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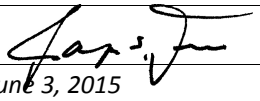
VOC Emissions from Building Products

Customer & Building Product Sample Information

Report Certification	
Report number	740-001-01A-Jun0315
Report date	Jun 3, 2015
Certified by (Name/Title)	Raja S. Tannous, Laboratory Director
Signature	
Date	*June 3, 2015*

Standards	
Test method	CDPH/EHLB/Standard Method V1.1 (Sect. 01350)
Acceptance criteria	CDPH/EHLB/Standard Method V1.1
Modeling scenario(s)	CDPH/EHLB/Standard Method V1.1 Standard Classroom & Office
Product type	Wallcoverings

Customer Information	
Manufacturer or organization	Spectrim Building Products, LLC
City/State/Country	Bensalem, PA USA
Contact name/Title	Mike Andersen, General Manager
Phone number	1-800-437-0557

Product Sample Information*	
Manufacturer (if not customer)	Spectrim Building Products
Product name / Number	Ven4ma
Product CSI category	Wall Coverings (09 72 00)
Customer sample ID	Wall Protection - PVC
Manufacturing location	SpecTrim, Bensalem, PA
Date sample manufactured	May 8, 2015
Date sample collected	May 8, 2015
Date sample shipped	May 8, 2015
Date sample received by lab	May 12, 2015
Condition of received sample	No observed problems
Lab sample tracking number	**740-001-01A**
Conditioning start date & duration	May 15, 2015; 10 days
Chamber test start date & duration	May 25, 2015; 4 days (96 hours)
Total test start date & duration	May 15, 2015; 14 days (336 hours)

*Chain-of-custody (COC) form for product sample is attached to this report

Conformity Assessment – CDPH VOC Concentration Criteria

VOC Emission Test Results – The product sample was tested for emissions of VOCs following California Department of Public Health CDPH/EHLB/Standard Method Version 1.1, 2010. The chamber test results were modeled to one or more scenario(s) defined in Standard Method V1.1. The modeled indoor VOC concentrations then were compared to the acceptance criteria defined in Standard Method V1.1 to determine compliance of the product sample to the standard. The modeling scenario(s) are detailed in Table 3, and the predicted indoor VOC concentrations at 336 hours are given in Table 6 of this report. The allowable concentrations used as acceptance criteria are reproduced in Appendix B of this report. Table 1 summarizes the pass/fail results based on the predicted indoor air concentrations of individual VOCs of concern in the modeled scenario(s).

TVOC Concentration Range – The next versions of USGBC's LEED rating systems for buildings are anticipated to include a requirement for reporting of the predicted TVOC concentration in one of three range categories, i.e., ≤0.5 mg/m^3, >0.5 to 4.9mg/m^3, and ≥5.0 mg/m^3. Table 1 includes the TVOC concentration range in the modeled scenario(s).

Table 1. Pass/Fail results based on the test method and identified modeling scenarios. Only detected individual VOCs with defined acceptance criteria are listed. The TVOC concentration range also is shown

Chemical	CAS No	Allowable Concentration (µg/m^3)	Predicted Concentration (Pass/Fail)	
			Classroom	Office
No formaldehyde or other CREL VOCs were detected	--	--	**Pass**	**Pass**
TVOC[a]	--	--	≤ 0.5 mg/m^3	≤ 0.5 mg/m^3

[a] Reporting of TVOC range is for information only; TVOC is not a Pass/Fail criterion

Test Method for Building Product Samples

Test Specimen Preparation – Cut to size and taped over stainless steel plate covering back surface and all edges. The emission factor calculations are based on the top surface. Photographs of the tested specimen are shown later in this report. The test results presented herein are specific to this item.

Test Protocol Summary* – This VOC emission test was performed following California Department of Public Health CDPH/EHLB/Standard Method Version 1.1, 2010. This standard updates the earlier standard CA/DHS/EHLB/R-174, 2004. Note: these standards derive from California architectural Specification 01350 and frequently are referred to as "Section 01350." The chamber test prescribed in the standard follows the guidance of ASTM Standard Guide D 5116. Chemical sampling and analyses were performed following U.S. EPA Compendium Method TO-17 and ASTM Standard Method D 5197. The product specimen was prepared from the supplied product sample and was placed directly into the conditioning environment and maintained at controlled conditions of air flow rate, temperature and relative humidity for ten days. At the end of this period, the specimen was transferred directly to a small-scale chamber. The chamber conditions for the 96-h test period are summarized in Table 2. Air samples were collected from the chamber at 24 h, 48 h and 96 h elapsed time. Samples for the analysis of individual VOCs and TVOC were collected on multisorbent tubes containing Tenax-TA backed by a carbonaceous sorbent. Samples for the analysis of low molecular weight aldehydes were collected on treated DNPH cartridges. VOC samples were analyzed by thermal desorption GC/MS. TVOC was calculated using toluene as the calibration reference. Individual VOCs (iVOCs) were quantified using multi-point (4 or more points) with calibration curves prepared with pure standards, unless otherwise noted. iVOCs without pure standards were quantified based on their total-ion-current responses using toluene as the calibration reference. Formaldehyde and acetaldehyde were analyzed by HPLC and quantified using multi-point (4 or more points) calibration curves. The analytical instruments and their operating parameters are described in Appendix A.

