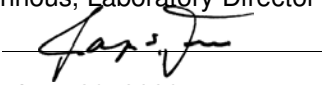


BERKELEY ANALYTICAL ASSOCIATES, LLC

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Richmond, CA 94804
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PRODUCT VOC EMISSION TEST RESULTS

Report Certification

Report Number & Date: 135-025-02AA-Jun2309 6/23/2009
Recalculation Job:
Original Specimen ID (if recalc job):
Protocol or test method/criteria: Standard Practice CA/DHS/EHLB/R-174, 2004
Certified By: Raja S. Tannous, Laboratory Director
Signature 
Date June 23, 2009

Customer Information

Customer: Forbo Flooring
City/State/Country: Hazelton, PA USA
Contact name/Title: Tim Cole, Director of Support Services
Contact Address: 2 Maplewood Dr., Hazelton PA 18202
Phone number: 570-450-0238

Manufacturer Information

Manufacturing company: Forbo Flooring
Product name: Coral Brush Active+Forbo V-920 Adhesive
Product sample ID: Production 72011409+Production SCA9E102
Product category: Carpet (9680)
Product subcategory: Entry System - Vinyl Backed Tufted Textile
Manufacturer ID: Color - C59022+V-920
Date manufactured: 5/19/2009
Date collected: 5/20/2009
Date shipped: 5/27/2009

Sample/Specimen Information

Date received: 5/28/2009
Specimen ID (Lab tracking No.): **135-025-02AA**
Specimen preparation: prepared an assembly specimen from the adhesive and flooring material using a stainless steel plate (see comments on last page for details)
Conditioning period start & duration: 5/29/2009, 10 days
Test period start & duration: 6/8/2009, 96 hours

Protocol -- Emission tests are performed following California Dept. of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," CA/DHS/EHLRB/R-174, 07/15/04 (http://www.cal-iaq.org/VOC/Section01350_7_15_2004_FINAL_PLUS_ADDENDUM-2004-01.pdf). This practice is based on ASTM D 5116, "Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products" and incorporates the chamber testing portion of California Specification 01350 (<http://www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350/>). Project-specific results are calculated as described in Specification 01350.

Table 1. Chamber Conditions for Test Period *

Parameter	Symbol	Units	Value
Product exposed area	A_c	m^2	0.0316
Chamber volume	V_c	m^3	0.067
Loading ratio	L_c	$m^2 m^{-3}$	0.47
Inlet air flow rate	Q	$m^3 h^{-1}$	0.067
Ventilation rate	a_c	h^{-1}	1.00
Temperature		$^{\circ}C$	23.1
Relative humidity		%	49.1

* Specified ranges: 22°C to 24°C, RH 45% to 55%, and Q 0.064 to 0.070 (small chamber) or 5.81 to 6.42 (mid-size chamber)

Table 2. Parameters used to calculate building VOC concentrations

Bldg. Component/ Material	Floor - Floor Covering (any)		
Parameter	Symbol	Units	Building Type*
<u>Standard Classroom</u>			
Product exposed area	A_B	m^2	89.2
Building volume	V_B	m^3	231.1
Ceiling height		m	2.59
Loading ratio	L_B	$m^2 m^{-3}$	0.386
Ventilation rate	a_B	h^{-1}	0.90
Ventilation vol. fraction	V_{fB}		0.90
Vent. flow rate per area		$(m^3 h^{-1}) / m^2$	2.10
<u>Standard Office Space</u>			
Product exposed area	A_B	m^2	11.1
Building volume	V_B	m^3	30.6
Ceiling height		m	2.74
Loading ratio	L_B	$m^2 m^{-3}$	0.365
Ventilation rate	a_B	h^{-1}	0.75
Ventilation vol. fraction	V_{fB}		0.90
Vent. flow rate per area		$(m^3 h^{-1}) / m^2$	1.85

* Standard building types are: (1) School classroom defined in Table 7.4, CA/DHS/EHLB/R-174, 07/15/04; (2) Office space (individual) defined in Table 7.5, CA/DHS/EHLB/R-174, 07/15/04; and (3) Large office building with volume ceiling height from East End Project, Products Passed Section 01350, Calif. Integrated Waste Management Board. For floor products ceiling panels, 100% coverage is assumed. For wall paint and wallcoverings, exposed area is wall paint area for the building (<http://www.ciwmb.ca.gov/GreenBuilding/Specs/EastEnd/>).

