studies show effects for all similar situations, because the individual variability across subjects is always a factor. Of course, one cannot assume that ALL carpet will precipitate these effects in ALL people. It is important to note, as reported in the literature, that some carpet can cause a response in some people.

**39. Comment:** The report states that ozone from ozone generators can react with interior surfaces such as carpet to produce toxic and irritating byproducts. The problem is the ozone generator, not the interior surfaces.

**Commentor: Carpet and Rug Institute  
Interface Research Corporation**

**Response:** The intent of the report is that the ozone generator is the problem, not the interior surfaces. However, data exists to support that these reactions occur on surfaces found indoors.

**40. Comment:** The CIWMB study (Alevantis) is an inappropriate reference due to many unknowns including age of sample, exposure history, lack of chain of custody documentation, controversy over test methods, and possibly cross contamination between samples.

**Commentor: Carpet and Rug Institute  
Interface Research Corporation**

**Response:** Guidance was solicited and received from a peer review panel throughout the study. The lack of some information, for some products, is acknowledged as a limitation to the CIWMB report. Every effort was made to obtain recent, dated samples directly from manufacturers, but a number of manufacturers did not provide dated samples. It was decided not to exclude commonly used products just because a sample was not provided by the manufacturer. Cross-contamination should not be an issue because samples were pre-conditioned in a large test chamber with high air flow for 10 days, then moved to a small chamber for testing.

**41. Comment:** Table 2.6 lists TACs detected in the emissions from carpet and carpet cushion. Test results from one or two specific carpets should not be generalized to all carpet.

**Commentor: Carpet and Rug Institute  
Interface Research Corporation**

**Response:** The listed compounds were emitted from the carpet and cushions tested at the time the study was conducted. No statement was made that these are emitted from all carpets. Refer to the final report of the study for more detail.

**42. Comment:** House dust and carpet dust are the same thing. By using the term “carpet dust”, there is an implication that the carpet generates the dust. There is also an implication that the carpet is the source of pesticides, metals, etc. associated with the dust.

**Commentor: Carpet and Rug Institute  
Interface Research Corporation**

**Response:** Most literature refers to dust found in homes and carpets as house dust and carpet dust, respectively. It is generally understood that tracked-in pollutants and pollutants infiltrated from outdoors are the source of exposure, not the carpet. Luedtke (2003) makes it clear that the association between blood lead levels and lead levels in house and carpet dusts is not indicative of cause and effect. It has been noted in the report that a causal effect can not be inferred from the association of lead-dust and blood-lead levels.

**43. Comment:** It is inaccurate to characterize the 2003 study by Rosenman *et al.* as having further demonstrated an association between asthma symptoms and VOCs, primarily from cleaning products. Epidemiological studies such as this are often subject to confounding factors that mask actual causes...

**Commentor: Consumer Specialty Products Association**

**Response:** It is correct that epidemiological studies must deal with confounders, but that does not negate the statistical associations identified by the investigators among factors examined in the study. Because this study focused on janitors who worked with substantial amounts of cleaning products daily, it has a more direct link with cleaning products that other studies may not have.

**44. Comment:** As noted in Attachment C (provided as Attachment A) to these (CSPA's) comments, there are numerous and comprehensive regulations aimed at assuring the safety and efficacy of various consumer products.

**Commentor: Consumer Specialties Products Association**

**Response:** We recognize that there are federal regulations aimed at safety and efficacy of products; however, as we indicate, there are few effective rules aimed at preventing actual health impacts. The information provided focuses on regulations that require labeling of hazardous products, not emission limitations or prohibited uses of certain products. Labeling is useful in some situations, but is not a fully effective way to prevent harmful exposures. Similarly, child-resistant closure requirements prevent poisonings, not health impacts of consumer product use, and federal pesticide sale and use rules are not necessarily adequate to prevent exposures due to persistent pesticides that may accumulate in carpets. At the recent October 2004 conference of the International Society of Exposure Analysis, several presenters noted the apparent longer half-life of pesticides in indoor environments, possibly due to the reduced effect of weather (no wind, rain) in indoor environments.

**45. Comment:** The report should include additional factors related to the incidence and/or severity of asthma, such as hormone replacement therapy and increases in obesity. CDC indicates from 2001 to 2003 the rate of Americans experiencing

asthma attacks has declined. Chemicals found in consumer products, particularly cleaning products, are not associated with asthma.

**Commentor: Consumer Specialty Products Association**

**Response:** The review by Delfino (2002) provides epidemiological evidence for links between air toxics and asthma. He states that asthmatic symptoms in adults occurred in association with several chemicals including terpenes and limonene, compounds often used in cleaning products. Research may indicate a variety of other factors related to asthma; however, this report deals only with indoor air pollution. Generally researchers indicate an association between asthma and a specific activity (i.e. remodeling, appliance use, etc). Caution must be exercised when drawing conclusions from these studies because the effects seen may be subject to confounding by other causal agents.

- 46. Comment:** The draft report should be revised to indicate which specific indoor sources are known to produce more reactive PM emissions, based on the data of Long et al, and not speculate that all indoor combustion products produce them. Also, the rationale of why these indoor air pollutants are more reactive lacks references, and thus the speculation should be deleted until the results of the research appropriately called for in the draft report are available.

**Commentor: Consumer Specialty Products Association**

**Response:** It is not known which specific indoor sources produce more reactive PM emissions. The report does not make the speculation indicated. It is clearly stated that more research is needed in this area.

- 47. Comment:** Much of the PM from clean-burning candles is below one micron in diameter and therefore generally not considered respirable.

**Commentor: Consumer Specialty Products Association**

**Response:** The majority of the PM mass in almost all combustion source mass distributions falls below 1 um. Both ultrafine and fine PM are deposited throughout the respiratory track (upper airways, alveolar area, and tracheo-bronchial area). Ultrafines will agglomerate and/or undergo other changes that affect their respirability.

- 48. Comment:** In discussion related to cancer risk, consumer products are inaccurately identified as a source of several pollutants including formaldehyde.

**Commentor: Consumer Specialty Products Association**

**Response:** Product reformulations have reduced or eliminated TACs from some consumer products, but products such as cosmetics (fingernail hardeners, polish), clothing, textiles, and some others do contain, and emit, formaldehyde and/or other TACs. Not all consumer products are regulated by ARB.

**49. Comment:** The report should cite the California Attorney General Letter, April 17, 2000 which states that “nail polish containing toluene and formaldehyde sold for consumer use does not require a Prop 65 warning”. The report also states “consumers in salons where nail polish contains toluene and formaldehyde do not need to be given warnings”.

**Commentor: Cosmetic, Toiletry, and Fragrances Association**

**Response:** Staff were not able to obtain a copy of this letter. If the letter is provided to us, it will be reviewed and statements incorporated into the report as appropriate. However, it is not clear whether the need to provide a Prop 65 warning is useful here; Prop 65 accounts only for emissions from individual sources under typical conditions, not multiple sources that may be present indoors, nor some elevated emission situations that may occur regularly.

**50. Comment:** The peer review should include a Certified Industrial Hygienist.

**Commentor: Daggett, Denise**

**Response:** The peer review panel does not include an industrial hygienist; however, Dr. Katharine Hammond, one member of the panel, has conducted extensive research on indoor and personal exposure to a variety of pollutants in occupational environments. Additionally, the report was reviewed by staff from Cal/OSHA, who provided valuable information from the industrial hygienist perspective.

**51. Comment:** The threshold for formaldehyde irritant effects is approximately 1,000 ppb according to a “panel of experts”. Some agencies use a level as low as 100 ppb as a threshold for irritation. References to formaldehyde’s irritant effects should be removed from the report or edited to make it clear that no irritation would be expected to occur at concentrations present in indoor environments.

**Commentor: Formaldehyde Council, Inc.**

**Response:** The acute and chronic RELs established by OEHHA are the health benchmarks used by ARB for California programs, and are substantially lower than the levels mentioned in the comment. The levels of the RELs are included in the report so the reader can compare them to the indoor concentrations.

**52. Comment:** The weight of scientific evidence supports a lack of association between formaldehyde and asthma. “The references to formaldehyde and asthma should be removed from the report.” “The studies cited by Delfino ... to support an association between asthma and formaldehyde are unreliable.”

**Commentor: Formaldehyde Council, Inc.**

**Response:** According to Tables 2.2 and 2.3 of the report, the Institute of Medicine finds suggestive evidence for an association of asthma exacerbation by formaldehyde and possible, but insufficient evidence for an association for the development of asthma by formaldehyde. As stated in the report, Delfino (2002) identified several links between asthma symptoms and indoor formaldehyde. This information has been in peer reviewed literature for several years.