Availability of Data – All data, including but not limited to raw instrument files, calibration files, and quality control checks used to generate the test results will be made available to the customer upon request.

Table 2. Chamber conditions for test period

Parameter	Symbol	Units	Value
Tested specimen exposed area	A_S	m^2	0.032
Chamber volume	V_C	m^3	0.067
Loading ratio	L	m^2/m^3	0.473
Avg. Inlet gas flow rate & Range	Q_C	m^3/h	0.067 (0.064-0.070)
Avg Temperature & Range		^oC	23.5 (22-24)
Avg Relative humidity & Range		%	48 (45-55)
Duration		h	96

*All standards identified in this section are included in Berkeley Analytical's scope of ISO/IEC17025 accreditation, Testing Laboratory TL-383, International Accreditation Service, www.iasonline.org

Modeling Parameters for Building Products

Modeling Parameters – CDPH/EHLB/Standard Method Version 1.1 describes the modeling procedures and parameters for estimating the impact of VOC emissions from a building product on indoor air concentrations in a standard classroom and a standard office space. The dimensions and ventilation of the spaces and the exposed surface areas of major materials are prescribed. The modeling scenario(s) and parameters applicable to this test are listed in Table 3.

Table 3. Parameters used for estimating VOC air concentrations at 336 hours for the modeling scenarios

Parameter	Symbol	Units	Value	
			Classroom	Office
Product exposed area	A_{P_B}	m^2	94.6	33.4
Building volume	V_B	m^3	231	30.6
Floor/Ceiling Area	A_B	m^2	89.2	11.15
Ceiling height	H_B	m	2.59	2.74
Outdoor air (OA) flow rate	Q_B	m^3/h	191	20.7
Area-specific air flow rate	q_A	m^3/m^2-h	2.02	0.62

VOC Emission Test Results

Chamber Background Concentrations – Background concentrations measured at time zero are reported in Table 4. The background concentrations of TVOC, formaldehyde, acetaldehyde, and reported iVOCs are listed.

Table 4. Chamber background VOC concentrations at time zero

Chemical/Chemical Group	CAS No	Chamber Conc (µg/m^3)
Acetaldehyde	75-07-0	LQ
Formaldehyde	50-00-0	LQ
Nonanal	124-19-6	2.3
TVOC	--	LQ

Emitted VOCs – Individual VOCs (iVOCs) detected in the test and present above the lower limits of quantitation in chamber air are reported in Table 5. All iVOCs with CRELs and/or on other lists of toxicants of concern are listed first. Next, all frequently occurring iVOCs with pure standard calibrations are listed. Additionally, the 10 most abundant iVOCs quantified using toluene as the reference standard are listed; identifications of these compounds are considered tentative. Reporting of fewer than 10 iVOCs indicates that fewer than 10 chemicals met these criteria.

Table 5. Listed and abundant iVOCs detected above lower limits of quantitation in 96-h air sample

Chemical	CAS No	Surrogate?*	CREL (µg/m^3)	CARB TAC Category	Prop 65 List?
2-Butanone (methyl ethyl ketone)	78-93-3			T-IIa	
4-Methyl-2-pentanone (MIBK,Hexone)	108-10-1			T-IVa	Yes
Ethyl acetate	141-78-6				
n-Butyl acetate	123-86-4				

*"Yes" response indicates iVOC quantified using toluene as the calibration reference; all other iVOCs quantified using pure standards

VOC Emission Test Results, Continued

VOC Emission Factors and Estimated Indoor Air Concentrations – The 96-h chamber sample was analyzed for iVOCs including formaldehyde and acetaldehyde. The emission factors for iVOCs presented in Table 6 were calculated from the chamber parameters, the exposed area of the test specimen and the measured 96-h chamber concentrations corrected for any chamber background concentrations. The emission factors were used to predict the indoor air concentrations of iVOCs for the modeling scenario(s) applicable to this test as shown in Table 3. See Equations for calculation methods.

Table 6. Measured chamber concentrations at 96 h, calculated emission factors, and estimated indoor air concentrations of individual VOCs for the modeling scenarios

Chemical	Chamber Concentration ($\mu g/m^3$)	Emission Factor ($\mu g/m^2$-h)	Estimated Indoor Air Concentration ($\mu g/m^3$)	
			Classroom	Office
2-Butanone (methyl ethyl ketone)	19.2	40.8	20.2	65.9
Ethyl acetate	8.4	17.9	8.9	28.9
4-Methyl-2-pentanone (MIBK,Hexone)	46.8	99.3	49.2	160.6
n-Butyl acetate	53.3	113.0	56.0	182.7

VOC Emission Test Results, Continued

Quality Measurements – Chamber samples collected at 24, 48 and 96 hours were analyzed for total VOCs (TVOC). Because the TVOC response per unit mass of a chemical is highly dependent upon the specific mixture of iVOCs, the measurement of TVOC is semi-quantitative. TVOC primarily is used as a quality measure to determine if the VOC emissions from a product are relatively constant or generally declining over the test period. Some programs may require the reporting of predicted indoor air TVOC concentrations or concentration ranges in mg/m^3. TVOC emission factors and predicted TVOC concentrations are shown in Table 7. Aldehyde samples collected at 24, 48 and 96 hours were analyzed for formaldehyde as another quality measure. Formaldehyde emission factors are shown in Table 8. Product claims related to formaldehyde content may be based, in part, on formaldehyde emission factors.

Table 7. TVOC chamber concentrations at 24, 48, and 96 h with corresponding emission factors and predicted indoor air concentrations (mg/m^3)

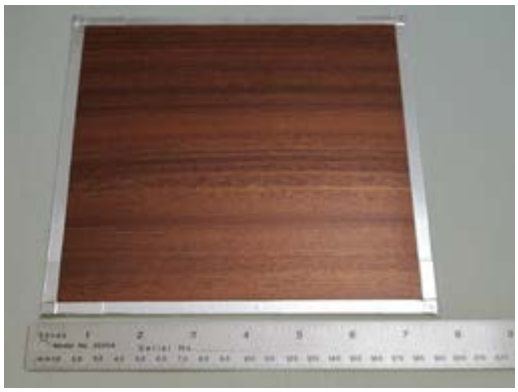
Elapsed Time (h)	Chamber Concentration ($\mu g/m^3$)	Emission Factor ($\mu g/m^2$-h)	Estimated Indoor Air Concentration (mg/m^3)	
			Classroom	Office
24	125	264	0.131	0.427
48	120	255	0.126	0.413
96	92	195	0.096	0.315

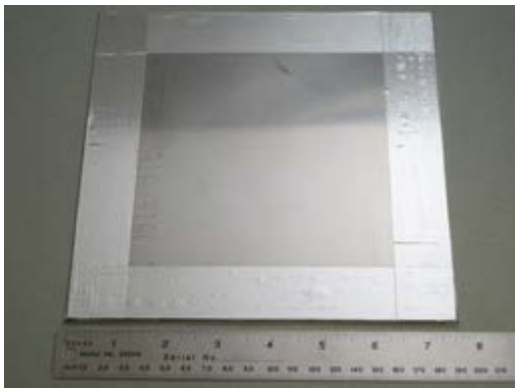
Table 8. Formaldehyde chamber concentrations at 24, 48, and 96 h with corresponding emission factors

Elapsed Time (h)	Chamber Concentration ($\mu g/m^3$)	Emission Factor ($\mu g/m^2$-h)
24	LQ	LQ
48	LQ	LQ
96	LQ	LQ

Photographs of Tested Product Specimen

Photo Documentation – The product sample specimen is photographed immediately following specimen preparation and prior to initiating the conditioning period. Typically, the top and bottom faces of the specimen are photographed. Bottom faces may show a stainless steel plate or other substrate if prescribed by the standard.