Table 3. Pass/fail results of emission test for identified VOCs with chronic RELs
 (Only VOCs detected above quantitation limits are reported)

Substance	CAS No.	$\frac{1}{2}$ REL $\mu\text{g m}^{-3}$	Building Type
No formaldehyde or other CREL VOCs were detected*			None
			Standard Classroom and/or Office Space
			PASS

* CREL compound concentrations were below the lower limit of quantitation (LOQ). For formaldehyde and acetaldehyde the LOQ is 1 μg per cubic meter and for all other CREL compounds, the LOQ is 2 μg per cubic meter.

Table 4. List of emitted VOCs* (Only VOCs detected above quantitation limits are reported. Individual VOCs with chronic RELs and/or on other lists of toxicants are shown first, followed by unlisted abundant compounds)

Substance	CAS No.	Surrogate?	Chronic REL* µg m ⁻³	CARB TAC Category	Prop 65 List?
Caprolactam	105-60-2			T-V	
2-Ethyl-1-hexanol	104-76-7				
N,N-Dimethylethanolamine	108-01-0	Yes			
2-Ethylhexyl acetate	103-09-3	Yes			
2-Propenoic acid, 6-methylheptyl ester	54774-91-3	Yes			
4-tert-Butylcyclohexanol	98-52-2	Yes			

* For formaldehyde an interim Indoor REL (IREL) of 33 (µg per cubic meter), developed by Calif. Office of Environmental Health Hazard Assessment (Refer to CA/DHS/EHLB/R-174, 07/15/04), is used to set the pass/fail criterion as shown in Table 3.

Table 5. Emission Test Results for Individual VOCs*

Substance	96-h Chamber Concentration $\mu\text{g m}^{-3}$	Emission Factor $\mu\text{g m}^{-2} \text{ h}^{-1}$	Building Concentration $\mu\text{g m}^{-3}$
			<u>Standard Classroom</u>
N,N-Dimethylethanolamine	45.7	97.2	46.3
2-Ethyl-1-hexanol	385.8	820.2	390.9
2-Ethylhexyl acetate	46.8	99.6	47.4
2-Propenoic acid, 6-methylheptyl ester	6.7	14.3	6.8
4-tert-Butylcyclohexanol	5.0	10.6	5.0
Caprolactam	7.7	16.4	7.8

Substance	96-h Chamber Concentration $\mu\text{g m}^{-3}$	Emission Factor $\mu\text{g m}^{-2} \text{ h}^{-1}$	Building Concentration $\mu\text{g m}^{-3}$
			<u>Standard Office Space</u>
N,N-Dimethylethanolamine	45.7	97.2	52.5
2-Ethyl-1-hexanol	385.8	820.2	443.0
2-Ethylhexyl acetate	46.8	99.6	53.8
2-Propenoic acid, 6-methylheptyl ester	6.7	14.3	7.7
4-tert-Butylcyclohexanol	5.0	10.6	5.7
Caprolactam	7.7	16.4	8.8

* Parameters and reported values are defined and explained in Table 9

Table 6. TVOC Chamber & Building Concentrations for Different Test Periods

Test Duration	Chamber Conc. $\mu\text{g m}^{-3}$	Emission Factor $\mu\text{g m}^{-2} \text{ h}^{-1}$	Building Conc. $\mu\text{g m}^{-3}$
<u>Standard Classroom</u>			
24-h	525	1115	531
48-h	591	1257	599
96-h	559	1188	566
<u>Standard Office Space</u>			
24-h	525	1115	602
48-h	591	1257	679
96-h	559	1188	642

Table 7. Formaldehyde Chamber & Building Concentrations for Different Test Periods

Test Duration	Chamber Conc. $\mu\text{g m}^{-3}$	Emission Factor $\mu\text{g m}^{-2} \text{ h}^{-1}$	Building Conc. $\mu\text{g m}^{-3}$
<u>Standard Classroom</u>			
24-h	LQ	LQ	LQ
48-h	LQ	LQ	LQ
96-h	LQ	LQ	LQ
<u>Standard Office Space</u>			
24-h	LQ	LQ	LQ
48-h	LQ	LQ	LQ
96-h	LQ	LQ	LQ

Table 8. Photographs of Test Specimen

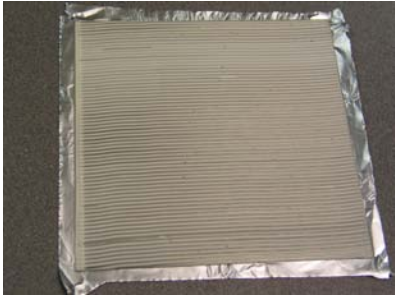


Table 9. Definition of Parameters and Notes to Tables

Parameter/Value	Definition
CAS No.	Chemical Abstract Service identification number
Surrogate?	“Yes” indicates compound was quantified by GC/MS total-ion-current (TIC) method using toluene as calibration reference
Chronic REL	Chronic Reference Exposure Level (REL) established by Calif. Office of Environmental Health Hazard Assessment, Feb. 2005 and adopted by Section 01350 as target IAQ limit for building; for formaldehyde, IAQ limit is interim Indoor REL of 33 $\mu\text{g m}^{-3}$. No product may contribute more than 1/2 IAQ limit for an REL compound, with the exception of acetaldehyde for which the full REL is allowed.
CARB TAC Cat.	Toxic Air Contaminant (TAC) on Calif. Air Resources Board list, Dec. 1999, with toxic category indicated
Prop 65 List?	“Yes” indicates compound is chemical known to cause cancer or reproductive toxicity listed by Calif. Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), Mar. 2005
96-h Chamber Conc.	Measured chamber VOC concentration at 96-h time point minus any analytical blank or blank concentration for empty chamber operated following same procedure. Lower limit of quantitation (LOQ) for individual VOCs on lists of toxicants is 2 $\mu\text{g m}^{-3}$, based on a 2 ng limit for a 1-liter sample. LOQ for TVOC is 20 $\mu\text{g m}^{-3}$. LOQ for formaldehyde and acetaldehyde is given below
Emission Factor	Mass of compound emitted per square meter of exposed surface per hour (calculations shown below). Reporting limits for emission factors are established by LOQ or reporting limit for chamber concentration and specimen’s exposed surface area
Classroom/Office/Office Bldg. Conc.	Concentrations for school classroom, small office (individual), large office building, or specific project building calculated using parameters given in Table 2 (calculations shown below)
TVOC	Total Volatile Organic Compounds quantified by GC/MS TIC method using toluene as calibration reference
Formaldehyde & acetaldehyde	Volatile aldehydes quantified by HPLC following ASTM Method D 5197-97. LOQ for formaldehyde and acetaldehyde are 1.2 $\mu\text{g m}^{-3}$ and 1.3 $\mu\text{g m}^{-3}$, respectively
Individual VOCs	Quantified by thermal desorption GC/MS following EPA Methods TO-1 and TO-17. Compounds are quantified using multipoint calibrations prepared with pure substances unless otherwise indicated (see Surrogate?). VOCs with chronic RELs are listed first, followed by other TAC and Prop. 65 compounds. Additional abundant VOCs at or above reporting limit of 5 $\mu\text{g m}^{-3}$ are listed last. VOCs are listed in order of decreasing volatility within each group
“<”	“Less than” concentrations established by LOQ
“HC”	Hydrocarbon compound
“LQ”	Indicates calculated value is below quantitation based on concentration LOQ
“na”	Not applicable

Equations Used in Calculations

An emission factor (EF) in $\mu\text{g m}^{-2} \text{h}^{-1}$ for a chemical substance in a chamber test is calculated using Equation 1:

$$EF = (Q (C - C_o)) / A_c \quad (1)$$

where C is the chamber concentration of the substance ($\mu\text{g m}^{-3}$) and C_o is the corresponding substrate or chamber blank concentration ($\mu\text{g m}^{-3}$). The other parameters are defined in Table 1. For an emitting unit, such as a chair, the number of units, N, is substituted for surface area, A_c , and EF is expressed as $\mu\text{g/unit-h}$.

A building concentration (C_B) in $\mu\text{g m}^{-3}$ can be estimated from the EF using Equation 2:

$$C_B = (EF * A_B) / Q_B \quad (2)$$

where A_B is the area of the product in the building space and Q_B is the outdoor air flow rate to the space.

An EF in $\mu\text{mol m}^{-2} \text{h}^{-1}$ for an individual VOC in a chamber test is calculated from the above EF using Equation 3:

$$EF (\mu\text{mol m}^{-2} \text{h}^{-1}) = EF (\mu\text{g m}^{-2} \text{h}^{-1}) / MW \quad (3)$$

where MW is the molecular weight (molar mass) of the respective compound.

A chamber concentration in ppb (molar basis) for an individual VOC is calculated from the chamber concentration ($C - C_o$) in $\mu\text{g m}^{-3}$ using Equation 4:

$$\text{Chamber concentration (ppb)} = (C - C_o) \times 24.45 / MW \quad (4)$$

where 24.45, in L/mol, is the molar volume of air at standard conditions (1 atm pressure, 25° C).

For a furniture component, the workstation concentration of formaldehyde and total aldehydes in ppb can be estimated from the corresponding aldehyde EF ($\mu\text{mol m}^{-2} \text{h}^{-1}$) using Equation 5:

$$\text{WS Aldehyde concentration (ppb)} = (EF_{\text{aldehyde}})(A_{\text{ws}})(24.45) / Q_{\text{ws}} \quad (5)$$

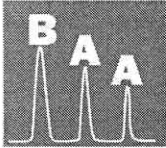
where A_{ws} is the surface area of the component in the workstation (m^2) and Q_{ws} is the outdoor air flow rate to the workstation (m^3/h).

Comments

Prepared an assembly from the received adhesive and flooring material by applying 11.29 g of adhesive to a 17.78 cm by 17.78 cm stainless steel plate (using 1/32" by 1/32" trowel) and allowing to dry for 30 minutes; then placing a cut 17.78 cm by 17.78 cm flooring specimen on top of the adhesive-covered plate, leaving all edges and top surface exposed. The given emission factors are calculated based on the assembly exposed area (17.78 cm x 17.78 cm).

Note: The test results presented herein are specific to this item. 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.

END OF REPORT



Berkeley Analytical Associates, LLC

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 e-mail: baalab@berkeleyanalytical.net

CHAIN OF CUSTODY PRODUCT / MATERIAL VOC EMISSION TEST 2007 Update

(Note: a separate COC must be filled for each product sample)

Client Information*
Company: FORBO FLOORING
Street Address: 8 MAPLEWOOD DRIVE
City/State: HAZLETON / PA
Zip/Postal Code: 18202
Country: NORTH AMERICA
Contact (for reporting): TIM COLE OR KEVIN MAKAREWICZ
Contact Title: TECHNICAL ANALYSIS
Phone/Fax Numbers: 800-342-0604 X 238 OR 255 / FAX: 570-45-0330
Email Address: tim.cole@forbo.com / kevin.makarewicz@forbo.com

Manufacturer Information (if different from client)
Company:
City/State/Country:
Contact Name/Title:
Phone Number:

Sample Details
Product Name*: Coral Brush Active
Manufacturer Product ID #: Color - C59022
Sample Internal ID #: Production 72014409
Date Manufactured*: May 19, 2009
Product Category & Use*: Floor Covering - Entry System
Sample Construction Material*: Vinyl Backed Tufted Textile
Plant Name & Location*: Forbo - Krommenie (Bonar Location)
Collection Location within Plant: Netherlands warehouse in pilot manufacturing area
Date & Time Collected* : May 20, 2009 - a.m.
Number of Sample Pieces*: (4) