

**California Department of Public Health
Indoor Air Quality Section**

**Discussions of Comments on the Proposed Standard Method
V1.1 Draft (*SM2009*, dated 10/19/2009)**

January 28, 2010

The CDPH/IAQ program received comments on *SM2009 Draft Version 1.1* (dated 10/19/2009), herein referred as *SM2009*, from 17 individuals/organizations (see Addendum Table A). The topics summarized in Table 1 cover the comments we received from most of the individuals/organizations, including those raised during the public meeting on Oct 23, 2009. For each topic listed in Table 1, we first consolidated the comments. Because of the varying positions of comments we received, we made the responses and decisions based on our best knowledge and judgments. A revised *SM2010 Final Version 1.1* (dated Jan, 2010) with marked changes, herein referred as *SM2010*, was then prepared to reflect the detailed corresponding changes. The additional comments not covered by the topics listed in Table 1 are either editorial or minor comments raised by only one individual/organization. For these comments, we did not summarize them but adopted them directly whenever appropriate in *SM2010*.

It is our intention that this will be a continuous process. Comments not fully addressed herein and any potential comments after the final version of *SM2010* is formally issued will be addressed in the preparation of *SM2011 [Version 2.0]* (expected to be issued by Jan, 2011).

Table 1 Summary of Comments by Topics

Topic No. ^a	Topic Description	# of individual/organizations commented ^b
1	<u>Maximum Allowable Concentration for Formaldehyde and Acetaldehyde</u>	15
2	<u>Establishment of Residential Scenario(s)</u>	12
3	<u>Sample Collection, Handling and Shipping</u>	8
4	<u>Application of BIFMA Test Method for Furniture</u>	8
5	<u>TVOC Definition and Use of TVOC Limit</u>	8
6	<u>Document Title and Document Number</u>	6
7	<u>Quality Assurance and Quality Control</u>	6
8	<u>Guidelines for Use of Standard Method as Basis for a Building Product Claim</u>	6
9	<p><u>Other Major Technical Topics^c</u></p> <p>9.1 <u>Test of other types of insulation besides fiberglass insulation batt products</u></p> <p>9.2 <u>Test specimen preparation for carpet</u></p> <p>9.3 <u>Removal of the use of glass plate</u></p> <p>9.4 <u>Requirements for sample conditioning period</u></p> <p>9.5 <u>Operating parameters for test chambers - loading factor and air change rate</u></p> <p>9.6 <u>Test chamber background concentration and measurement requirement</u></p> <p>9.7 <u>Replicate chamber test frequency requirement</u></p> <p>9.8 <u>Air sampling schedule</u></p> <p>9.9 <u>Test method harmonization with European practice and standards</u></p> <p>9.10 <u>Regarding how to deal with future change of CREL</u></p> <p>9.11 <u>VVOCs in list of target VOCs in Table 4.1</u></p> <p>9.12 <u>Parameters used in the current standard classroom and office model scenario</u></p> <p>9.13 <u>Regarding whether to allow adjusting material areas or quantities based on room coverage under specific conditions</u></p>	≤ 3

- Topics are listed in order of decreasing number of comments received.
- Comments received in public meeting (see summary of public meeting discussion below) are also counted;
- Topics with comments received from ≤ 3 individual/organizations.

1 Maximum Allowable Concentration for Formaldehyde and Acetaldehyde

Comments

(a) Summary of public meeting discussion

Participants agreed that the new formaldehyde CREL value should be the target for the maximum allowable concentration level. However, there was much discussion about how quickly the new formaldehyde CREL could or should be implemented:

- *Mr. Randal Carter, Mr. Al Hodgson, Mr. Leon Alevantis, et al.* supported the 1/1/2012 effective date (as proposed in the *SM2009*). They agreed that the *SM2009* should be set “to press the industry to reduce emissions further than current limits; the proposed timeline would keep the manufacturers engaged but not be so stringent that manufacturers give up”. Only 20% of leading office furniture manufacturers currently meet SP/01350 (it is not clear what will happen once they comply with CARB’s Composite Wood ATCM).
- *Mr. Bruce Ray, Mr. Tom Phillips, Ms. Peggy Jenkins, Ms. Jan Stensland et al.* supported more rapid incorporation of the new formaldehyde CREL. They highlighted that: (a) setting aggressive targets that are truly health protective is fundamental to SP/01350, (b) the ARB Composite Wood ATCM already raises the bar for mandatory emission limits, (c) some products on the market already meet “*No-Added Formaldehyde*” criteria, (d) formaldehyde is a known human carcinogen and exposure to it should be minimized, and (e) SP/01350 should remain a progressive standard.
- *Mr. Hal Levin* indicated that we may consider setting separate formaldehyde emission limits for some product types to encourage the potential emission reductions on a realistic, product type basis.

(b) Further comments supporting the 1/1/2012 effective date for Formaldehyde

Supportive comments have been received from various stakeholders, including commercial testing labs, third-party certification body, manufacturers and manufacturer associations (especially furniture industry):

From commercial test labs

- *Mr. Al Hodgson and Mr. Raja Tannous - Berkeley Analytical.* We support the phase-in period for the formaldehyde guideline concentration as defined in this draft Standard. Undoubtedly, the largest source contributing to formaldehyde concentrations in indoor air is composite wood products used in flooring, doors and trim, built-in cabinets and furniture. In order for the Standard to have the broadest impact with respect to reducing indoor formaldehyde exposures, we think it is essential to engage and continue to engage industries and manufacturers that utilize these composite woods in their products. At present, the commercial office furniture industry has moved to support the goals of the current Standard Practice in their new BIFMA e3 sustainability standard. A number of furniture manufacturers also test and certify their products to the criteria in the Standard Practice through the SCS Indoor Advantage Gold program and the GEI Greenguard Children & Schools program. These are significant steps

forward from the legacy formaldehyde guideline that BIFMA has used for years. Furthermore, the CA DGS Furniture Spec for office furniture purchased by the State requires conformance to the Standard Practice guidelines. The inclusion of a residential scenario in the draft Standard presents an opportunity to engage the manufacturers of residential building products and furnishings, thus expanding the sphere of influence of the Standard into the environment that is probably the most important with respect to indoor air exposures.

The composite wood industry is in the midst of fundamental change due to the CARB ATCM regulation on formaldehyde emissions from composite wood products. This industry is struggling to meet the Phase 2 requirements of the regulation. According to the regulation, this transition is supposed to occur on Jan 1, 2011 for particleboard and MDF. Realistically, an industry-wide change will NOT occur by that date. Thus, Phase 2 products are unlikely to be broadly available to building product and furniture manufacturers by Jan 1, 2011. Even assuming CARB allows an additional year for phase 2, the goal may be overly optimistic.

Generally, the goals of the draft Standard are more ambitious than the CARB ATCM. A transition to Phase 2 composite woods will not be sufficient in some cases to allow products to meet the new OEHHA CREL guideline of $9 \mu\text{g}/\text{m}^3$. For example, a no-added formaldehyde composite wood must have test concentrations of 0.04 ppm (40 ppb) or less. This is equivalent to a formaldehyde emission factor of $58 \mu\text{g}/\text{m}^2\text{-h}$. When this value is projected to the private office scenario for flooring, the resulting concentration is $31 \mu\text{g}/\text{m}^3$. In the residential scenario, the projected concentration is $96 \mu\text{g}/\text{m}^3$. Thus, a goal of $9 \mu\text{g}/\text{m}^3$ is very ambitious for composite wood.

The guidelines and scenarios within the draft Standard already are highly conservative. The new formaldehyde CREL includes an uncertainty factor of 10, i.e., it's been adjusted down from a predicted effect level of $90 \mu\text{g}/\text{m}^3$. Additionally, the Standard assumes that emissions measured at 14 days remain constant over many years.

We're concerned that an abrupt change or an unrealistically accelerated transition to a formaldehyde guideline value of $9 \mu\text{g}/\text{m}^3$ may force the furniture industry, in particular, and other industries using composite woods to abandon the Standard. If that occurs, it is a lost opportunity for the Standard to have significant impacts on exposure concentrations of formaldehyde and the other chemicals of concern.

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S.* Formaldehyde limit value is very ambitious. Many sustainable products with natural material base will need huge development if they want to comply, if possible at all. Delay of lower formaldehyde limit value until Jan 1st, 2012, should not be shortened if not wanting to disturb market balance and market share of certain industries.

From third-party certification body

- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS).* As a third-party certification body, SCS supports the proposed phase-in period for the formaldehyde guideline concentration as defined in this draft Standard. Based on our own experience with assessing various product categories for indoor air quality performance, the largest source contributing to formaldehyde concentrations in indoor air is composite wood

products used in flooring, doors and trim, built-in cabinets and furniture. In order for the Standard to have the broadest impact with respect to reducing indoor formaldehyde exposures, we think it is essential to engage and continue to engage industries and manufacturers that utilize these composite woods in their products.

A number of furniture and hard surface flooring manufacturers test and certify their products to the criteria in the Standard Practice through the SCS Indoor Advantage Gold program, the GEI Greenguard Children & Schools program, and the FloorScore program. The commercial office furniture industry has demonstrated further support for the Standard Practice through their new BIFMA e3 sustainability standard and associated certification program, **level™**. These are significant steps forward from the legacy formaldehyde guideline that BIFMA has used for years. The inclusion of a residential scenario in the draft Standard presents an opportunity to engage the manufacturers of residential building products and furnishings, thus expanding the sphere of influence of the Standard into the environment that is probably the most important with respect to indoor air exposures.

The composite wood industry is in the midst of fundamental change due to the CARB ATCM regulation on formaldehyde emissions from composite wood products. This industry is struggling to meet the Phase 2 requirements of the regulation. According to the regulation, this transition is supposed to occur on Jan 1, 2011 for particleboard and MDF. Realistically, an industry-wide change will NOT occur by that date. Thus, Phase 2 products are unlikely to be broadly available to building product and furniture manufacturers by Jan 1, 2011. Even assuming CARB allows an additional year for phase, the goal may be overly optimistic.

Despite these efforts, most finished wood furniture manufacturers still have great difficulty in meeting the current Standard Practice formaldehyde limits with their wood veneer products. The reduction in emission from the finish has been improved through the application of water-based, UV-cured finishes. This challenge is compounded by the broader context imposed by the various green building rating systems, including CHPS and LEED. These rating systems, in addition to low-emitting material credits, provide credit for the inclusion of sustainably harvested wood products certified programs such as the FSC. SCS, as a certifier for many of these other criteria, including FSC and CARB, is in a unique position to understand this conflict. Already, manufacturers may not be able to find product that meets both FSC and indoor air quality criteria. The architect and design community want to find products that meet as many criteria as possible, whether that is technically feasible or not. As this Standard Method continues to evolve, it must do so in the context of its impact in the marketplace. This Standard Method must provide time for finished wood product manufacturers to meet reduced formaldehyde limits in order to avoid the consequence of mutually exclusive green building rating system criteria (e.g. FSC or Low-emitting material credit). The January 1st, 2012 implementation date allows time for manufacturers to work towards the new limits.

SCS is concerned that an abrupt change or an unrealistically accelerated transition to a formaldehyde guideline value of $9 \mu\text{g}/\text{m}^3$ may force the furniture industry, in particular, and other industries using composite woods to abandon the Standard. If that occurs, it

is a lost opportunity for the Standard to have significant impacts on exposure concentrations of formaldehyde and the other chemicals of concern.

From manufacturers and manufacturer associations:

- *Mr. William Freeman - Resilient Floor Covering Institute (RFCI).* We recommend that the implementation of the new formaldehyde emissions take effect on January 1, 2012. In the last few weeks we have had an opportunity to review the VOC emissions reports for flooring products certified in the FloorScore program. Based on this review there will be some products that will be challenged with the new lower emissions requirements for formaldehyde. Manufacturers need time to reformulate products and change manufacturing processes in order to meet these very low formaldehyde emissions limits. Thus the effective date of January 1, 2012 is appropriate in order for responsible manufacturers to be able to take the steps to comply with the new lower emission limits.
- *Ms. Denise Van Valkenburg - MASCO RetailCabinetGroup.* Formaldehyde limit: Adoption of the new OEHHA CREL for formaldehyde should be delayed. The impact of the lower Formaldehyde CREL has not been fully vetted. Building materials that use wood or biobased materials often have natural formaldehyde emissions. Additionally many composite wood based products emissions decay over time. It is possible that most wood based products may not be able to meet the new level at the 14 day time frame but may meet a time weighted average over the life of the product. Another consideration regarding the validation of the proposed formaldehyde CREL is that since the additional modeling scenarios and product loadings have not been determined, an evaluation of potential product compliance with the new limits cannot be completed. Once that evaluation is completed, additional time will be required by manufacturers to assess their product's emission profile and respond appropriately.
- *Mr. Randal Carter – Steelcase.* Regarding the controversial issue of incorporating the formaldehyde limit of 9 ug/m³, the proposed effective date of January 2012 should not be implemented any sooner for office furniture. The CA Standard Practice fulfills a unique, voluntary role, which has historically been successful due to incorporation in a wide variety of standards and proposed codes. To continue this success, I believe it is essential to maintain a balance between the highly conservative, well-intentioned limits and the practical realities of available materials and technologies.