**53. Comment:** The Chemical Industry Institute of technology (CIIT) evaluation of potential cancer risk from formaldehyde, published in 1999, should be included in the report. CIIT predicted that cancer risk is negligible until exposures reach a level associated with cytotoxicity, which is in the range of 600 to 1,000 ppb. The CIIT risk assessment has been used by the U.S. EPA, Health Canada, WHO, and the German MAK Commission. The CIIT overcomes problems that exist in normal risk assessment methodology, such as the fact that formaldehyde has a role in normal physiology.

**Commentor: Formaldehyde Council, Inc.**

**Response:** In November 2002, OEHHA denied a petition to review the California formaldehyde risk assessment. The petition was based in part on the potency estimate change associated with the CIIT 1999 report. OEHHA stated that the report was a new analysis of old evidence rather than new evidence. OEHHA also stated that more information is needed to evaluate the risk assessment model used by CIIT, and that it needs to be peer-reviewed and validated.

**54. Comment:** Differentiate between types of gas appliances.

**Commentor: Gas Appliance Manufacturers Association**

**Response:** The wording for unvented appliances was clarified in some cases. Technical detail on types of venting for various types of vented appliances is not deemed necessary for this type of review document.

**55. Comment:** Reducing product emissions is very costly.

**Commentor: Gas Appliance Manufacturers Association**

**Response:** This varies by product. Evaluating the cost of cleaner burning technologies and improved exhaust ventilation for specific applications is beyond the scope of this report. Mitigation measures are often less expensive than original estimates, especially once the economies from mass production are included. For example, a review of the porous insert technology for gas stove burners by Battelle Memorial Institute suggests that this could be a low-cost technology that reduces emission of CO, NO<sub>x</sub>, acids of nitrogen, and formaldehyde but does not affect energy efficiency (<http://www.battelle.org/energy/cases/gasburn.stm>; Reuther and Billick, Appliance Engineer, October 1996, pp. 92-95).

**56. Comment:** Grocery Manufacturers of America object to requiring emissions testing and special labeling by manufacturers of consumer products. Multiple labels on consumer products serves only to confuse consumers, rather than provide any demonstrable health benefit. Instead, GMA's members will continue to provide products that are safe for both the consumer and environment.

**Commentor: Grocery Manufacturers of America**

**Response:** Thank you for your perspective. We believe that labeling serves a purpose by providing full information to the customer who can then make an informed choice among products. The need for testing and labeling of different categories of products would be determined after more detailed assessment if further legislation establishes such a program.

**57. Comment:** PBDE should be listed as a pollutant, and endocrine disruption should be a health effect for PBDE.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** Several chemicals that are unrelated by product source (i.e. plastics, pesticides, and computers) have the potential to cause disruption to endocrine systems so this category remained in the pollutant column of Table ES-1 and Table 2.1.

**58. Comment:** The MATES II study conducted in 1999 by the South Coast Air Quality Management District (SCAQMD) indicates that cancer risk from diesel particulate in the South Coast Air Basin alone is 1 in one thousand (71% of a total average basin risk of 1414 per million). Even considering adjustments for period of exposure, ARB's estimate for the total potential risk (statewide) from diesel particulates is one-half that of SCAQMD's estimate for the South Coast Air Basin alone.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** This is addressed in California's Diesel Risk Reduction Plan, on page 16. The plan is available on ARB's website at <http://www.arb.ca.gov/diesel/diesel.htm>.

**59. Comment:** The report cites Smith (1988) for calculating that pollutants emitted indoors have a 1000-fold greater chance of being inhaled than do those emitted outdoors. There is concern that the public cannot find the original publication and review the assumptions used in it. A discussion of the author's calculations as a footnote or in an appendix would be helpful.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** The ARB would be happy to provide a copy of the paper on request.

**60. Comment:** Preliminary results from special air-monitoring studies indicate that pollutant levels in selected communities near industrial and vehicular sources of pollution are similar to levels in other communities. These findings appear contradictory to statements made elsewhere in the draft report about exposure to indoor air pollutants within lower socioeconomic groups.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** The above statement indicates ambient air pollution may not be significantly worse in communities located in industrial areas. The focus of statements related to socioeconomic factors is related to poor building practices, biological contaminants, and lead, not ambient air pollution.

**61. Comment:** The findings of a single study cannot lead one to conclude that the finding or result is generally true. This comment is made several times, directed to different citations through the report. One comment is specific to the use of room fresheners by a higher percentage of low-income individuals than the general population.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** In general, when a statement is made with a citation, it should be taken at face value. A conclusion cannot be drawn that the reported situation is true for all of California. However, the comment about use of room fresheners by low-income individuals is based on a statewide survey of 1579 California adults in a weighted population-based study (Wiley *et al.*, 1991b). Thus, it is appropriate to apply that statement to all of California.

**62. Comment:** The conclusion that air pollution was identified as a potentially important contributor to the increase of asthma appears to be a conclusion of ARB staff.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** Actually, the conclusion is that of the three sources cited, as well as several other sources not cited.

**63. Comment:** The potential for carpets to act as sinks for indoor air pollutants should receive greater attention in this report.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** Carpets and other soft surfaces may serve as a sink for pollutants; however, they are not the primary source of the pollutant. The report focuses on the primary sources of pollutants.

**64. Comment:** “Although distributions were used to estimate risk, the resulting average individual risk was used to estimate annual cancer cases, and thus these may be conservative estimates, since the average does not necessarily fully capture those

at very high risk.” HSIA disagrees with this statement. Using the average overstates the potential risk for those at lower exposures as much as it understates the risk for those at higher exposures.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** Although carcinogens pose some risk of cancer even at very low levels, the “yardstick” used to identify excess cancer is the number exposed above a certain level for a lifetime, such as one in a million, one in a hundred thousand, etc. Thus, it is the percent of the population exposed above these levels that is of greatest interest. Statistically speaking, the average doesn’t reflect the upper end of the distribution if the distribution is bi-modal, or takes certain other forms.

**65. Comment:** Statements in Appendix III-3 regarding additional carcinogens that were not included in the risk estimate are confusing. HSIA does not believe that PCBs can be produced by indoor sources.

**Commentor: Halogenated Solvents Industry Alliance**

**Response:** The point made in the appendix is that there are many carcinogens measured in indoor air that were not included in the Comp Risk estimate. PCB was one of several chemicals mentioned in the example. In an older study, PCBs were measured in indoor air inside a school, office building, and residential care homes for the elderly. It is not clear if the PCB originated from sources inside the buildings, or whether it infiltrated with outdoor air.

**66. Comment:** The link is missing between reduced ambient emissions due to wood stove regulations and improved IAQ.

**Commentor: Hearth, Patio & Barbecue Association  
Lennox**

**Response:** The Northern California PAH study (Sheldon *et al.*, 1993) and others have documented the influence of outdoor smoke on indoor air pollutant levels. In addition, opening the door during fueling or ash removal, and the deterioration of the stove’s door seals and flue joints, can significantly increase indoor PM levels.

**67. Comment:** ISSA objects to the general characterization of cleaning agents as a major source of indoor pollutants and urges the ARB to delete reference to cleaning products. ISSA also recommends “consumer products” be removed from Tables ES-3 and 6.1.

**Commentor: International Sanitary Supply Association**

**Response:** Consumer products and cleaning products will remain in the report and the text. They are in the medium priority category. Some cleaning products

liberate indoor pollutants when used according to label directions. The individual doing the cleaning is usually in close proximity to the release of these pollutants. Before further action would be taken for cleaning products, a thorough review of concentrations of pollutants released and any related health impacts would be conducted.

**68. Comment:** Make the distinction between formaldehyde-free products and products that are low-emitting or “green certified”. Make a clear recommendation in favor of formaldehyde-free products such as the statement in the ARB Guideline, “Formaldehyde in the Home”.

**Commentor: Johns Manville**

**Response:** Our current ARB Guideline urges the homeowner to “use insulation materials that emit little or no formaldehyde”, and to obtain emission test results from the manufacturer to document claims made. The ARB strongly prefers formaldehyde-free products, but emissions test data are needed to document the availability of formaldehyde-free materials.

**69. Comment:** Trends in manufactured home production have resulted in a substantial decrease in formaldehyde emissions from the 1980s. Homes manufactured today use gypsum board on walls and ceilings, earlier styles used composite wood paneling. Using the method ARB employed to calculate formaldehyde concentrations in manufactured homes, but correcting for errors in the underlying assumptions, estimated formaldehyde levels in modern manufactured homes should be approximately 11% of the levels observed in 1985.

**Commentor: Manufactured Housing Research Alliance**

**Response:** The calculations presented in the comment result in a formaldehyde level of 8.25 ppb in modern manufactured homes, compared with 37 ppb in the report. The study by Hodgson et al (2000) found the geometric mean formaldehyde concentration in new manufactured homes to be 34 ppb. He commented that this was reduced about 50 percent from concentrations measured during the 1980s due to reduced use of paneling and reduced emission rates from composite wood products. Mobil homes measured in the Sexton (1985) study were selected so that 60 percent were manufactured in 1981, 1982, and 1983, past the date when the composite wood industry made great reductions in their product emissions. This additional information supports the formaldehyde concentrations presented in the report.

**70. Comment:** The report does not address indoor air pollution that results from agricultural spraying, both from ‘drift’ and from workplace exposures that are brought into the home. These are serious concerns in rural California.

**Commentor: Mendocino County AQMD, Christopher Brown**

**Response:** We agree that these can be serious concerns in some areas. The report cites studies that were conducted in farm worker homes and non-farm worker homes, as well as agricultural and non-farming families. Data indicate higher levels of pesticides are generally found in the farming, agricultural homes. The focus of the AB 1173 report is on indoor sources, but some information was added to highlight the many outdoor sources of pollutants that contribute to indoor concentrations.

**71. Comment:** The report does not fully integrate in its analysis the effects of outdoor pollution on indoor environments. Diesel PM is a special concern that should be highlighted as an indoor air pollutant. Diesel PM is an indoor TAC, carcinogen, and asthma aggravator that disproportionately impacts some communities in California more than others.

**Commentor: Pacific Institute and other environmental groups**

**Response:** The focus of the report is on the contribution of indoor sources to indoor pollution and health risk, and indoor sources of diesel are rare. Additionally, programs and regulations already exist to address outdoor sources including diesel PM. However, language was added to further highlight the impact of outdoor air quality on indoor air quality.

**72. Comment:** None of the recommended mitigation options specifically target low-income housing. Many of the indoor air quality problems experienced in low-income housing are due to their location near freeways. To address indoor air quality, agencies need to consider outdoor air impacts when choosing locations for housing and provide mitigation technologies such as HEPA filters to all residents.

**Commentor: Pacific Institute and other environmental groups**

**Response:** The ARB shares the Institute's concern regarding the proximity of some homes, especially low income housing, to freeways and other busy roadways. Legislation was approved this year (SB 352, Escutia) requiring school districts to identify freeways and other busy traffic corridors within one-fourth of a mile from proposed school sites. Similar policies are under consideration for homes. However, HEPA filters are not the immediate answer. In homes, their usefulness is limited because most outdoor air enters through open doors and windows and through leakage; homes generally do not have outdoor air intakes associated with their heating and cooling systems. Additionally, HEPA filters require heating and air conditioning motors with sufficient power to handle the increased airflow resistance

The report discusses mitigation options to reduce indoor emissions, control moisture, and improve ventilation, which will especially benefit low-income populations. These populations are more likely to live in multi-family buildings and manufactured housing, which typically have smaller interior volumes and, hence, indoor air pollutant levels that build up more quickly and to higher levels, relative to homes with larger volumes. Low-income populations are also less

likely to have adequate maintenance of combustion appliances, ventilation systems, and moisture control features.

**73. Comment:** More information is needed on the ozone emissions of ozone-emitting air cleaning equipment. Manufacturers do not provide accurate answers regarding emissions from their air purifiers.

**Commentor: Parents for a Safer Environment**

**Response:** We agree. Mitigation options to regulate emissions from air cleaners and to require third party emissions testing of all types of materials and products would address this concern.

**74. Comment:** Market forces are spurring the development and implementation of emissions testing programs for building materials. For example, the Los Angeles Unified School District requires building materials used in construction projects to meet the Section 01350 emission concentration levels. Given these market forces, state-required mandatory emissions testing by manufacturers is unwarranted.

**Commentor: Resilient Floor Covering Institute**

**Response:** We are pleased that some entities are requiring manufacturers to provide data on emissions testing and are using low emission materials. However, those taking advantage of the availability of low-emitting building materials are a small minority. Improved specifications across the board would provide a more level playing field and result in lower exposure for all.

**75. Comment::** Include information on continuous monitoring and solutions seeking out cancer triggers and asthma triggers, the use of air filtering systems such as the Defender model for elimination of toxins, and the use of air handlers for elimination.

**Commentor: Rose, Carl**

**Response:** The report discusses the use of source removal, air handlers (ventilation), and air cleaning to remove indoor air pollutants such as carcinogens and asthma triggers. Discussion of specific air cleaner models is beyond the scope of this report. Continuous monitoring of indoor CO<sub>2</sub> for ventilation control systems, as it relates to building standards, is discussed in Section 4.

**76. Comment:** Remove recommendations to improve appliance efficiency because the federal government regulates this area.