Definitions, Equations, and Comments

Table 9. Definitions of parameters

Parameter/Value	Definition
CARB TAC	Toxic Air Contaminant (TAC) on California Air Resources Board list, with toxic category indicated
CAS No.	Chemical Abstract Service registry number providing unique chemical ID
Chamber Conc.	Measured chamber VOC concentration at time point minus any analytical blank or background concentration for empty chamber measured prior to test. Lower limit of quantitation (LQ) or reporting limit for individual VOCs is 2 µg/m^3 unless otherwise noted
Indoor Air Conc.	Estimated indoor air concentration in standard modeled environment calculated from the emission factors from test results and the modeling parameters in Table 3 using the equations given below
CREL	Chronic non-cancer Reference Exposure Level established by Cal/EPA OEHHA (http://www.OEHHA.ca.gov/air/allrels.html)
Emission Factor	Mass of compound emitted per unit area per hour (calculation shown below). Reporting limits for emission factors are established by LQ or reporting limit for chamber concentration and specimen area tested
Formaldehyde & acetaldehyde	Volatile aldehydes quantified by HPLC following ASTM Standard Method D 5197. LQs for formaldehyde and acetaldehyde are 1.5 µg/m^3 and 0.8 µg/m^3, respectively
Individual VOCs	Quantified by thermal desorption GC/MS following EPA Method TO-17. Compounds quantified using multi-point calibrations prepared with pure chemicals unless otherwise indicated. VOCs with chronic RELs are listed first, followed by other TAC and Prop. 65 compounds. Additional abundant VOCs at or above reporting limit of 2 µg/m^3 are listed last
LQ	Indicates calculated value is below its lower limit of quantitation
Prop 65 list	"Yes" indicates the compound is a chemical known to cause cancer or reproductive toxicity according to California Safe Drinking Water Toxic Enforcement Act of 1986 (Proposition 65)
TVOC	Total Volatile Organic Compounds eluting over retention time range bounded by n-pentane and n-heptadecane and quantified by GC/MS TIC method using toluene as calibration reference. LQ for TVOC is 20 µg/m^3
"na"	Not applicable
"<"	Less than value established by LQ

Equations Used in Calculations – An emission factor (EF) in µg/m^2-h for a chemical in a chamber test of a building product sample is calculated using Equation 1:

$$EF = (Q_c (C - C_o)) / A_S \qquad (1)$$

where Q_c is the chamber inlet air flow rate (m^3/h), C is the VOC chamber concentration (µg/m^3), C_o is the corresponding chamber background VOC concentration (µg/m^3), and A_S is the tested specimen exposed area (m^2).

Definitions, Equations, and Comments, Continued

The indoor air concentration (C_B) for the modeled space in µg/m^3 is estimated using Equation 2 and the parameters defined in Table 3:

$$C_B = (EF \times A_{P_B}) / Q_B \qquad (2)$$

where A_{P_B} is the exposed area of the product in the building (m^2) and Q_B is the outside air flow rate (m^3/h).

Comments: None

END OF REPORT

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Appendix A
Analytical Instruments & Operating Parameters

Table A1. Description of analytical instrument components

Component	Description
HPLC	1260 Infinity Quaternary LC, G1314F VW Detector, Agilent
Analytical column	Poroshell 120 EC-C18, Agilent
Column dimensions	2.1 mm x 100 mm
Thermal desorber	Unity / UltrA TD, Markes International, Ltd.
Gas chromatograph	Model 7890A, Agilent
Analytical column	DB-624, J&W Scientific
Column dimensions	1 µm film, 0.18 mm ID, 20 m
Mass spectrometer	Model 5975C MSD, Agilent

Table A2. HPLC operating parameters for analysis of formaldehyde and acetaldehyde

Parameter	Value
Solvent A	65/35% H_2O/Acetonitrile
Solvent B	100% Acetonitrile
Flow rate	0.3 mL/min
End time	11 min
Detector wavelength	360 nm

Table A3. Thermal desorption GC/MS parameters used for analysis of iVOCs and TVOC

Parameter	Value
Thermal desorption	
Tube desorb temperature	285 °C
Trap temperature	-5 °C
Trap desorb temperature	300 °C
Trap desorb split ratio	10:1
Gas chromatograph	
Initial temperature	40 °C
Initial temperature time	6.0 min
Final temperature	225 °C
Final temperature time	3 min
Mass spectrometer	
Low scan mass, *m/z*	30 amu
High scan mass, *m/z*	450 amu
Scan rate	0.5 Hz

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Appendix B
Target CREL VOCs and Their Maximum Allowable Concentrations
Copied from CDPH/EHLB/Standard Method Version 1.1, 2010, Table 4-1