A review of the ANSI/BIFMA M7.1 standard exposure scenarios shows the scenarios are based on 90th percentile conditions for furniture surface area in combination with the minimum legally required outdoor air ventilation in accordance with ASHRAE 62.1-2007 as commonly referenced in building codes. These conditions in combination are inherently very conservative and protective. Add in the fact that the scenarios do not consider the known effects of adsorption with other materials in the environment, the time allowed between manufacture and testing is conservatively short, and the assumption that higher, initial emissions at seven and 14 days represent long-term levels, and the result is arguably over conservative. This is even before considering the additional, highly conservative safety factors used by OEHHA when establishing the proposed concentration limits.

While BIFMA has incorporated the concentration levels of the 2004 CA Standard Practice as a voluntary, reward-based credit within the BIFMA e3-2008 Furniture Sustainability Standard, I must point out that many manufacturers have expressed concern that these 2004 levels, especially in combination with the protective ANSI/BIFMA exposure scenarios, are overly conservative and are unrealistically difficult to achieve.

Composite wood materials and wood veneer finishing materials are widely used throughout the furniture industry. Even if composite wood materials that are compliant to the CARB ATCM phase II levels become widely available by 2012, it is not clear that these materials will be sufficiently low-emitting to facilitate furniture compliance with the proposed formaldehyde limit of 9 ug/m³.

An abrupt and immediate transition to the proposed, conservative formaldehyde limit of 9 ug/m³ risks alienating much of the office furniture industry, which has been a leader in this area. This could slow implementation of lower emitting materials through further use of arbitrary, less protective exposure scenarios currently outside the scope of the ANSI/BIFMA standards or by outright dismissal of the limit as simply impractical for common materials.

- *Mr. Larry Dykhuis – Herman Miller.* Adoption of new OEHHA REL for formaldehyde should be delayed and considered for adoption within the Next Generation standard. More time is needed to determine an appropriate application and implementation plan for new OEHHA formaldehyde RELs.
- *Dr. Blaisdell* indicated OEHHA's purview is risk assessment which leaves risk management to CDPH. Risk management includes the application of ARELs, IRELSs and CRELs. SM2004 has been widely applied as criteria for building materials. As a result of this wide adoption CDPH has a significant responsibility to "get it right". In the development of the Composite Wood ATCM, which is also intended to be a health protective regulation, the State of California ARB conducted an extensive economic impact analysis, adopted a phased in approach and did not adopt the REL's directly. Here are a few of the issues that deserve in depth investigation.
 - ✓ Further investigation is warranted relative to the development of the formaldehyde REL. Significant questions are raised by OEHHA's promotion of the IREL and CREL being the same level, after their assertion that IRELS are intended for repetitive 8 hour exposures for extended periods vs. CRELs which are intended to be protective for 24 hour exposure over 20 + years. As far as I can determine the same health studies and same safety factors were used as the basis for the IREL and CREL.
 - ✓ Further investigation is warranted relative to the application of CRELs or IRELS to building materials since data shows the decay of emissions from building materials occurs in a very short time relative to the years of exposure assumed in the development of CRELs and IRELS.
 - ✓ Since formaldehyde is ubiquitous in the natural world, building materials with no sources of formaldehyde will sometimes produce test results which show measureable amounts of formaldehyde. Further investigation is warranted to assess

the impact on test results of emissions test uncertainty, and adsorptive contamination from formaldehyde sources other than the building materials being assessed such as ambient air, packaging and handling materials, and test chamber “clean air”.

- ✓ Since wood is a natural source of formaldehyde and no one wants to take wood and composite wood products out of the hands of green architects, designers and builders, further investigation is warranted to determine appropriate emissions criteria for wood based products which may be different from other building materials.
- *Mr. Steven Trinkel – Kimball International.* We are a manufacture of office, hospitality and healthcare furniture the majority being constructed of wood and wood based materials. As wood furniture manufacturers, the proposed target VOC's and their maximum allowable concentrations primarily formaldehyde will be very challenging. We support keeping the maximum allowable concentration for formaldehyde at the full CREL and setting the date for formaldehyde at Jan. 1st, 2012.
- *Mr. Phil Gattis - Community Playthings.* I request the proposed timeline for new formaldehyde CREL adoption.
- *Mr. Steve Pfeiffenberger - Armstrong World Industries.* We support maintaining the existing maximum allowable concentration for formaldehyde ($16.4 \mu\text{g}/\text{m}^3$) in the new *SM2009*. The need to change the Chronic Reference Exposure Levels (CREL) for formaldehyde is not supported, because valid peer reviewed data do not exist. For this reason, we recommend maintaining the maximum allowable concentration for formaldehyde at the existing level. The following five (5) points support this suggestion:
 1. The CREL for Formaldehyde is Arbitrary: The CREL that OEHHA set for formaldehyde is arbitrary and developed based on a single occupational study instead of multiple studies conducted in a typical commercial building setting. We recommend conducting a significant number of scientific studies in a commercial building setting before establishing the maximum allowable concentration for formaldehyde.
 2. Uncertainty in measurement and testing: The uncertainty in measurement and testing becomes very critical if the maximum allowable concentration is lowered to $9 \mu\text{g}/\text{m}^3$. Reporting an Emission Factor (EF) without an estimated error is not good scientific practice. The current and proposed version of 01350 provides ranges for the following input variables, but not for output results:
 - ✓ maximum background concentration of any individual VOC in the ventilated chamber at 1.0 air changes per hour is $2 \mu\text{g}/\text{m}^3$,
 - ✓ the airflow in the chamber should be within $\pm 5\%$,
 - ✓ temperature shall not exceed by $\pm 2^\circ\text{C}$, and RH shall not exceed $\pm 5\%$,
 - ✓ the minimum sensitivity to reliably quantify individual VOCs is $2 \mu\text{g}/\text{m}^3$,
 - ✓ the limit of quantitation (LOQ) for most VOCs is at the most $2 \mu\text{g}/\text{m}^3$.

Because of all of the ranges mentioned in the above bullets, it is expected the deterministic uncertainty in measurement of emission factors will be similar in magnitude to the new proposed CREL levels (e.g., 9 $\mu\text{g}/\text{m}^3$ for formaldehyde). In general, for reasonable accuracy when measuring VOC concentration, at least 5 – 10 times the LOQ is recommended. Many inter-laboratory studies conducted in the past report intra-lab repeatability and inter-lab reproducibility ranges from 25% to 60% in relative standard deviation. Such variation can be attributed to the many steps involved in measurements (i.e., operation of the emission chamber, gas-phase sampling, gas-sample analysis, etc.).

Examples of the 14-day test procedure prescribed in SM2009 are provided to illustrate two points:

- ✓ Measurement variation: The data below show the 24, 48 and 96h EFs for a sample after 10 days of conditioning:

Table 2. Formaldehyde Chamber Concentration and estimated emission factors (EF)

Duration	Chamber conc ($\mu\text{g}/\text{m}^3$)	EF ($\mu\text{g}/\text{m}^2\text{-h}$)
24-h	x	y
48-h	1.13x	1.13y
96-h	1.06x	1.06y

Table 2 provides an example of when the EF is less at 24-h than at 96-h. This type of example is commonly seen in emissions test data. Because there is no known reason for the EF to increase during this period, one can reasonably associate the variation seen in EF with the measurement uncertainty rather than actual product behavior.

- ✓ Decaying EF: The data below show the 24, 48 and 96 h EF for another sample after 10 days of conditioning.

Table 3. Formaldehyde Chamber Concentration and estimated EFs

Duration	Chamber conc ($\mu\text{g}/\text{m}^3$)	EF ($\mu\text{g}/\text{m}^2\text{-h}$)
24-h	x	y
48-h	0.97x	0.97y
96-h	0.76x	0.76y

The above product data exhibit decay in EF during the 96 h period even after 10 days of conditioning. While in principle, for many solid products the EF after 14 days should be primarily dependent on the steady-state diffusion of formaldehyde through the sample, it is not the case in this example (unless the decay is attributed to variation in measurement). It is reasonable to expect that the product would have continued to decay and would perhaps meet the pass/fail criteria of 0.67y $\mu\text{g}/\text{m}^2\text{-h}$ in another day or two. In many products, depending on the age, the cross-linking of the binders and other chemical reactions continued to occur over several days, resulting in a continued decay of emission that is measurable. In such cases, the strict adherence to a threshold value instead of a range (giving measurement variation, changing emission characteristics etc.) is not realistic and practical. For this reason, standards such as the Finish M1 allow for 28 days for a final EF.

In addition to measurement uncertainty, an undeterminable amount of uncertainty is associated with product sampling, product age, transport conditions, storage

duration, storage conditions, product history, sample preparation, etc. For these reasons, we recommend maintaining the existing maximum allowable concentration for formaldehyde ($16.5 \mu\text{g}/\text{m}^3$) in the new SM/2009 and aligning the specimen conditioning requirement with existing European standards.

3. Use of recycled and renewable materials & product emissions: Many building products contain significant amounts of recycled and renewable materials. This practice has a very favorable impact on environmental and sustainability; however, such materials may occasionally have relatively higher emissions of VOCs and formaldehyde. Decreasing the allowable limit for formaldehyde to $9 \mu\text{g}/\text{m}^3$ may restrict the use of more recycled material and thus have unintended adverse impact on the environment and sustainability.
4. Consider typical indoor air concentrations: The Base Study conducted by EPA on 100 randomly chosen buildings found that the average concentration of formaldehyde in buildings was $16 \mu\text{g}/\text{m}^3$. The formaldehyde concentrations at the 5th and 95th percentiles were found to be $4.4 \mu\text{g}/\text{m}^3$ and $32 \mu\text{g}/\text{m}^3$ respectively. Formaldehyde levels in the range can always be found indoors from persistent sources such as office equipment, indoor chemical reactions, outside air, etc. and may not necessarily associated with building materials. This base study supports the current maximum allowable concentration for formaldehyde emissions corresponding to an indoor air concentration not to exceed the full CREL of $9 \mu\text{g}/\text{m}^3$.
5. Consider outdoor air concentration of formaldehyde: According to the Agency for Toxic Substances and Disease Registry, the average formaldehyde concentrations reported in U.S. urban areas range from 10 to 20 parts per billion (12.3 to $16.26 \mu\text{g}/\text{m}^3$). For the same reasons mentioned in the above paragraph, it is restrictive for the allowable limit for formaldehyde ($9 \mu\text{g}/\text{m}^3$) to be below average outdoor levels.

In addition, we recommend any changes to SM/2009 be consistent with emissions requirements under California Code of Regulations § 93120, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products. Globally, manufacturers of composite wood products are following the regulatory requirements of 93120 which include not only emissions testing, but documentation, labeling and third party certification. As a result, there are two sets of requirements that would establish different levels of formaldehyde emissions for identical product categories. This is problematic for manufacturers.

(c) Further comments requesting more rapid incorporation of the new formaldehyde CREL.

From state agencies:

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB.* We recommend that you phase in the new CREL more rapidly: $16.5 \mu\text{g m}^{-3}$ for one year rather than two, e.g., until December 31, 2010. The new CREL is still well above the Proposition 65 cancer-based guideline of $1.7 \mu\text{g m}^{-3}$. In light of the 2004 IARC and 2009 NTP reclassification of formaldehyde to a known human carcinogen, we should be trying to minimize formaldehyde exposures as much as feasible. We expect that most products can meet the new CREL targets within the first year.

From manufacturers and manufacturer associations:

- *Mr. Bruce Ray - Johns Manville (JM)*. Some factors to consider on this issue include
 - ✓ since ES-1350 is supposed to be a voluntary standard that goes beyond what is required by law, it is appropriate that some products will not qualify unless the manufacturers make substantive changes to reduce formaldehyde content
 - ✓ since protection of health is the paramount mission of the CDPH, the CREL implementation schedule should be based on health factors and not manufacturing capability factors
 - ✓ all fiber glass insulation manufacturers make forms of insulation that are formaldehyde-free
 - ✓ manufacturers have known for some time that formaldehyde is a chemical with health hazards and that they should be planning for eliminating formaldehyde in their products
 1. 2002: Johns Manville moves its entire line of building insulation to a formaldehyde-free formulation
 2. 2003: National Cancer Institute (NCI) study released showing relationship between formaldehyde exposure and cancer (NPG and leukemia)
 3. June 2004: IARC moves formaldehyde to known carcinogen status
 4. August 2004: CARB recommends use of building materials and insulation that are formaldehyde-free
 5. 2005: Formaldehyde Council unsuccessful in its effort to stop JM from calling JM's insulation "formaldehyde-free"
 6. 2005: NIEHS recommends that NTP move formaldehyde to known carcinogen status in US
 7. 2007 – 2008: substantial controversy over formaldehyde in FEMA trailers
 8. May 2009: NCI releases formaldehyde study update (leukemia still an issue)
 9. September 2009: NTP releases formaldehyde background document and schedules Expert Panel to review carcinogen status of formaldehyde
 10. November 2-4, 2009: NTP Expert Panel on formaldehyde to meet

Products that meet the new CREL will have important side benefits

- ✓ Moving to a formaldehyde free formulation for JM's building insulation means that
 1. JM's workers are no longer exposed to formaldehyde in the binder
 2. JM's neighbors are no longer exposure to binder-related air emissions
- ✓ JM has helped to reduce its carbon footprint because it no longer uses at its building insulation plants a binder that is reactive at room temperature and needs to be chilled before application

(d) Comments on the adoption of new acetaldehyde CREL.

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB.* We recommend that the target concentration of this carcinogen be reduced to at least $20 \mu\text{g m}^{-3}$ to provide a reduced cancer risk. In the recent study of new single family homes in California, Offermann (2009) found that the median concentration was $20 \mu\text{g m}^{-3}$, and 93% of the homes exceeded the cancer-based guideline. This concentration should be very feasible to achieve.

Resolution(s) to Topic 1

- *Maximum Allowable Concentration for Formaldehyde:* Formaldehyde is classified as a known human carcinogen, and exposure to it should be minimized as rapidly as possible. On the other hand, the proposed timeline to reduce the allowable limit by nearly one-half (from 16.5 to $9 \mu\text{g m}^{-3}$) must be realistic, attainable, and keep manufacturers engaged. Therefore, we retain the timeline for new formaldehyde CREL adoption proposed in *SM2009* and did not make any further changes in *SM2010*. At the same time, we have added the following texts in Section 8 of *SM2010* to encourage the early compliance to the $9 \mu\text{g m}^{-3}$ requirement: “*For products that meet the $9 \mu\text{g m}^{-3}$ requirement for formaldehyde earlier than January 1, 2012, a claim of “compliance with $9 \mu\text{g m}^{-3}$ formaldehyde CREL” (see Section 4.3.2) may be made together with the claim of compliance with the Standard Method.*”
- *Maximum Allowable Concentration for Acetaldehyde:* We agree with ARB’s comment that it may be necessary to also consider factors other than non-cancer health effects. It is our intention to have the group work together to develop rational procedures and address other known health concerns (i.e., carcinogens) during next update process. In this interim version, we retain the recommended value proposed in *SM2009*, which is $70 \mu\text{g m}^{-3}$ ($1/2$ of the revised CREL).

2 Establishment of Residential Scenario(s)Comments*(a) Summary of public meeting discussion*

Participants strongly supported establishing appropriate residential scenario(s). Several voiced their view that current product claims using SP/01350 in residential environments are inappropriate and misleading. There was much discussion about what are the scenarios and model parameters to be used:

- *Mr. Tom Phillips* indicated that median size homes and air exchange rates may not be the most appropriate; 5 or 10 percentile values would be more health protective, to avoid the “tyranny of the median or mean”.
- *Mr. Tom Phillips, Ms. Denise Van Valkenburg et al.* suggested adding scenarios for multi-family homes and manufactured homes, which house a large part of the population, especially the sensitive subgroups.
- *Mr. Bruce Ray, Mr. Hal Levin and Ms. Jan Stensland* mentioned that we may need to consider a nursery room scenario as the most stringent case. German studies presented

at ISEA 2002 indicated that newborns were exposed to high emissions from new furniture and furnishings.

- *Mr. Hal Levin* indicated that the types of chemicals, the pollutant source strengths and the ventilation rate can vary greatly from home to home, and special attention must be paid when defining residential scenarios.
- *Mr. Bruce Ray* suggested adding an average of 10 m² acoustical insulation because there is typically an additional 10 m² of acoustical insulation in any new home even if there is not an acoustic upgrade. He also indicated that an increasing number of new homes have added acoustic insulation in interior walls and between floors to provide increased comfort. Based on the design of the typical home in the proposed residential scenario, he suggested adding the following amounts of acoustical insulation if included in a new home: (a) 300 m² if most areas of internal walls are insulated; (b) 350 m² if all areas of internal walls and ceilings are insulated.

(b) Further comments on SM2009

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB.* We support the addition of this scenario as soon as possible. This is a major gap in the application of the Standard Practice.

In selecting model parameters for the residential setting, we recommend that you use model parameters that are conservative in terms of public health, e.g., the lower 5-10%ile of air exchange rates and home volumes. The selected percentile value should have a sample size large enough to provide some statistical confidence.

- ✓ We recommend that for new single family homes you use an air exchange rate (AER) of 0.13 ach over 24 hours, and a house volume of 1,610 ft³ (45.6 m³). These are the 10%ile values for new, single family California homes with and without mechanical ventilation in the recent ARB-CEC funded study by Offermann (2009). The homes were made by production builders and were sampled in the summer and winter, plus a few samples in the fall.

The CDPH slides presented at the October workshop used AER data from the Offermann et al. Indoor Air 2008 paper. These results were from preliminary data, and these analyses were done outside of the ARB-CEC contract. We have calculated the AER for the homes, using the final corrected data, and confirmed that the 10%ile AER for all the homes was 0.13 ach for all 91 homes. For the 73 non-mechanical ventilation homes, it was 0.14 ach. Coincidentally, in order for the study homes to meet the 2008 Title 24 ventilation requirements (ASHRAE 62.2-2007), the outdoor air flow rate was calculated to be equivalent to 0.15 ach on average.

- ✓ For newer homes with mechanical ventilation, which will be required under the 2008 Title 24 standards as of January 1, 2010, we recommend assuming that the homes will sometimes operate more like a home without a mechanical ventilation system. We currently lack sufficient data to estimate what actual AERs will be in homes with a mechanical ventilation system, and how those systems perform over

time. The data from 22 such homes in the Offermann study indicate that their AERs ranged from 0.02 to 0.45 ach, and 66% of the ducted outdoor air systems did not meet the ASHRAE 62.2 ventilation rates adopted in Title 24. About one-third of the homes had ventilation systems with outdoor air flow rates well below 60 cfm, and three of the homes had the systems turned off. In addition, the AERs in homes with mechanical systems were not significantly different from those in homes without mechanical systems, except for those homes with heat recovery ventilators.

We recommend including later on the other major types of residential construction in Version 2.0, e.g., multifamily and manufactured housing, which both have much different volume, air exchange, and material loading characteristics. Multifamily and manufactured homes are expected to have smaller volumes and lower AERs in general, relative to single family homes. They may also have higher humidity levels, which can exacerbate indoor formaldehyde concentrations. Therefore, the model scenarios for single-family homes are likely to be less protective for multifamily and manufactured homes.

- *Ms. Denise Van Valkenburg - MASCO RetailCabinetGroup.* Residential Modeling Scenario: The residential modeling scenario proposed in the draft SM 2009 appears to be representative of current new construction single family homes with respect to size (sq. ft.) and ventilation rate. We support the inclusion of residential modeling scenarios and are encouraged to see additional scenarios added to the draft SM 2009.

Cabinetry loading: Appropriate building product loading is an important component of the residential modeling scenario. However, the proposed cabinetry loadings need to be further validated prior to inclusion into the Standard Method. The CDPH recommendation that cabinet loading be postponed until the 2010 version of the method is warranted.

Cabinetry testing: While further researching the loading, additional work is also needed regarding the sample collection and testing of cabinets. The ANSI/BIFMA M7.1 standard would make a good starting point for the testing component but needs to be supplemented with the specifics as it relates to sample age, packaging, shipment, and chamber testing. There are several vastly different manufacturing models within the cabinetry industry depending on the target customer and price point. These need to be further assessed as it relates to product emissions prior to making recommendations on these critical parameters. Once these issues have been addressed and validated, cabinets could then be included in the SM, possibly in 2010.

- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS).* I recommend removing all TBD values (windows, kitchen cabinets, other cabinets, countertops) in Table 4.7 until further research is completed. I recommend that these values be vetted through the v2.0 process and not included in v1.1. I also encourage the consideration of other interior furnishings, including furniture (sofas, chairs, tables, desks, storage). I caution the inclusion of certain types of furniture (mattresses, bedding, cribs) without due consideration of the unique exposure concerns.
- *Mr. Randal Carter – Steelcase*

- ✓ The addition of the fundamental elements of a residential exposure scenario as shown in Section 4.2.6 is a much-needed improvement. As discussed during the meeting held October 23, 2009, the commercialized “IAQ certification” of infant cribs, mattresses, and other residential products without a publicly accessible residential exposure scenario has been potentially misleading in the market place.
- ✓ For Table 4.7, determinations of compliance for cabinets and countertops should utilize the BIFMA M7.1 test method, as the materials and construction of cabinets essentially mirrors that of casegoods furniture.
- *Mr. William Freeman - Resilient Floor Covering Institute (RFCI)*. We agree that it would be beneficial for Section 1350 to establish a new scenario for new single-family residences. However, we recommend that the loading factors (product quantities) required in Table 4.7 be changed to reflect the actual coverage of various types of floor covering in a new residence. The following estimates are provided by the U.S. FLOORReport, 2010 Edition:

Carpet	52.50 %
Ceramic	16.80%
Wood	15.40%
Vinyl	12.30%
Laminate	3.00%

The loading factors for the classroom or office scenario are much simpler as you are only dealing with flooring in one room versus a house full of rooms. Reality is that each room of a residence normally has a different floor covering depending on the performance requirements or aesthetics desired.

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*. The residential scenario looks very complicated. Please consider using just a small room as e.g. the European reference room, see doc. N0124 clause 4.
- *Mr. Al Hodgson and Mr. Raja Tannous - Berkeley Analytical*. We support the ventilation rate (0.23 ACH) that approximately corresponds to the measured median value for new homes (as proposed in *SM2009*). This value is in fact the minimum ASHRAE requirement from Table 4.1a. New homes that don’t achieve the minimum value should have a supplemental ventilation system, either active or passive. Further, there are many conservative factors already incorporated into the Method (i.e., uncertainty factors in the CRELs and the fact that emissions are presumed to stay the same over long periods of time). Using an unrealistically low ventilation rate that does not meet ASHRAE requirements just adds another conservative factor.
- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI)*. In its work towards a product emission ANSI standard, GREENGUARD Environmental Institute worked with nationally recognized residential architecture firm Lord Aeck & Sargent (www.lordaecksargent.com) to define a ‘typical’ home in America. Recognizing that ‘CA 01350’ gets utilized in national sustainability standards, we would like to provide the fruits of our work together. Please see the attached documents that were developed by Lord Aeck & Sargent for our project. Within this home we would be utilizing the EPA’s suggested 0.45 air changes/hour as this data comes from looking at not only

newer 'energy-efficient' homes, but also existing building stock. The use of this air change rate would allow the standard to be more representative of existing homes nationwide. The use of 0.23 ACH may only apply to a small group of newly constructed energy efficient homes, and it does not take into account home activity including leakage, exhaust fans, opening doors and windows, etc. In addition, feasibility should be considered in product being able to achieve this standard. The residential model needs thorough consideration and it may be premature for introduction, especially with the loadings TBD.

- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ In Table 4.6 Definition of new single-family residence: I would ask you to consider splitting the home into two floors: 1) the downstairs with kitchen, living room, den, etc. with 9' ceilings and considered to be one open area, all interconnected; and 2) the upstairs with bedrooms and bathrooms with 8' ceilings and each room considered to be independent. This would require defining a standard bedroom.
 - ✓ In Table 4.6 Definition of new single-family residence: While we understand the desire to be maximally protective, is it feasible for many products to meet the criteria with the selected ventilation rate of 0.23ACH? For example, flooring for residential use will need to have emissions that are ~1/3 what would be required to meet the criteria in an office setting. It is our understanding that this ACH is based on new construction, which comprises a relatively small stock of homes. Older homes have higher ventilation rates. Additionally, the ventilation rate of 0.23 does not account for door and window opening. Thus, we suggest a reevaluation of the proposed ACH, and suggest the use of a ventilation rate of 0.45 ACH, the recommended typical residential ventilation rate from the USEPA Exposure Factors Handbook (Table 17-31) (August 1997).
 - ✓ In Table 4.7 Product quantities and specific air flow rates to be used for estimation of VOC concentrations in standard new single-family residence: What about mattresses and cribs and other residential products? Will those be addressed?
 - ✓ In Table 4.7 Product quantities and specific air flow rates to be used for estimation of VOC concentrations in standard new single-family residence: What is the plan for determining numbers for the TBD's in this table and will there be a chance to review them before they are finalized?
- *Mr. Ken McIntosh and Mr. Frank Hurd – CRI.* Regarding Table 4.6 and the proposed residential model:
 - ✓ We recommend delaying the introduction of the residential model until all parties have had a chance to study the final parameters of exposure.
 - ✓ For example, if we test a carpet designed for either commercial office use or home use and if the home air exchange rate is different than the office air exchange rate, there will be two different Emission Factor calculations, i.e., that carpet for home use may have a 3X larger EF than that carpet for a commercial office installation. We need time to fully understand this development.

- *Mr. Bruce Ray - Johns Manville (JM)*. We suggested adding a line in Table 4.7 and using 343 m² of acoustic insulation in residential scenario to cover optional comprehensive acoustic upgrade. The value is calculated as sum of insulation required for partition walls and floors and a detailed calculation has been provided.