**Commentor: Sempra Energy Utilities**

**Response:** The wording in Section 5.1 mentions this as one way to reduce emissions, but the report does not recommend that California take this action unilaterally. Table 3.1 does not include appliance efficiency as a possible

mitigation option for combustion appliances. However, energy is a critical issue in California, and improved indoor air quality and improved energy efficiency must be pursued together.

**77. Comment:** Include electric cooking appliances when discussing NO<sub>2</sub> emissions and impacts.

**Commentor:** Sempra Energy Utilities

**Response:** Indoor NO<sub>2</sub> levels during cooking with an electric stove were all much less than those during cooking with a gas stove (Fortmann et al., 1991).

**78. Comment:** Include recent articles suggesting that NO<sub>2</sub> levels and gas stoves are not associated with asthma to balance the other references that are cited.

**Commentor:** Sempra Energy Utilities

**Response:** The discussion of indoor NO<sub>2</sub> health effects was expanded in Section 2, and includes additional information on associations found between indoor NO<sub>2</sub> and asthma and other respiratory health effects. In any body of health effects research, there are always studies with a “no effect” finding, usually because the sample size was not large enough to discern the effect, or the study was not designed correctly to identify the effect. There are a number of studies that do link indoor NO<sub>2</sub> levels and gas stoves with asthma exacerbation: from a public health perspective, these studies raise substantial concern. The articles cited by Sempra do not address this issue very well: neither of the two studies cited included indoor NO<sub>2</sub> measurements. Additionally, Peters found an association of outdoor NO<sub>2</sub> with asthma.

**79. Comment:** Include electric cooking appliances in discussions of CO, NO<sub>2</sub>, formaldehyde and PAH emissions and impacts.

**Commentor:** Sempra Energy Utilities

**Response:** The literature reviewed by ARB indicates that these pollutants are generally emitted at much lower levels by electric cooking appliances, with some exceptions depending on the food being cooked and that specific method used. ARB will consider adding language to the formaldehyde and PAH sections if additional literature is identified that clearly shows such a result.

**80. Comment:** The report does not indicate specific cancer types in humans that could be initiated by indoor carcinogenic chemicals. A qualification should be noted in regard to formaldehyde and other indoor pollutants with respect to specific cancers. For comparative purposes, the health care costs associated with obesity and smoking could be included.

**Commentor:** Sharp Rees-Stealy Medical Groups, Inc.

**Response:** Target organs for specific chemicals are discussed on a pollutant by pollutant case in documents prepared by the Office of Environmental Health Hazard Assessment (OEHHA) and in ARB's indoor air quality guidelines. That type of information was considered too detailed for a report of this type; however, we may add limited specific information if the scientific peer review panel suggests this. Health care costs associated with obesity and smoking are outside the scope of this report.

**81. Comment:** Aerosol sprays are listed as a source of particulate matter in Table ES-1. This is incorrect and aerosol sprays should be removed from the table.

**Commentor: Soap and Detergent Association**

**Response:** Airborne aerosol droplets fall within the definition of PM. Aerosol droplets also serve as nucleation centers for the growth of particulate matter.

**82. Comment:** Vent-free gas heaters and fireplaces do not generate enough moisture to foster mold growth.

**Commentor: Vent-Free Gas Products Alliance**

Responses: Reviews by Traynor and Leader, and anecdotal evidence of heavy condensation indoors, suggest that use of these appliances produces enough moisture to contribute to mold growth in homes.

**83. Comment:** Since vent-free products are prohibited in California, all discussion related to such products should be deleted.

**Commentor: Vent-Free Gas Products Alliance  
Lennox**

**Response:** The sale of these devices for residential use is prohibited, but not necessarily their actual use indoors. Some of these products are sold for non-residential use, such as in warehouses and offices, but as with kerosene heaters, they are sometimes used in homes too.

**84. Comment:** How does the ARB reconcile calculation of the impact on indoor air of ambient intermittent industrial releases of pollutants that are the topic of AB2588 health risk assessments relative to statements in this report that the building shell partially traps pollutants emitted indoors? Wouldn't the building's shell also then retard infiltration of outdoor pollutants?

**Commentor: West Coast Environmental and Engineering**

**Response:** The extent of retardation of infiltration from an outdoor source varies based on a number of factors, such as the type of pollutant, the wind speed and direction, the leakiness of the building, whether windows and doors are opened,

relative indoor-outdoor pressures, and so on. Because infiltration can be highly variable, and because AB 2588 is focused on preventing a potentially unacceptable risk, assumptions used for the AB 2588 estimations are health-protective.