

Improving Indoor Air Quality with the California 01350 Specification

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Overview

California 01350 is a Special Environmental Requirements standard specification developed by the State of California to cover key environmental performance issues related to the selection and handling of building materials. It represents a significant step forward in specification to evaluate and reduce the impact of building materials on indoor air quality and health in buildings and could become a major driving force for better products and healthier buildings as its use spreads.

The key elements affecting indoor air quality are in the specification for screening building materials (primarily major interior finishes) based on:

- **emissions** testing protocol
- **hazardous content** screening and
- avoiding **mold and mildew** from construction practices

This protocol and associated specification was initially developed for a model office building project in Sacramento, CA (The Capitol East End project). It quickly proved its usefulness in this project providing manufacturers with a consistent protocol to test their products and has already resulted in the product changes to reduce emissions of troublesome chemicals.

The Section 01350 specification language is now being integrated into other broader specification programs:

- Scientific Certification Systems (**Indoor Advantage** Indoor Air Quality Performance Environmental Certification Program SCS-EC10-2004, their EPP carpet specification and the Resilient Floor Covering Institute **FloorScore** (www.scs-certified.com/iaq))
- **Green Guide for Health Care** (www.gghc.org)
- US Green Building Council **LEED** (www.usgbc.org)
- **Collaborative for High Performance Schools** Best Practices (www.CHPS.net)
- **Institute for Market Transformation to Sustainability** (MTS) SMART standards (<http://MTS.sustainableproducts.com>)
- Carpet & Rug Institute's **Green Label Plus** Carpet Testing Program (www.carpet-rug.com)
- The **California's** Reference Specifications for use in all major State construction (www.ciwmb.ca.gov/greenbuilding/Specs/Section01350).

An increasing number of manufacturers are reformulating their products to bring their emissions down below 01350 mandated levels. As it is adopted more widely by other major buyers, such as educational institutions and healthcare organizations, we can expect this market transformation to pick up steam throughout the building interior finish market.

Materials screening components

The 01350 standard has three key components related to materials screening for IAQ:

1) Screening based upon emission testing for exposure

Products are tested by an independent laboratory in assembly (that is, as they will be installed, such as a floor tile glued to a concrete pad) for 96 hours after 10 days of conditioning. At the end of the test period (that is, after 14 days – akin to a two week flush out) the emission rate is measured for each of the chemicals on the CA Office of Environmental Health Hazard Assessment (OEHHA) Chronic Reference Exposure Limit (CREL) list. This emission rate is the amount of the chemical (in micrograms) emitted by a square meter of the material in one hour ($\mu\text{g}/\text{m}^2\text{-hr}$). The OEHHA CREL list addresses volatile organic compounds (VOCs) with known chronic health effects. OEHHA has then established a concentration level (the CREL in $\mu\text{g}/\text{m}^3$ or micrograms per cubic meter) where studies have found no health effects. Eighty chemicals are currently listed: www.oehha.ca.gov/air/chronic_rels/AllChrels.html

The emission rate from the lab test is then plugged into a model of the planned building to predict the concentration of each of the chemicals measured in the air in the building given three factors:

- the amount of the product to be installed (e.g., the square footage of flooring)
- the volume of the building and
- the weekly average air change rate.

If the resulting modeled concentration of any of the individual chemicals exceeds 1/2 of the established CREL value, the material fails.

The only exception to the 1/2 of CREL standard is formaldehyde – for which the OEHHA staff has determined that the CREL is unattainable (ambient air exceeds it). Instead staff set a recommended air limit in office environments of 33 $\mu\text{g}/\text{m}^3$ (23ppb) based on the ALARA principle (As Low As Reasonably Achievable). The materials must not emit enough formaldehyde to result in a concentration 1/2 of this recommended level.

The detailed "standard practice" lab protocol for as designed by CA DHS is available under at: www.cal-iaq.org/VOC

2) Construction adhesives component screening

No component listed as a carcinogen or reproductive toxicant by the following State of California Environmental Protection Agency lists can make up more than 1% of the total mass of the adhesive:

- CA OEHHA, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). http://www.oehha.ca.gov/prop65/prop65_list/Newlist.html
- CA Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics) <http://www.arb.ca.gov/toxics/id/taclist.htm>

3) Reporting on compounds measured

In addition to the screening processes, the contractor reports on:

- the ten most abundant compounds emitted
- all compounds on the CA OEHHA CREL list
- all compounds on the CA OEHHA Proposition 65 and ARB Toxic Air Contaminants lists

Moisture & flush out component

The specification sets clear standards to insure that the contractor protects sensitive products from moisture damage and from dust and VOCs throughout the construction process and promptly removes any materials that do become moisture damaged or show evidence of mold or mildew. It also specifies sequencing, preconditioning and flush out periods.