Resolution(s) to Topic 2

- *Regarding whether to delay the introduction of a residential model: Materials/products certified according the *Standard Practice 2004* document currently apply only to product claims for school and commercial buildings. To curtail inappropriate or misleading product claims using SP/01350 in residential environments requires adding a new set of appropriate scenarios. While we recognize there are still some material/product categories not covered and some material quantities are not fully determined in the model proposed in *SM2009*, we feel that these do not justify further delay. Adding the residential scenarios is urgently required and is retained in *SM2010*.*
- *Whole-house vs. two-floors or small single room model: We have reviewed the two-floors model submitted by Ms. Mason and Mr. Jacobs, and the small-single room model submitted by Mr. Oppl. While these offer some utility, the material/product categories currently defined in the model (ceiling, floor, walls & wallcoverings, interior wallboard paint, insulation, windows and doors) apply well to the whole house. Therefore, we retain the whole-house model in *SM2010*.*
- *Selection of outdoor ventilation rate and home size: The factors that influence the concentration modeling results include material loading factor (material areas/home volume) and outdoor air change rate (ACH). When home size decreases, the loading factor remains relatively unchanged because most material areas also decrease proportionately. Therefore, the influence of home size on the concentration modeling results is relatively small. As for the ventilation rate, the proposed value (0.23 ACH) is the minimum ASHRAE 62.2-2007 requirement from Table 4.1a. The value suggested by Ms. Mason and Mr. Jacobs (0.45ACH) was taken from the *1997 USEPA Exposure Factors Handbook*, a relatively dated reference. The recent study on new California homes (Offermann, 2009; see <http://www.arb.ca.gov/research/apr/past/indoor.htm>) has documented smaller air change rates in half of the homes; the median value (2-week measurement) was 0.24 ACH. These air change rates were measured during normal occupancy in two seasons and took into account opening of windows and doors for ventilation. The currently proposed value (0.23 ACH) leads to an allowable emission factor of about 1/3 – 1/4 of that for the office scenario for various product categories. Therefore, it is already a very challenging goal for industries. The value of 0.14ACH suggested by Mr. Phillips and Ms. Jenkins will further reduce these numbers. Considering that there are many conservative factors already incorporated into the *Standard Method* (e.g., uncertainty factors in the CRELs and the fact that emissions are presumed to stay the same over long periods of time), we retain 0.23ACH for the proposed residential scenario in *SM2010*.*
- *TBD values in Table 4.7: We have removed TBDs in Table 4.7, including only material areas or quantities available in the Buildings Energy Data Book (U.S. DOE 2008). Area specific flow rate has now been defined for each product category listed in Table 4.7. An estimated window area has been added based on a window-to-floor area ratio*

of 18%. This value is calculated by assuming the total window area is three times of the openable window area and using the measured median openable window area/floor area of 0.06 taken from the recent CA home study (Offermann, 2009). It is also consistent with the range of window-to-floor area ratio recommended by *Minnesota Green Affordable Housing Guide* (<http://www.greenhousing.umn.edu/>). Further information is needed to determine the areas of kitchen cabinets and other cabinets, which will be deferred to the next update. All interested parties will have a chance to provide further research data and suggestions. Please see Table 4.7 of *SM2010*.

- *Other residential products not listed in Table 4.7:* It is not clear whether the proposed residential scenario can properly apply to specific interior furnishings (mattresses, crib, etc.) until further research is completed. This topic will be deferred to the next update. All interested parties will have a chance to provide research data and suggestions.
- *Inclusion of acoustic insulation (for optional comprehensive acoustic upgrade only) in model parameters:* We are glad to incorporate more product types in the modeling scenario to address industry needs provided that the data/analysis submitted is scientifically valid. Mr. Ray from JM has provided detailed calculation to justify the use of 343 m² material area for optional comprehensive acoustic upgrade, considering the design of typical home for the proposed residential scenario. We have contacted North American Insulation Manufacturers Association (NAIMA) regarding whether JM has proposed is a good representative of industry practice, and have not received any objection/response. Therefore, suggestion from Mr. Ray has been accepted. Interested parties may provide further comments during the next update. Please see Table 4.7 of *SM2010*.
- *Floor areas to be used in the residential scenario:* We acknowledge the concern of Mr. Freeman (RFCI) and agree that individual floor materials may only have partial coverage in some cases. However, in order to keep the scenario simple, we prefer to use the conservative assumption of 100% floor coverage. Hence, we retain the single floor material area assumption in Table 4.7 of *SM2010*. At the same time, we recognize that the certification/verification organization may have sufficient evidence to justify the use of partial coverage. Therefore, we have made the following statements in Sections 8.4.2 and 8.4.3 of *SM2010*: “8.4.2 *Certification/verification organizations may adjust the material areas or quantities of a product in concentration modeling to account for partial coverage or unique conditions provided that the adjustment is consistent with the product usage commonly employed in building design and construction practices. Such deviations shall be stated in reports and public claims of compliance, e.g., on certificates of compliance; 8.4.3 In order for a certification/verification organization to make a claim of essential compliance with the method, modifications shall be documented, including detailed evidence of the basis. This documentation shall be made available to program participants, the public and any other interested parties.*”

3 Sample Collection, Handling and Shipping

Comments

(a) Summary of public meeting discussion

There was some divergence in views on the proper time allowances:

- *Mr. Frank Hurd* indicated that the currently proposed update allowed too much time between manufacturing and sampling & testing.
- *Mr. Randal Carter* indicated that different product types may require different sampling collection, shipping and handling procedures and this factor should be considered.
- *Mr. Al Hodgson* indicated that the current method addresses long term VOC emissions. For dry building materials, this is normally a diffusion controlled process. Therefore, it may not matter that much between 1 week and 1 month if the samples are properly collected and sealed.
- *Ms. Wenhao Chen* indicated that Europe typically allows up to 8 or up to 12 weeks age of sample (per information provided by Mr. Reinhard Oppl of Eurofins).
- There were related discussions regarding the allowable packaging methods as different packaging methods may lead to different results and different appropriate time allowance for sample collection, handling and shipping. Mr. Randal Carter indicated that Tyvek bags are too small for office furniture, and that BIFMA standard only requires the most air tight means possible with a maximum of 15 days between manufacturing the earliest part of a workstation and receipt by the laboratory of the last part of a workstation. Mr. Hal Levin indicated that packaging can vary widely among products, and even Tyvek bags do not prevent VOC loss or spreading to other materials. Mr. Frank Hurd indicated they have measured VOC loss with Tyvek bags.

(b) Further comments on SM2009

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*. Section 2.1.6.3: In Europe we typically allow up to 8 or up to 12 weeks age of sample. 5 weeks still is pretty strict, you might consider allowing at least +/- 2 weeks. Else this could be a problem for samples coming in from far away.
- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS)*
 - ✓ Section 2.1.6.3 Dry products: Laboratories need flexibility regarding the start of testing so that human resources devoted to coordination and scheduling of tests are not excessive and chamber facilities are efficiently utilized. Very short times lead to higher testing costs. Use of a 5-week window for start of testing should not compromise results because the Standard requires packaging to preserve chemical integrity and the tests are 14-days in duration. CRI has suggested significantly decreasing the window. However, CRI's derivative program is a special case because they rely on 24-h tests and they use less than optimal packaging.
 - ✓ Section 2.1.6.3 Containerized products: Containerized products are sealed so there should be no loss of VOCs during storage. There is no need to shorten this period as participants have suggested.
- *Mr. Frank Hurd - Carpet and Rug Institute (CRI)*. Regarding Section 2.1.6: We recommend that test sample collection and handling be controlled and consistent.

Consistency is very important for the ongoing certification programs that attempt to control the level of emissions from individual manufactured products.

- ✓ We recommend that sample collection take place at the end of the last production step. If this is not practical, sample collection should be no later than 24 hours of production.
- ✓ We also think it is important that the analysis in the laboratory occur within the 5 to 10 day period from the collection date.
- ✓ These changes will help insure uniformity of testing and preclude the gamesmanships in product VOC testing.

Detailed suggested changes include:

- ✓ Page 14 – Item 2.1.6.1 Delete “within one week (7 days)” and change to “24 hours”.
- ✓ Page 14 – Item 2.1.6.3 Delete “within 5 weeks” and change to “7 days \pm 2 days”.
- ✓ Page 14 – Item 2.1.6.3 Delete “within 4 weeks of receipt at the testing laboratory (maximum of 4 months from actual production date)” change to read “within 3 weeks from actual production date”.
- ✓ Page 14 – Table 2: For Event “Sample Collection” the Schedule should be changed to read “At the end of the production process”– delete “No more than 7 days after production (specific procedures apply)”. Rationale: In order ensure that samples are collected and package IAW 2.1.8.1 and are not allowed to off gas prior to packaging it is necessary to collect the sample at the end of the production process. This will ensure that samples collected are tested under similar conditions.
- ✓ Page 14 – Table2: Event: Shipment Laboratory - Schedule should be changed to read: ”Within 24 hours of collection”. “and no more than 7 days after production” Rationale: There is no reason that once a sample has been collect and package not to send it to the testing laboratory.
- ✓ Page 14 – Table 2: Event: Commence Laboratory Testing – Schedule should read testing Laboratory shall start testing within 7 \pm 2days. Delete: “Within 5 weeks of production”. Rationale: 5 weeks is excess time frame for commencing testing and could lead to inaccurate and highly variable results.
- ✓ Page 14 – Under Containerized products (e.g. adhesive, sealants, paints etc) the timeframes listed for shipment and commencement of testing seem excessive. Recommend these be reduced to more reasonable timeline e.g. 2 week for shipment and 3 week for commencing testing.
- ✓ Page 15 Item 2.1.8.1 delete “if possible” and delete “within 24hrs”. Rationale is sample collection should and needs to be directly off the production and not allow for off gassing.
- ✓ Page 15 Item 2.1.8.1 delete the “or Mylar bag”. Add “When utilizing a Mylar bag the above procedures are not necessary”

- ✓ Page 15 Item 2.1.10.1 delete “Samples collected more than 24-hours from the production shall be taken a minimum of 2 yards or at least two full roll circumferences (i.e. roll diameter x 3.14x2) from the end of roll”
- ✓ Page Item 15 2.1.10.2 add: “An alternative method is to roll the strip and place into the Mylar bag. Rationale: This procedure closer simulates the shipment of carpet and therefore should provide more realistic data.
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ In Section 2.1.6 Sample Age: We believe sample collection should occur within 24 hours of the end of the manufacturing process in order for the sample to be representative of emissions from the product. Other certification programs, such as CRI’s GLP and GREENGUARD have this time constraint. BIFMA M7.1 incorporated this thinking in their methodology as well. We are concerned about sample integrity, contamination, airing out, etc. that may occur in the 7 day period from manufacturing completion to sample collection. We have inserted suggested changes.
 - ✓ In Section 2.1.6 Sample Age: Testing for both dry products and containerized products should occur within 10 days of arrival at the test lab. The longer the product sits before testing, the great the possibility for loss of sample integrity. Test labs can coordinate sample receipt to meet the requirements.
 - ✓ In Section 2.1.8 “Seal the samples with two layers of heavy-duty aluminum foil so the air space within the package is minimized and the seams are crimped to create an airtight seal”: What is the purpose of this step if the product is placed in an airtight Mylar bag? Additionally, oils on the shiny side of aluminum foil can contaminate products and care should be taken in this regard.
- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI)*
 - ✓ Section 2.1.6.1 – Allowing products to be collected and shipped after one full week following production is not being as precautionary as possible when it comes to the testing of products. Products should be required to be collected and shipped for testing within 24 hours of production.
 - ✓ Section 2.1.6.3 – Allowing samples to be tested five weeks after arriving at the laboratory is not being a precautionary as possible. Testing should be done in an expedited manner and should be required to happen within 10 days of arrival at the laboratory as currently required in key certification programs and from lessons learned in the carpet program.
 - ✓ Section 2.1.8.1 – Why does this state that products should be collected 24 hours after production, yet in previous section (2.1.6) it allows for products to be collected up to one full week following production. We feel that it should be collected and shipped within 24 hours of production to preserve sample integrity and program integrity.
- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB.* Sec. 2.3.3, Sample Collection Procedures, Chain of Custody: We recommend that requiring that the Chain of Custody form be completed every time the product changes hands, location, or storage

conditions. The form should document whoever handles the materials, from the production line to the laboratory, until final disposal of the material. The form should also include information on storage conditions for the each location, e.g., air the types of air-tight containers or seals to prevent cross-contamination or aging of the material.

Resolution(s) to Topic 3

- *General Consideration:* Section 3.7.1 of **SM2009** states: “At the 14-day time point, the emissions of VOCs from most products primarily will be dependent upon the characteristic diffusion rate of the VOCs within the material and the concentration of the VOCs in the bulk material and should change slowly from day to day and from week to week. Thus, minor differences in product sample age at the time of collection should be partially or wholly compensated for by use of a 10-day conditioning period and any minor surface contamination not directly related to the content of VOCs in the bulk material should be eliminated. Also, the potential effect of external mass transfer resistance on the emission rates of most VOCs should be diminished substantially after 10 days of conditioning.” We think this statement remains valid, and we have retained it in **SM2010**.
- *Sample collection for dry products:* We agree that samples should be collected at the point of production as soon as possible after the normal manufacturing process. **SM2010** now requires that samples be collected directly from the manufacturing or packing line within 24-hours of production with a few exceptions, under which product samples may be collected within 7 days of actual production. We believe these detailed specifications are sufficient to preclude the misuse of **Standard Method** or gamesmanships in product sample collection. Please see Sections 2.1.6 through 2.1.12 of **SM2010**.
- *Commencing laboratory testing for dry products:* We agree that laboratories need flexibility regarding the start of testing. We feel that a 5-week window for start of testing should not compromise results because the **Standard Method** requests packaging to preserve chemical integrity and includes use of 10-day conditioning period. The 5-week window is shorter than European practice (e.g., up to 8 weeks) as indicated by Mr. Oppl. A certification/verification program can choose to request quicker laboratory testing based on its individual program need. Therefore, we retain the 5-week window in **SM2010**.
- *Commencing laboratory testing for containerized products:* We agree that there is no need to shorten the proposed time schedule for sample collection and testing because containerized products are sealed and there should be no lose of VOCs during storage. We retain the requirements of **SM2009** in **SM2010**.
- *Sample packaging method:* We believe that the requirements specified in **SM2009** are still optimal packaging practices for relative long term sample storage (i.e., up to 5 weeks). Therefore, we retain these in **SM2010**.
- *Chain of Custody Documentation:* We agree with CARB’s comments in general, except that there is no need for a dual request after samples being logged into the laboratory’s quality management system. Once a sample is logged into the laboratory’s quality management system, its progression through testing and disposal is fully recorded and

documented. We have added the following requirements in *SM2010* : 1) “*The chain-of-custody shall be executed every time the product sample moves between organizations or between physical facilities within an organization prior to be tested.*” 2) “*The chain of custody form shall include packaging details – Types of Air-tight Containers or Seals*”. Please see Sections 2.3.2 and 2.3.4.7 of *SM2010*.

4 Application of BIFMA Test Method for Furniture

Comments

(a) Further comments on SM2009

- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS).* The current inclusion of the ANSI/BIFMA M7.1 standard only incorporates the open plan scenario, not the private office scenario. I encourage the use of the private office scenario in addition to the open plan scenario from ANSI/BIFMA M7.1.
- *Mr. Reinhard Oppl - Eurofins Product Testing A/S.* Section 4.2.5 Private Office scenario: There should also be furniture in those scenarios, not just empty rooms - see BIFMA M7.1 as inspiration.
- *Mr. Steven Trinkel – Kimball International.* Section 7.2 Concentration Modeling for Furniture and Office Seating - We support adding the private office environment as defined in ANSI/BIFMA M7.1-2007 for the free standing furniture used in the private offices. We would also support development or expansion of the standard for the commercial office furniture market following the lead USGBC levels in the LEED programs.
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ Section 7 - It is not clear what is meant by the use of the word “freestanding”. Actually, it is not clear what is being accepted from the BIFMA method, i.e., which furniture and modeling parameters.
 - ✓ Section 7.1 – This needs to be modified to specify the components of the M7.1-2007 standard that have been recognized, as there are components, such as the private office model, product grouping and selection, and re-test requirements which have not.
 - ✓ Section 7.1 – Is office seating included in this method? Earlier in section 4.2.5 it states “Furniture and seating used in private offices is not addressed within the current scope of this standard method.”
 - ✓ Section 7.1.2 - Please note that a curve based on two time points (72 and 168 hours) is being used to predict results at 336 hours for comparison to health-based criteria. At a minimum, it should be required that additional data be collected between 0 and 168 hours for the generation of a more accurate modeled value. This change would be consistent with the options in section 8.4.

- ✓ Table 7.1 in Section 7.1.2 - Please include a paragraph explaining why 0.92 ACH is used for open-plan office furniture, whereas 0.68 ACH is used for all products in the private office.
- ✓ Section 7.2.3 “To estimate the VOC concentration in office air for non-standard, free standing furniture items, calculate the area using the conventions in ANSI/BIFMA M7.1, determine the area-specific emission rate (i.e., emission factor) and divide by the area-specific air flow rate for the entire workstation, 0.69 m h^{-1} .” - This process is not in the current version of ANSI/BIFMA M7.1, thus there is no clear direction on how this would be implemented. What types of products is this referring to?
- ✓ Section 7.2.4 “The unit specific air flow rate for office seating is also presented in Table 7.2. Two identical seating units are assumed.” - How is this used? What air change rate does it correspond to? If seating is to be included, the model parameters should be those of the BIFMA M7.1 open-plan office. Currently, as it is written in this document, it is not.
- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI)*
 - ✓ Section 7.1 - Clarify components of the BIFMA test method that are applicable, testing, analytical measurements and modeling? And what furniture is applicable for this practice- classroom and open panel systems.
 - ✓ Section 7.1.2 – Measurements are being compared to health based end points. The use of two measurement points to define product emissions for this purpose is not robust- recommend requiring more data points like the other products.
 - ✓ Table 7.1 - It appears to be inconsistent to use a 0.92 ACH for open-plan office furniture and 0.68 ACH for all other products. Recommend one or the other. If not, please provide rationale for two different air change rates on an office floor. Could the open panel system be modeled to the private office or all other product be modeled to the open area? Please clear confusion.
- *Mr. Randal Carter – Steelcase.* I am pleased and proud to see the ANSI/BIFMA M7.1 standard test method incorporated directly into the proposed changes. This single change is a fundamental improvement to the Standard Practice with benefits extending to built-in cabinetry and residential furniture.
 - ✓ I propose the draft Standard Method incorporate the updated, 2009 version of the BIFMA M7.1 standard, which will likely be available for reference in early January 2010. The updated version incorporates additional capabilities based on research completed following the release of the earlier version. Specific improvements in the updated version of the BIFMA M7.1 test method include:
 - Expanding the use of small scale chamber testing to allow determinations of compliance for assembled furniture products (Hodgson et.al paper #444, Healthy Buildings 2009).
 - Providing detailed guidance for determinations of compliance of individual items (e.g. tables, file cabinets, easels, etc.) in addition to whole workstations and seating.

- Defining the translation of compliance criteria based on emission concentrations (ug/m³) into maximum allowed emission factors (ug/m² h) as an option to facilitate suppliers of material assemblies (e.g. laminated work surfaces, surface finishes with appropriate substrates, etc.) in providing emissions data relevant to compliance of finished products.
 - Expanding use of the power-law to predict emissions at 14 days.
 - Adding examples to make applying the standard easier, with emphasis on the emissions credits in the BIFMA e3-2008 sustainability standard that incorporate ½ CRELS.
 - Multiple technical and analysis refinements to decrease variation and/or increase harmonization with other standards (ASTM, ISO, etc.).
- ✓ I also propose the draft Standard Method incorporate the private office exposure scenario for furniture defined in the ANSI/BIFMA M7.1 standard, in addition to the open plan scenario. ASHRAE published the research defining both the open plan and private office standard exposure scenarios in the paper already cited in the draft Standard Method (Carter, R.D. and J.S. Zhang, 2007. Definition of standard office environments for evaluating the impact of office furniture emissions on indoor VOC concentrations. ASHRAE Transactions 113(2):466-77). The inclusion of the BIFMA private office scenario could be limited to furniture, allowing the continued use of the private office scenario already present in the draft Standard Method for use with flooring, wall coverings, and other interior finish materials.
 - ✓ Section 7 should be edited to include cabinets within the scope. The inclusion of ANSI/BIFMA M7.1 also addresses the unique needs of sample selection, shipment timing, packaging, and related issues for large assemblies like cabinets.
 - ✓ If the updated, 2009 revision of the BIFMA M7.1 test method can be referenced, then Section 7.1.2 can be revised to use 0.15 instead of 0.2 when determining if the power-law is applicable. This improvement is reflected in the updated version of M7.1 and is supported by research conducted by Dr. Zhang of Syracuse University, Al Hodgson of Berkeley Analytical Associates, and others.
- *Mr. Larry Dykhuis – Herman Miller.* As is currently planned within the draft, BIFMA M7.1-2007 emissions test method, and approved updates should be adopted in all respects for the testing of open plan, private office and seating furniture products.

Rationale:

- ✓ The test method described within CDHP SP2004 was not intended for use in testing business and institutional furniture.
- ✓ BIFMA M7.1-2007 has been designed for and validated for testing furniture.
- ✓ BIFMA M7.1-2007 is nearly universally used for testing of furniture.

Resolution(s) to Topic 4

- *Incorporation of ANSI/BIFMA M7.1-2007 vs. BIFMA M7.1-2009:* We will retain reference to ANSI/BIFMA M7.1-2007, as BIFMA M7.1-2009 is still in ballot process and has not become an ANSI-approved standard. Its incorporation will be considered

(i.e., during next update process) after it becomes an ANSI-approved standard.

- *Clarifications on which components of ANSI/BIFMA M7.1-2007 are incorporated:*
 - ✓ We have retained the term “*freestanding*” in the title of Section 7 to clearly indicate that this section currently does not address built-in cabinetry testing and concentration modeling.
 - ✓ In Section 7.1 of *SM2010*, we have made further clarification that ANSI/BIFMA M7.1-2007 test method (including specimen collection and preparation, chamber testing, and air sampling) and the power-law modeling procedures described in that method are recognized with the exceptions defined in Sections 7.1.1 through 7.1.4:
 - In Section 7.1.1 of *SM2010*, we have added the following texts to allow the use of small chamber component testing option: “*As defined in BIFMA e3-2008, small chamber testing of component pieces of workstations per the ANSI/BIFMA M7.1-2007 method is acceptable if there is third-party oversight in selecting representative components and in applying the calculations in ANSI/BIFMA M7.1-2007 (Section 10.6.1 and 10.6.2) to estimate the emission factor of a product.*” This approach is consistent with California Bid Documents for Office Furniture Systems and we believe it has already been frequently used in current practice.
 - We have also added section 7.1.2 in *SM2010* to clarify that air samples shall be analyzed for individual VOCs following procedures that are equivalent to the procedures described in Section 3.9.
 - ✓ In Section 7.2 of *SM2010*, we have made the following clarifications:
 - Single-occupant open plan office workstations are modeled to the open-plan office environment defined in ANSI/BIFMA M7.1-2007. Please see Section 7.2.2 of *SM2010*.
 - Private office workstations are not addressed within the current scope of this Standard Method. We recognize that the ANSI/BIFMA private office scenario, which is based on offices of the 50th percentile floor size with furniture at the 90th percentile surface area, in combination with the minimum outdoor air ventilation rate required by ASHRAE 62.1-2009, is a good starting point. However, we feel that the research community has not reached a consensus on what are the best floor size and ventilation rate to be used for private office workstation concentration modeling. We would also like to avoid two private office scenarios if possible. Therefore, the inclusion of private office workstation modeling scenario will be deferred to next update. It is our intention to have the group work together to either develop a new private office scenario that apply to all products or reach further consensus on the best private office furniture scenario to be included.
 - Office seating units are listed separately. The unit-specific air flow rate determined for each seating unit is consistent with the credit criteria for seating in CHPS 2009 and BIFMA e3-2008. Please see Section 7.2.4 of *SM2010*.
- *Estimation of VOC concentration in office air for non-standard, freestanding furniture*

items: We agree with Ms. Mason that the current version of ANSI/BIFMA M7.1-2007 does not fully specify this process although it allows alternative workstation system configurations to be defined for specific purposes (see Section 6.3 of M7.1-2007). Therefore, we have removed the following texts: “*To estimate the VOC concentration in office air for non-standard, free standing furniture items, calculate the area using the conventions in ANSI/BIFMA M7.1, determine the area-specific emission rate (i.e., emission factor) and divide by the area-specific air flow rate for the entire workstation, 0.69 m h⁻¹.*” Its incorporation will be reconsidered (i.e., during next update process) after it becomes part of the new ANSI-approved version of M7.1.

5 TVOC Definition and Use of TVOC Limit

Comments

(a) Summary of public meeting discussion

- *Mr. Tom Phillips* raised the issue of TVOC not being health-based, and that perhaps a caveat and user instructions are needed on this topic.
- *Mr. Raja Tannous* noted that major VOCs are missing from the TVOC metric.
- *Mr. Al Hodgson* indicated that TVOC is not a suitable metric for pass/fail because the uncertainty of the TVOC measurement is dependent upon the mixture of compounds and therefore unknowable. However, certifiers might use a qualitative approach of warning "flags". In other words, if TVOC is above some limit but the product otherwise qualifies, a caution flag would appear. The same flag approach might work if chemicals, for example carcinogens, are detected.
- *Ms. Stephany I. Mason* suggested TVOC limits be addressed and TVOC along with key identified individual VOCs with known health endpoints be used as indicators of a product's low emitting status. She indicated that: (a) TVOC limits have been widely used in Europe, but that the carbon-length ranges are different than that for SP/01350; (b) There is scientific data that shows TVOC can be utilized as an accurate metric; (c) Some products meet REL-based limits but not TVOC limits. Data is available for review if the group requests.
- *Mr. Josh Jacobs* indicated that the utilization of a TVOC limit along with individual health-based criteria fit in perfectly with the Precautionary Principle.
- Several participants (*Mr. Bill Orr, Mr. Leon Alevantis, Mr. Tom Lent, et al.*) indicated that we need to review the available data and further discuss this topic.

(b) Further comments on SM2009

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB.* We recommend providing directions on the use of the TVOC results, i.e.: a) the TVOC measurement, unlike the other VOC target concentrations, is not a health-based measurement; and b) that it should be used to identify individual VOCs with unusually high concentrations and to assess whether steady state is achieved at different time periods during the test.

- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI)*. Sections 1.3.2 & 3.9.4.2 – Definition of TVOC should be updated to be consistent with well accepted ISO and EPA definitions (C6 – C16). This would also allow the rest of the method to be consistent with BIFMA M7.1-2007 which is referenced /utilized within this document.
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*. Sections 1.3.2 & 3.9.4.2 - Definition of TVOC should be updated to be consistent with EPA and ISO definitions of TVOC. Also to make consistent with BIFMA M7.1 definition and with that used by other labeling programs such as The Blue Angel and GREENGUARD.
- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*.
 - ✓ Sections 1.3., 3.8.6.2.1, 3.9.4.2 and 4.1.3 - We suggest you define VOC and TVOC similar as in rest of world (CEN, ISO, FloorScore, BIFMA) as in the range of n-hexane to n-hexadecane (n-C6 to n-C16), as detected when analyzing with a GC on a 100% non-polar separation column.
 - ✓ Section 4.1 - A limit value for TVOC (most probably 500 µg/m³) would be helpful as a surrogate limit value for the non-listed VOCs. Today Section 1350 has much weaker requirements than all European VOC emissions rating schemes, just because only a limited number of individual VOCs are listed, and the non-listed VOCs can show highest emissions without any limit. This is a clear weakness of the puristic "TVOC limit is not scientifically proved" approach.
- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS)*. Section 1.3. - The Standard should retain the TVOC definition as C5 thru C17 because this generally delineates the volatility range of interest. The Standard does not exclude the use of C6 thru C16, as mentioned during the meeting by other laboratories, as long as the method is clearly stated in the test report.
- *Mr. William Freeman - Resilient Floor Covering Institute (RFCI)*. We believe the discussion on TVOC requirements is beneficial and should continue. However, the major reason that a program like FloorScore is based on California 1350 is that the VOC limits are based on health based risk assessments. Before OEHHA established exposure levels IAQ certification programs arbitrarily selected a TVOC limit regardless of whether there was a health hazard associated with the VOCs. There are flooring products sold today which are considered environmentally preferable like linoleum but because linoleum is made with linseed oil it can have VOC emissions for some time and not meet a 500 micrograms per cubic meter requirement. It does not mean that the linoleum VOCs are a health hazard. It is my understanding that although you may be able to measure TVOCs accurately within a product category, it is very difficult to accurately measure TVOCs between different product categories, thus making it very difficult to establish one TVOC limit for all product categories. I recommend that a TVOC requirement not be required in Section 1350 until this subject is studied further.

Resolution(s) to Topic 5

Since its inception, SP/01350 has been a health-based standard focusing on individual VOCs. While there is sparse scientific evidence for a health-based TVOC exposure limit, we acknowledge the benefit of providing some guidance on using such data. There has been a longstanding debate on how to define TVOC (e.g., the mass range C₅ through C₁₇ versus C₆

through C₁₆) and the appropriate guideline for using TVOC results (i.e., a qualitative approach of warning "flags" versus a number limit) in the *Standard Method*. Recognizing that the current update is on a fast track, we defer this debate further to be addressed in *SM2011 Version 2.0* (expected to be issued by Jan, 2011). All interested parties will have a chance to provide further research data and suggestions.

6 Document Title and Document Number

Comments

(a) Summary of public meeting discussion

- *Mr. Frank Hurd* suggested changing name to “*Standard*” to better convey the content and intent of the document.
- *Mr. Jed Waldman* said he was concerned whether Departmental policy restricts the term “*Standard*” for just regulatory documents. He will investigate this with the CDPH attorneys.
- Some participants suggested that “01350” somehow be retained, as this is the way the standard is currently known, that is, it is a well-respected “brand”, cited by many people/organizations.
- *Mr. Anthony Bernheim* reminded the group that the “*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers (“Standard Practice”)*” and what is known as Section 01350 are very different documents with different uses. Section 01350 was named based on the Construction Specifications Institute’s (CSI) nomenclature for naming project specifications intended for use in construction by a General Contractor, Sub Contractor and product manufacturer in bidding and building a project. It is prepared by an Architect as the way to convey information to the General Contractor as to how the building should be built and what materials should be used. As the *Standard Practice* is updated, so section 01350 will need to be revised and renumbered as the CSI has updated its specification numbering system.

(b) Further comments on SM2009

- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS)*. I think that the ‘brand’ of CA 01350 has become well established in the green building rating system world, including the architect and design community. I like the new long title, but recommend that the short name remain “CA 01350”
- *Mr. William Freeman - Resilient Floor Covering Institute (RFCI)*. We would recommend that the reference to Section 1350 in the document remain for the time being. As unusual as the title is, this title is now widely recognized across the country and now referenced in multiple programs.

Resolution(s) to Topic 6

We acknowledge that the “brand” of *California’s Specification 01350* has become well established and received wide acceptance/citations. However, as Mr. Bernheim points out, its

name was based on the Construction Specifications Institute's (CSI) nomenclature, and the CSI has since updated its specification numbering system. The section number no longer has the same meaning, so it would be anachronistic to include "Section 01350" in the title for this *Standard Method*. We retain "Emission testing method for *California Specification 01350*" as the subtitle. Thus, people can still refer to this *Standard Method* using the "brand" of CA 01350. The revised title replaces the word "Various" with "Indoor" to clarify the scope of the standard.

7 *Quality Assurance and Quality Control*

Comments

(a) *Summary of public meeting discussion*

- *Mr. Frank Hurd and Mr. Josh Jacobs* suggested making the requirements that laboratories shall operate their quality system in accordance with **ISO/IEC 17025:2005** as mandatory lab practices (instead of recommended lab practices as currently proposed). They also indicated that lab certification/accreditation, not just activities, should be required.

(b) *Further comments on SM2009*

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*
 - ✓ Section 5.2. - VOC concentration is calculated linearly from VOC emission factor - it makes no sense to assign different accuracy requirement to both of these.
 - ✓ Section 5.3.1 & 5.5.3 - In these days accreditation (ISO 17025) shall be the minimum requirement, and good performance in proficiency tests including chamber operation and chamber air sampling / analysis should be added upon. Otherwise the method will not become sufficiently reproducible.
- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS)*. Section 5.3.1 - I think this recommend practice should be made mandatory, effective in v1.1. All active labs that test products to the 01350 Standard Practice already have achieved 17025 accreditation with their scope inclusive of 01350.
- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI)*
 - ✓ Section 5.1 – Laboratories conducting this testing should be required to have this standard in the scope of their ISO 17025 accreditation. This allows those of us utilizing information from this test method to trust the laboratories data as being consistent.
 - ✓ Section 5.3.1 – As stated before, this should be required.
 - ✓ Section 5.3.2 – This should be a requirement.
 - ✓ Section 5.3.3 – Interlaboratory proficiency test participation should be required as it is a way to ensure that the laboratory is within generally accepted parameters.
- *Mr. Al Hodgson and Mr. Raja Tannous - Berkeley Analytical*. We recommend that conformance to ISO/IEC 17025 be made mandatory. At some point, accreditation to ISO/IEC 17025 should be made mandatory.

- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ Section 5.1.3 QMS performance shall be audited on an annual basis – By whom? Internal? External?
 - ✓ Section 5.3.1, 5.3.2 & 5.3.3 - These should be required. Ideally the lab should be accredited to these by an independent organization.

Resolution(s) to Topic 7

- *Mandatory vs. Recommended Laboratory Practices:* In bowing to the unanimity of commenters, *SM2010* requires listed laboratory practices to be mandatory. Please see Section 5.2 of *SM2010*. The mandatory accreditation to ISO 17025 will be considered during the next update.
- *Section 5.1.3:* Further clarification has been made that QMS performance shall be audited on an annual basis according to ISO/IEC 17025:2005. Please see Section 5.1.3 of *SM2010*.
- *Table 5.2 in Section 5.2:* Besides the measured VOC concentration, the VOC emission factor is affected by other parameters such as temperature, relative humidity, chamber air flow rate and the exposed area of test specimen. Therefore, precision for VOC emission factors should be estimated based on propagation of errors of the individual factors (including VOC concentrations). We retain different precision requirement for VOC concentration and VOC emission factor measurement.

8 Guidelines for Use of Standard Method as Basis for a Building Product Claim

Comments

(a) Summary of public meeting discussion

- Requirements on frequency of retesting were discussed. *Mr. Stowe Hartridge-Beam* indicated that SCS requires certified products to be tested annually. *Mr. Bill Orr* indicated that the CHPS High Performance Products Database is going to replace its current Low Emitting Materials (LEM) table, which will retire at the end of 2009. He also asked how often we should revalidate the original assumptions for the emission limits. *Mr. Frank Hurd* suggested adding the following language in Section 8.3 of *SM2009*: “*The organization’s certification process will be considered meeting this standard if the testing organization has conducted at least one full test per product type in accordance with the prescribe procedures and criteria outlined in this standard.*”

(b) Further comments on SM2009

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB.* Sec. 8.6.11, representative sample collection - We recommend providing guidance on how to randomly select the samples, rather than relying on arbitrary and variable procedures to determine what is

“representative”. Industrial quality control programs should have good examples for random sample selection protocols.

- *Mr. Stowe Hartridge-Beam - Scientific Certification Systems (SCS)*. Section 8.3.4 - Accreditation to ISO 65 should be required in v2.0. Certification bodies should be informed at least one year in advance if certification bodies will be expected to obtain ISO 65 accreditation, inclusive of 01350 within the accreditation scope.
- *Mr. Randal Carter – Steelcase*. In Section 8.3.4, I strongly support the requirement for certification bodies to operate in accordance with ISO Guide 65 when making claims based on the proposed Standard Method.
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ Section 8.2 Breadth of Claim – The decision should be made by an independent third-party.
 - ✓ Section 8.3.1 “A certification/verification organization may use an abbreviated list of target VOCs for a specific product type, provided they have sufficient test evidence demonstrating that omitted chemicals of concern are essentially absent.” - Please define ‘sufficient’ and indicate who is allowed to make this decision. Is it the certification/verification organization alone?
 - ✓ Section 8.3.4 - Accreditation to ISO 65 should also be required.
 - ✓ Section 8.4 Acceptable Alternative to Method – This is not consistent with the requirements in section 7 for furniture.
- *Mr. Al Hodgson and Mr. Raja Tannous - Berkeley Analytical*. Section 8.3.4 - We recommend that all testing laboratory and claims certification/verification organizations be required to operate in accordance with international quality standards (ISO/IEC Guide 65). At some point, we believe adherence to these standards should be made mandatory.

Resolution(s) to Topic 8

- *Requirement on Certification Organization’s Operation*: All the commenters concurred that any certification organization shall operate in accordance with ISO Guide 65. Therefore, we have added Section 8.1.2 in *SM2010* and clarified that “*Certification/verification organizations involved in substantiating manufacturers’ claims shall operate in accordance with ISO Guide 65 (1996). Program documentation, quality manuals, and information on the procedures, criteria and data used to substantiate manufacturers’ claims shall be made available to interested parties upon request.*” As of the accreditation to ISO 65, all the commenters agreed that it should be made mandatory eventually but had different views on when it should occur. We feel the one-year in-advance notice request from Mr. Hartridge-Beam is reasonable. Therefore, we defer the requirement of accreditation to ISO 65 to the next update. Please see Section 8.1.2 of *SM2010*.
- *Breadth of Claim*: We believe that manufacturers should also be allowed to make claims if: a) such claims are made following the principles of ISO 14021 for self-declared environmental labels and declarations, and b) information on the procedures

and criteria used to support such claim are to be made available to the public and any other interested parties upon request. Therefore, we have added Section 8.1.1 in **SM2010** and clarified that *“Claims made by manufacturers regarding their own products shall be made following the principles of ISO 14021 (2001) for self-declared environmental labels and declarations. These requirements include that such claims be: based on scientific evidence; accurate; verifiable; and updated if circumstances alter their accuracy. Information on the procedures, criteria and data used to support such claims shall be made available to interested parties upon request.”* We have subsequently made the following changes in the section of *Breadth of Claim* (Section 8.3 in **SM2010**): *“A claim that extends beyond the individual product that is tested shall only be made if there is clear evidence justifying that tested items are representative of this product or related products. Such evidence shall be documented and the documentation shall be made available to interested parties upon request.”* Please see Sections 8.1.1 and 8.3 of **SM2010**.