No.	Compound Name	CAS No.	Allowable Conc. (µg/m^3)
1	Acetaldehyde	75-07-0	70
2	Benzene	71-43-2	30
3	Carbon disulfide	75-15-0	400
4	Carbon tetrachloride	56-23-5	20
5	Chlorobenzene	108-90-7	500
6	Chloroform	67-66-3	150
7	Dichlorobenzene (1,4-)	106-46-7	400
8	Dichloroethylene (1,1)	75-35-4	35
9	Dimethylformamide (N,N-)	68-12-2	40
10	Dioxane (1,4-)	123-91-1	1,500
11	Epichlorohydrin	106-89-8	1.5
12	Ethylbenzene	100-41-4	1,000
13	Ethylene glycol	107-21-1	200
14	Ethylene glycol monoethyl ether	110-80-5	35
15	Ethylene glycol monoethyl ether acetate	111-15-9	150
16	Ethylene glycol monomethyl ether	109-86-4	30
17	Ethylene glycol monomethyl ether acetate	110-49-6	45
18	Formaldehyde	50-00-0	9*
19	Hexane (n-)	110-54-3	3,500
20	Isophorone	78-59-1	1,000
21	Isopropanol	67-63-0	3,500
22	Methyl chloroform	71-55-6	500
23	Methylene chloride	75-09-2	200
24	Methyl t-butyl ether	1634-04-4	4,000
25	Naphthalene	91-20-3	4.5
26	Phenol	108-95-2	100
27	Propylene glycol monomethyl ether	107-98-2	3,500
28	Styrene	100-42-5	450
29	Tetrachloroethylene	127-18-4	17.5
30	Toluene	108-88-3	150
31	Trichloroethylene	79-01-6	300
32	Vinyl acetate	108-05-4	100
33-35	Xylenes, technical mixture (m-, o-, and p- xylene combined)	108-38-3, 95-47-6, 106-42-3	350

*All maximum allowable concentrations are one half the corresponding CREL adopted by Cal/EPA OEHHA with the exception of formaldehyde for which the full CREL of 9 µg/m^3 is allowed.

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Chain of Custody for Building Product/ Material VOC Emission Test

A Separate COC must be completed for EACH product/material sample

A link to Berkeley Analytical's Terms & Conditions is included in this workbook. By submitting samples, customer acknowledges and accepts these terms & conditions unless a prior written contract is in effect.

Berkeley Analytical Quotation Number:

Purchase Order (enter company & number):

Customer Information*

Company: Spectrim Building Products, LLC
Street Address: 3433 Marshall Lane
City/State/Zip(postal code): Bensalem, PA 19020
Country: USA
Contact Name & Title (for reporting): Mike Andersen - General Manager
Contact Phone/Fax Numbers:1- 800-437-0557/1-215-245-8704
Contact E-mail Address: mikea@spectrimbp.com
Financially Responsible Co. (if different):

Manufacturer Information (if different from customer)

Company:
City/State/Country:
Contact Name/Title:
Phone Number/E-mail Address:

Sample Details

Product Commercial Name*: Ven4ma
Product Commercial Part No.(if not part of the name)*:
Manufacturer Sample Tracking ID:
Date Manufactured*: May 8th 2015
Product Category & Use*: Wall Protection
Sample Construction Material*: PVC
Plant Name & Location*: SpecTrim, Bensalem, PA 19020 USA
Collection Location within Plant: SpecTrim, Bensalem, PA 19020 USA
Date & Time Collected* : 10:47 AM
Number of Sample Pieces*: 5 | Photo(s) of Collection Location: Attach
Sample Collected by*: Mike Andersen
Phone/Fax Numbers*: 1-800-437-0557/1-215-245-8704
E-mail Address*: mikea@spectrimbp.com

Shipping Details*

Packed & Shipped By: SpecTrim Building Products
Shipping Date: 5-8-15
Carrier/Airbill Number: Fed-Ex # 7735-6073-3597

Requested Test (automatically filled from BldgProdWorksheet Selections)

Test to be performed	CDPH Std. Method V1.1
Modeling scenario	Office & Classroom
Test schedule (screening tests only)	
Target chemicals and chemical groups (screening)	
CARB ATCM test, schedule	
Test results application(s)	LEED, CHPS,

For Berkeley Analytical Use:

Report ID	RPT66
Billing Reference	

Customer Instructions for Sample Prep., Test Type, schedule, etc. (filled from BldProdWorksheet)

Customer Request for Laboratory Certificate of Compliance

Indicate if you are ordering a Laboratory Certificate of Compliance:

Laboratory certificates are available for the compliance test(s) listed on the BldgProdWorksheet. Berkeley Analytical's laboratory test results and associated certificates are specific to the tested item. Claims made by the customer regarding the broader representativeness of the test results and certificate are the sole responsibility of the customer.

Customer Authorizes Laboratory to Submit Copies of Test Report to:

Contact/E-mail Address:
Organization:
Contact/E-mail Address:
Organization:

For Berkeley Analytical Use Only

Condition of Shipping Package: OK
Condition of Sample: OK
Lab Tracking Number: 740-001-01A

Sample Handling

Relinquished By*	Received By*	Signature*	Date*	Company*
	F. MASRI	F Masri	5/12/15	BKA