The 01350 standard raises the bar on indoor air quality in important ways. It brings some of the best and current research to bear on the impact of product emissions on chronic health problems. It is customized to the individual building project, but is straightforward. The equation for modeling the concentration is not complex to apply. One test may cost a manufacturer a couple of thousand dollars but can be applied by the lab or the architect or engineer to a wide variety of building projects at little additional cost. The State of California has now established modeling scenarios to allow testing of materials for a generic classroom or office building, allowing pre-screening of materials without new modeling for every project. It is important, however, that manufacturers retest their products whenever formulations are substantially changed. It is also important that specifiers refer to 01350 in the individual sections that apply

VOC issues yet to be addressed

A range of VOC issues remain inadequately unaddressed by 01350 or any other IAQ program yet.

Untested compounds: The California OEHHA CREL State covers 80 chemicals. This does not mean that any of another thousand plus compounds that IAQ testing might uncover are with out health effects. It only means that the state has not studied them and set a CREL level yet. Thousands of volatile organic compounds remain very poorly understood for their effect individually or in combination and must be approached with caution.

Some systems address this through setting a limit on the total volatile organic compounds (TVOC). There is no health basis research on which to set such limit so it is of limited meaning. GreenGuard has recently proposed addressing it through an approach that takes the lesser of 1/2 of the CREL or 1/100 of the ACGIH's TLVs in its Children and School Standard (www.greenguard.org).

Residential, health care, and other sensitive settings: In homes the air change rate is generally far lower and occupancy longer than in the office and school environment for which this standard was designed. Therefore actual concentrations of VOCs emitted from materials are likely to be much higher than predicted by the 01350 model. 01350 should not be used for certifying materials for residential use until a residential protocol is established.

In healthcare facilities, conversely the air change rates are likely to be twice or more those in the offices and schools. Although this means that flushing will be more rapid and concentrations lower than modeled, these facilities have immune suppressed and otherwise highly sensitive populations that may require a higher standard of care. This trade off must be considered in applying this standard to healthcare.

Odor: There is no good testing protocol to predict odor and set appropriate emissions limits for its management.

Cancer effects: CRELs are based upon *chronic* health effects, including reproductive issues. There is no equivalent to the CRELs for carcinogenic effects. The specification requires reporting of chemicals known to be carcinogens. Except for

adhesives, it remains for the owner to make precautionary judgments and determine when to screen out a product. Likewise, even with chronic effects, there are many chemicals that have not yet been studied to determine appropriate exposure limits and synergistic effects between chemicals are even farther from our understanding.

Occupational impacts: While the 14 day test is useful for modeling long term exposures for building occupants, it is important to remember that installers of these materials are constantly exposed to higher levels before the outgassing subsides and therefore may be regularly exposed to levels substantially exceeding the CRELs

VOCs are not enough

The 01350 Standard can be an important part of - but not a replacement for - a study of the life cycle environmental health impacts of a material. In health impacts alone, several important areas are not yet addressed by 01350 or any other materials testing standard:

SVOCs & long term testing: Emissions of VOCs, tend to be strongest early in the life of the product and diminish over time – meaning that 01350 type emissions testing in the first few weeks is the most important indicator of potential health impact. Some other compounds – e.g., SVOCs (semi-volatile organic compounds) such as **phthalate plasticizers from PVC, halogenated flame retardants, such as PBDEs and perfluorocarbons** – may not emit from products until some time has passed after installation, with emissions increasing rather than decreasing with time, then remaining stable for long periods. More long term studies are needed to understand this phenomenon. Other heavy metal additives like **lead, mercury, and organotins** may dust off of products over time as well.

Life cycle emissions impacts: This protocol specifically addresses the emissions from the product when installed in a building, not emissions from the manufacture and disposal ends of the lifecycle. Some materials, such as PVC, may have more significant emission impacts at other stages of their lifecycle and warrant screening for these hazards too in healthy building specifications.

Conclusion & Recommendations

Much remains to be explored to provide us with more complete confidence that the materials we specify in buildings are not contributing to health problems. CA 01350 is an important new tool that we can use to help move a major step toward more healthy buildings as part of a more comprehensive material screening process.

A more thorough material screening process will address VOCs and other major health issues throughout the material life cycle. HBN recommends that a material screening policy include:

- No PVC** (polyvinyl chloride, vinyl)
- Low or no VOCs** (volatile organic compounds)
 - **CA 01350 compliant & No added formaldehyde**
- No phthalates or heavy metals**
- No HFRs** (halogenated flame retardants)
- No PFCs** (perfluorocarbons, PFOA, Teflon & others)

For more information:

Background documents describing the testing and assessment protocol in detail, plus information on ongoing efforts to update this standard is available from the California EPA Indoor Air Quality Program: www.cal-iaq.org/VOC/ and the California Integrated Waste Management Board's Green Building Program www.ciwm.ca.gov/greenbuilding/Specs/Section01350