- *Modification to Method:* We believe that a certification/verification organization should always use the full list of target VOCs at least for the first full compliance test, though it may be appropriate to use an abbreviated list of target VOCs for specific product types in its quality control retesting program. Therefore, we have deleted the following texts from Section 8.3 of **SM2009**: *“A certification/verification organization may use an abbreviated list of target VOCs for a specific product type, provided they have sufficient test evidence demonstrating that omitted chemicals of concern are essentially absent”*. We have subsequently added the following in Section 8.8 of **SM2010**: *“The full retesting of samples may be less frequent if a certification/verification organization implements a robust routine quality control testing program and demonstrates its equivalency to full test for the purpose of substantiating manufacturers’ claims. Detailed evidence of such equivalency shall be documented. The documentation shall be available to program participants, the public and any other interested parties.”* This allows a certification/verification organization to use an abbreviated list of target VOCs for a specific product type in its quality control retesting program.
- *Acceptable Alternative to Method:* We believe it is appropriate to adopt the ANSI BIFMA M7.1-2007 chamber testing method and power law modeling procedure for furniture testing because it is an ANSI approved standard and based on published research. For building products other than furniture, we agree that it is not necessary to report chamber concentrations and emission factors of formaldehyde and TVOCs at all five time points of 24, 48, 72, 96 and 120 hr as currently specified in *“Acceptable Alternative to Method”*. Therefore, we have made the following changes in Section 8.5 of **SM2010**: *“samples for formaldehyde and TVOCs are collected and their corresponding chamber concentrations and emission factors are reported at a minimum of three time points between 24 and 120 hours, spaced at least 24 hours apart (e.g., 24, 48, 72, 96 and 120-hr).”*
- *Guidance on Product Sample Selection:* It is our understanding that most testing laboratories and/or certification programs generally request a pre-defined and written sampling plan and provide general guidance on how to select a representative specimen, similar to Section 8.6 of **SM2009**. We do not believe current practice yet allows statistically representative sampling for material emission testing in practice;

that would necessitate a standard for random sampling (i.e., using random number generator). Therefore, we have only added the following texts in Section 8.7 of *SM2010*: “The manufacturer and/or certification/verification organization shall have a pre-defined, written sampling plan.”

- *What certification process (or retesting schedule) can be considered as meeting the Standard Method:* We think it is reasonable to reduce the retesting frequency when the certification organization meets certain conditions. Therefore, we have added the following texts in Section 8.8 of *SM2010*: “The full retesting of samples may be less frequent if a certification/verification organization implements robust routine quality control testing program and demonstrates its equivalency to full test for the purpose of substantiating manufacturers’ claims. Detailed evidence of such equivalency shall be documented. The documentation shall be available to program participants, the public and any other interested parties.”
- *Manufacturing Quality Control:* We have combined Sections 8.5 (*Quality Control*) and 8.6.2 (*Manufacturing Quality Control*) of *SM2009* into one section – Section 8.6 (*Quality Control*) of *SM2010* to streamline the document structure.

9 Other Major Technical Topics

9.1 Test of other types of insulation besides fiberglass insulation batt products

Comments

- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI).* Section 2.1.12 – Why is Fiberglass insulation the only type of insulation that is called out in sample collection? GREENGUARD Environmental Institute is pleased to supply our GGTM.P066 (<http://www.greenguard.org/uploads/TechDocs/GGTM.P066.pdf>) for ways that other insulation can be collected. Please see Section 2.7.4 (page 13 – 14).
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ Section 2.1.12 Fiberglass insulation butt products - What about other types of insulation, such as loose fill or duct boards? In GGTM.P066 section 2.7.4, there is instruction on how to collect other types of insulation samples. This document is available at <http://www.greenguard.org/uploads/TechDocs/GGTM.P066.pdf>.
 - ✓ Section 3.5.5 - Why is fiberglass insulation not placed in a tray to mimic placement between wall studs or floor joists? Recommend allowing this as an option and include insulation in 3.5.5.2.

Resolution(s) to Topic 9.1

- Section 2.1.12 of *SM2010* now addresses sample collection procedure for other types of insulation (loss fill insulation and boards and rigid form insulation products).
- We have adopted the recommendation of placing fiberglass batt insulation and other types of insulation in a stainless steel tray of appropriate depth for chamber testing. Please see Section 3.5.5 of *SM2010*.

9.2 Test specimen preparation for carpet

Comments

- *Mr. Frank Hurd and Mr. Ken McIntosh - Carpet and Rug Institute (CRI)*. Regarding Section 3.6.3.1, for carpet emission testing, we recommend that carpet samples be placed in a S.S. tray with vertical sides. This arrangement will seal the edges of the test sample and replicate how these products are applied and used at the consumer level.
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*. Section 3.6.3.1, specific requirements for tile and broadloom carpeting: Not sealing the edges will expose adhesive and edges of the carpet that would otherwise not be exposed in the room. Attempts to seal edges should be made using foil and low-emitting tape.

Resolution(s) to Topic 9.2

We have adopted the recommendation of fitting the test specimen into a stainless steel tray for carpet testing. Please see Sections 3.5.5 and 3.6.3 of *SM2010*.

9.3 Removal of the use of glass plate

Comments

- *Mr. Frank Hurd - Carpet and Rug Institute (CRI)*. Delete “glass plate” reference in Section 3. Rationale: Chamber and plates need to have consistent material i.e. polished stainless steel; in addition glass has a tendency to attach VOCs.

Resolution(s) to Topic 9.3

We have adopted the recommendation of eliminating the use of glass plate. Please see Sections 3.1.8, 3.2.2, 3.3.1, and 3.8.4.2 of *SM2010*.

9.4 Requirements for sample conditioning period

Comments

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB*. Sec. 3.7.3, Clean air supply. PM filtration required and VOC limits specified: We recommend specifically requiring active filtration through activated carbon or other methods specifically designed for removing organic compounds. This is consistent with other chamber test methods such as UL 867 for testing ozone emissions from air cleaners.
- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*. Operating parameters of conditioning period, see 3.7:
 - ✓ A separate conditioning room is more expensive and this approach includes higher risk of contamination between samples than having the test specimen in the test chamber all the time. Please consider requiring performing conditioning in actual test chamber.

- ✓ The 2 ach is too high ventilation. At least in case of renovation in residential settings, increased ventilation can be expected during max. 1/2 day, thereafter max. 1/2 ach will be realistic. The 2 ach is diluting the test result by flushing out VOCs and by increasing decay of emissions, when compared to realistic settings. In case of products that are liquid when applied, the higher ach can impact drying behavior and by that the emissions after 14 days. Please consider using same ventilation during conditioning, and in test chamber.
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ Sec. 3.7.2.2, Conditioning room with specimen in separate containers: Please allow an option for conditioning chambers with a direct input from a clean air supply and the conditions stated below. Also, what is the reasoning behind a minimum of 2 ACH in the conditioning room? This will limit the number of conditioning chambers and should be stated.
 - ✓ Section 3.7.3 Clean air supply: We recommend changing to “*The VOC content of the supply air shall not exceed 5 2 µg/m³ for any individual compound including formaldehyde and 25 µg/m³ for TVOC*”. Rational: 5 µg/m³ is too high for contaminant levels in the supply air for the conditioning chambers as porous materials may absorb these compounds and lead to deleterious results, especially when comparing to low level criteria such as where formaldehyde will be by 2012.
 - ✓ Section 3.7.5 Verification of conditions: We recommend changing to “*The air used for conditioning periodically shall be sampled and analyzed for VOCs, aldehydes and TVOC on at least a ~~monthly~~ weekly basis according to the laboratory’s quality management system*”. Rational: Sampling and analysis of this air on a monthly basis leaves a lot of opportunity for contamination to occur during the 10 day conditioning period.

Resolution(s) to Topic 9.4

- We have adopted the comments regarding the clean air supply. Section 3.7.3 of *SM2010* now requires that “*The supply air, if not from gas cylinders, shall pass through an active filtration system consisting of a bed of granulated activated carbon (or other methods specifically designed for removing organic compounds) and a particle filter*”.
- We have revised Section 3.7.2.2 to: 1) allow the direct clean air supply to each container, and 2) clarify that the clean air supply of minimum of 2 ACH is for the conditioned environment (room) in which the separate containers are placed. For each container, the clean air is supplied at a flow rate that provides an area specific flow rate nearly equivalent (i.e., within ± 20%) to the area specific flow rate achieved in the emission test chamber. The requirement of minimum 2ACH for the conditioned room is to prevent any background contamination in the conditioned room. Please see Section 3.7.2.2 of *SM2010*.
- We have checked with experts in CDPH laboratories as well as at some other commercial testing lab. Their consensus was that, reducing background concentrations of individual VOCs during conditioning from 5 to 2 µg/m³ might

preclude the use of relatively inexpensive activated carbon scrubbing systems for conditioning the room. The lab will need time to confirm that $<2 \mu\text{g}/\text{m}^3$ for individual VOCs is achievable by using active filtration system, and there is no direct evidence that low level concentrations of background contaminants $<5 \mu\text{g}/\text{m}^3$ have any significant impact on the measured concentrations of VOC during a subsequent chamber test. Therefore, we retain $5 \mu\text{g}/\text{m}^3$ as the allowable background concentration limit for individual VOCs in clean air supply in *SM2010*.

- The verification of conditioning conditions shall be conducted according to the laboratory's quality management system (QMS). Section 5 of *SM2010* specifies QMS requirements in details. Therefore, we have made no changes in Section 3.7.5.

9.5 Operating parameters for test chambers - loading factor and air change rate

Comments

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*
 - ✓ Ventilation in test chamber: Now 1 ach - but 0.5 ach (as mostly used in Europe) would be better. Lower ventilation gives less dilution of emissions, and this allows for higher sensitivity of the emission test and lower limit of detection. Or at least please allow performing the test within a broader interval as in doc N0124 clause 7c, for allowing performing a test in parallel for both US and EU purposes, as e.g. in BIFMA M7.1-2009 (draft).
 - ✓ Loading factor of tested material, now in the range $0.3 - 0.7 \text{ m}^2/\text{m}^3$: In Europe we are using $1.0 \text{ m}^2/\text{m}^3$ for wall materials and $1.4 \text{ m}^2/\text{m}^3$ for materials used for both walls and ceilings. It would be great if you allow a wider range of loading factors for testing, for allowing performing a test in parallel for both US and EU purposes, as e.g. in BIFMA M7.1-2009 (draft).
- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*. Why restricted to the range of $0.3 - 0.7 \text{ m}^2/\text{m}^3$, when for example the wallcovering loading ratio in the office defined in this document is closer to $1.0 \text{ m}^2/\text{m}^3$. This limited range does not allow for realistic loading ratios in the chamber.

Resolution(s) to Topic 9.5

The emission factor is proportional to the area-specific flow rate (ratio of air change rate to loading factor) under ideal chamber operating conditions (i.e., perfect mixing, zero sink effect). Thus, it may be sufficient to specify the range of area-specific flow rate while allowing larger range of variations for loading factor (and air change rate). However, further research is needed to fully determine the optimal range of these parameters. In deference to the experience in Europe and elsewhere, we have enlarged the allowable range of loading factor from $0.3 - 0.7 \text{ m}^2/\text{m}^3$ to $0.3 - 1.0 \text{ m}^2/\text{m}^3$. For a chamber operating at 1.0 ACH, this corresponds to a change of area-specific flow rate from $1.4 - 3.3 \text{ m}/\text{h}$ to $1.0 - 3.3 \text{ m}/\text{h}$. Please see Sections 3.1.3 & 3.8.2 and Table 3.1 of *SM2010*. Further optimization of the area-specific flow rate, the loading factor and the air change rate for

chamber testing will be deferred to next update process.

9.6 Test chamber background concentration and measurement requirement

Comments

- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*
 - ✓ Section 3.8.5.2 Background measurement: We recommend changing to “*The background of VOCs and aldehydes shall be determined prior to each ~~third~~ use of a chamber*”. Rational: There is the possibility of contamination from previous samples or cleaning detergents that will be missed if backgrounds are not collected prior to each use.
 - ✓ Section 3.8.5.2 Background measurement: We recommend changing to 10 µg/m³ for TVOC to be consistent with guidance in ASTM D5116. Here and elsewhere in the document.

Resolution(s) to Topic 9.6

- The chamber background measurements shall be conducted according to the laboratory’s quality management system (QMS). Section 5 of *SM2010* specifies QMS requirements in details. Therefore, we have made no changes in Section 3.8.5.2.
- As for the lower LOQ for TVOC, the *Standard Method* has been a health-based standard focusing on individual VOCs and the TVOC results are only used to assess whether the chamber concentrations reach steady-state at different time points during the test. We think the low LOQ of “25 µg/m³ or better” is sufficient for this purpose. Therefore, this value is retained in *SM2010*.

9.7 Replicate chamber test frequency requirement

Comments

- *Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS)*. Section 3.8.5 Replicate chamber test: We recommend changing to “*The fraction of replicates is determined by the laboratory’s quality management system, but at least one replicate is required for every ~~ten~~ twenty tests*”. Rational: Very frequent. Use a lot of time and materials. Recommend changing to every twenty tests.
- *Mr. Al Hodgson and Mr. Raja Tannous - Berkeley Analytical*. Section 3.8.5 Replicate chamber test: We suggested conducting one replicate for every twenty tests instead of ten. Very frequent replicate test is time consuming and increases emission test cost.

Resolution(s) to Topic 9.7

Typically 5–10% replicate tests are required for quality assurance and quality control purpose. One replicate every twenty tests is still within this range. Therefore, we have

adopted the recommendation. Please see Section 3.8.5.5 of *SM2010*.

9.8 *Air sampling schedule*

Comments

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*. Air sampling schedule, see 3.8.6.1: 24 h and 48 h tests are not connected to any limit values and evaluation criteria, so why not dropping those and saving a lot of money when testing.

Resolution(s) to Topic 9.8

The measurements at 24 and 48 hours, when compared to the corresponding 96-h measurements, are used to determine whether the chamber concentrations remained relatively constant or declined slowly throughout the test. It provides additional quality check for the test. The use of three points allows the data for TVOC and formaldehyde to be plotted and modeled using power law or exponential equations. Therefore, we retain the 24 and 48h sampling requirements in *SM2010*.

9.9 *Test method harmonization with European practice and standards*

Comments

- *Mr. Reinhard Oppl - Eurofins Product Testing A/S*
 - ✓ VOC Testing method, see 3.8.6.2.1: Allowing free selection of different samplers will inevitably lead to different test results between labs on same material, due to different adsorption and desorption capacity of different samplers, and different discrimination of certain substances, depending on which sampler you selected. We strongly recommend limiting selection of samplers for VOC to only Tenax TA and nothing else, as in Europe.
 - ✓ Sample collection procedures, see 2.1.3-2.2: Representative selection of samples for testing is an important issue. Please compare your text with European practices for inspiration, best summarized in http://www.rts.fi/M1/Testing_protocol_version_15122004.pdf and in document CENT TC 351 WG2 N0124, chapters 5+6.
 - ✓ Procedures for making test specimens, see 3.1-3.6: Appropriate and repeatable selection of samples for testing is an important issue. Please compare with European practice for inspiration, best summarized in http://www.rts.fi/M1/Testing_protocol_version_15122004.pdf and in document N0124, chapter 5+6
 - ✓ Substrate for paints and adhesives, see 3.2.1, 3.3.1: In Europe we accept only inert substrates (glass, metal) because gypsum, wood etc. may have unpredictable own VOC emissions (and a substrate emissions test is quite expensive), plus you will not find reproducible porosity and adsorptive properties. Porous non-inert substrates will insert a huge source of variability of test results, depending on substrate used today

- and substrate used tomorrow, even if nominally the substrates should be the same and carry the same name.
- ✓ Channel for Caulking product test specimen, see 3.4: Please compare with European practices for inspiration, best summarized 6.2.5 and 6.2.6 in M1 test method, http://www.rts.fi/M1/Testing_protocol_version_15122004.pdf
 - ✓ Specimen preparation for solid products, see 3.5.5 - 3.5.11: Please consider allowing another option - the Japanese seal box as defined in JIS A 1901, the best technique available today for isolating back and edges from emission test chamber air.
 - ✓ Duplicate Air samples from test chamber exhaust, see 3.8.6.5: Duplicate air sampling and analysis is very necessary for reliable results. Always something can go wrong during sampling, and you can only detect such errors when you sample twice - if an error occurs with one sampler, then you will see large discrepancy between results from both samplers, and then you can search for the problem and its origin. Please see European solution in doc. CENT TC 351 WG2 N0124, clause 8.1, and please consider requiring duplicate sampling all the times.
 - ✓ VOC analysis procedures, see 3.9.2.1, 3.9.6.1, 3.9.6.2: 1) In Europe we made the experience that details of VOC analysis procedures must be specified in much more detail for achieving comparable results of different labs on same material. By doing so we could reduce the overall variation in round-robin tests with similar samples to almost the than before. We strongly recommend doing something similar also here. See e.g. doc. N0124 clause 8.2 - and we even are about to consider still more strict specification of analytical details. For more details on quality issues, please see below links: <http://product-testing.eurofins.com/testing/safety---chemicalelectricalfire/chemical-safety/emission-into-indoor-air/quality-issues---emission-testing.aspx>, <http://product-testing.eurofins.com/media/17627/Quality%20of%20Emission%20Testing%20-%20en.pdf>, <http://product-testing.eurofins.com/media/18285/reliability%20of%20voc%20emission%20chamber%20testing%20-%20oppl%202008.pdf>; 2) On the other hand, the calibration must not need to be as worksome as described in 3.9.6.1, we have a well-working more pragmatic approach in doc. CENT TC 351 WG2 N0124 clause 8.2.6; 3) Quantification of unidentified VOCs (described in 3.9.6.2) should occur in the same way everywhere, no degrees of freedom should be left to laboratories by no longer saying "using appropriate surrogates" - else this freedom will lead to decreased reliability of quantification. International practice would be to apply the toluene equivalent to all unidentified VOCs. In Germany we saw data showing that major VOC emissions are treated pretty good with this approach, namely all hydrocarbons (aliphatic, aromatic and terpene-like HC), but also quite some of the more polar VOCs.
- Mr. Steve Pfeiffenberger - Armstrong World Industries. SM/2009 should be harmonized to be consistent with global air emissions standards in order for products to be sourced globally. For example, section 2.1.6.2 should be harmonized with other existing/draft international standards such as the Finnish M1 or CEN 351. Both of these standards allow for 28 days for determining a final EF. CEN 351 also requires that the maximum

time between the date of sampling and the beginning of a test in the laboratory (including storage at manufacturer, transport, and storage at testing laboratory) shall not exceed eight weeks, provided that the laboratory sample is stored in the specified packaging. Such requirements should be considered and incorporated into SM/2009.

Resolution(s) to Topic 9.9

We agree that it will be beneficial if various emission testing and evaluation standards/methods can be harmonized. On the other hand, we believe that harmonization has not been fully accomplished even within Europe. As this would be a longer term effort, we defer these topics to next update process.

9.10 *Regarding how to deal with future change of CREL*

Comments

- Mr. Josh Jacobs - Greenguard Environmental Institute (GEI). Section 4.1 - Please outline process to follow when new chemicals are added or deleted or levels changed in the official CREL listing.
- Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS). Sections 4.1 - How are changes to the VOCs in the lists handled and implemented? This applies to the addition or removal of compounds from the lists and/or changes in the target limits. We are interested in avoiding the confusion that occurred when the formaldehyde and acetaldehyde CRELs were changed. Please provide guidance.

Resolution(s) to Topic 9.10

It is our intention to maintain the *Standard Method* on a continuous basis. When OEHHA makes changes in the CRELs list in future, we plan to address the issue accordingly by issuing an addendum or during the following document maintenance/update cycle. Rather than merely adopting each new *risk assessment* value directly, part of CDPH responsibility is to ascertain the *risk management* issues, such as for formaldehyde and acetaldehyde. Therefore, we have added the following texts in Section 4.1.2 of *SM2010*: “*It should be noted that changes in the CREL list by OEHHA or in other references do not automatically imply that the Standard Method should reflect these changes. The maximum allowable concentrations in Table 4.1 shall continue to apply until these changes are published in the Standard Method.*”

9.11 *VVOCs in list of target VOCs in Table 4.1*

Comments

- Ms. Stephany I. Mason - Air Quality Sciences, Inc. (AQS). Compounds #21 to #24 listed in Table 4.1 (Isopropanol, Methanol, Methyl chloroform, Methylene chloride) are all VVOCs, which elute before C5. The lab needs to verify the ability to meet the measurement requirements for these compounds.

Resolution(s) to Topic 9.11

Section 3.8.6.2.1 of *SM2009* specifies that *the samplers shall be capable of quantitatively collecting VOCs with a broad range of functional groups and volatilities approximately within the volatility range of n-pentane through n-heptadecane*. We have checked with experts in CDPH laboratories as well as at a commercial testing lab. Their consensus was that, with the exception of methanol, these compounds (isopropanol, methyl chloroform, methylene chloride) can be well captured and quantified by the chemical analysis procedure described in Section 3.9. Therefore, methanol has been deleted from Table 4.1, while the other three compounds are retained. To be consistent with Section 3.8.6.2.1, we have added the word “*approximately*” in Section 4.1.3 of *SM2010*. Please see Table 4.1 and Section 4.1.3 of *SM2010*.

9.12 Parameters used in the current standard classroom and office model scenario

Comments

- *Mr. Tom Phillips and Ms. Peggy Jenkins – CARB*. Table 4.2. Revision of exposure model parameters for the standardized school classroom and the typical office environments, including reference to ASHRAE Standard 62.1-2007 for the outdoor ventilation flow rates. Effective outdoor air change rate of 0.82 ach, Footnote 2:
 - ✓ We recommend considering actual field data such as that from the California Portable Classroom Study (Whitmore et al., 2003), i.e., the 10%ile value for the maximum outdoor air flow rate in portables, 0.47 cfm/ft². The maximum outdoor air flow rates averaged 0.95 cfm/ft² for portables and 0.80 cfm/ft² for traditional. However, 10% of the portables had blocked outdoor air intakes, and the systems were often turned off or cycling.
 - ✓ If you decide to use design ventilation rates rather than actual measured rates, we would recommend verifying that the ventilation rates required in California (2008 Title 24) are not significantly different than those in ASHRAE 62.2-2007. If they are, we recommend using the Title 24 rates because the Standard practice is aimed primarily at California applications. This comment also applies to Table 7.1 for the office building setting.
- *Mr. Josh Jacobs - Greenguard Environmental Institute (GEI)*. Table 4.2, 4.3, 4.4 & 4.5 – Recognizing that we may not have the time to adequately do this for version 1.1 we would like to see a review of newer data to come up with more relevant models for current classrooms and offices. Again, GREENGUARD Environmental Institute would like to supply some of their data from Lord Aeck & Sargent to help in this process.
- *Mr. Steve Pfeiffenberger - Armstrong World Industries*. Table 4.1 for school classroom scenario: The document should include a recommendation for all buildings including schools to adhere to ASHRAE standards for ventilation rates all through the day for total IAQ. Facilities Management should be responsible for ensuring that the HVAC system is operating correctly so that poor IAQ is addressed at the root.

Resolution(s) to Topic 9.12

- We have verified that the ventilation rates required in California (2008 Title 24) are

either higher (for office scenario) or not significantly different (for school classroom scenario) than those in ASHRAE 62.1-2007. To be conservative in terms of public health, the use of design ventilation rate per ASHRAE 62.1-2007 requirement is retained in *SM2010*.

- We welcome any additional inputs that may further improve the school classroom and office modeling scenarios. They will be reviewed and considered during next update process.
- *Standard Method* is an emission test and evaluation standard. While useful and important, recommendations regarding building IAQ practices are beyond the scope of *SM2010*.

9.13 *Regarding whether to allow adjusting material areas or quantities based on room coverage under specific conditions*

Comments

- *Mr. Steve Pfeifferberger - Armstrong World Industries.* We recommend including a statement in the lab report (Section 6) that it is acceptable to adjust the loading factor based on the room coverage. For example, if an interior finish will only cover a portion of the room, then the emission factor can be proportionally adjusted to account for partial coverage. If this adjustment occurs, it must be clearly stated in the test report.

Resolution(s) to Topic 9.13

Although discouraged, we recognize that a certification/verification organization may have the need and sufficient evidence to justify the use of partial coverage. Therefore, we have made the following statements in Sections 8.4.2 and 8.4.3 of *SM2010*. : “8.4.2 *Certification/verification organizations may adjust the material areas or quantities of a product in concentration modeling to account for partial coverage or unique conditions provided that the adjustment is consistent with the product usage commonly employed in building design and construction practices. Such deviations shall be stated in reports and public claims of compliance, e.g., on certificates of compliance; 8.4.3 In order for a certification/verification organization to make a claim of essential compliance with the method, modifications shall be documented, including detailed evidence of the basis. This documentation shall be made available to program participants, the public and any other interested parties.*”

Addendum

Table A Records of Comments Received on *SM2009 Draft Version 1.1* (dated 10/19/2009)

#	Received From	Organization	Notes
1	Al Hodgson	Berkeley Analytical	Formal comments on <i>SM2009 (V1.1)</i>
2	Bruce Ray	Johns Manville (JM)	Comments on <i>SM2009 (V1.1)</i> & public meeting observation
3	Denise Van Valkenburg	MASCO RetailCabinetGroup	Formal comments on <i>SM2009 (V1.1)</i>
4	Frank Hurd	Carpet and Rug Institute (CRI)	Formal Comments on <i>SM2009 (V1.1)</i>
5	Hal Levin	Building Ecology Research Group	Public meeting observation
6	Josh Jacobs	Greenguard Environmental Institute (GEI)	Formal comments on <i>SM2009 (V1.1)</i>
7	Larry Dykhuis	Herman Miller	Formal comments on <i>SM2009 (V1.1)</i>
8	Phil Gattis	Community Playthings	Formal comments on <i>SM2009 (V1.1)</i>
9	Randal Carter	Steelcase Inc.	Formal comments on <i>SM2009 (V1.1)</i>
10	Reinhard OPPL	Eurofins Product Testing A/S	Formal comments on <i>SM2009 (V1.1)</i>
11	Stephany I. Mason	Air Quality Sciences, Inc. (AQS)	Formal comments on <i>SM2009 (V1.1)</i>
12	Steve Pfeiffenberger	Armstrong World Industries	Formal comments on <i>SM2009 (V1.1)</i>
13	Steven Trinkel	Kimball International	Formal comments on <i>SM2009 (V1.1)</i>
14	Stowe Hartridge-Beam	Scientific Certification Systems (SCS)	Formal comments on <i>SM2009 (V1.1)</i>
15	Tom Lent	Healthy Building Network	Public meeting observation
16	Tom Phillips	CARB	Formal comments on <i>SM2009 (V1.1)</i>
17	William Freeman	Resilient Floor Covering Institute (RFCI)	Formal comments on <i>SM2009 (V1.1)</i>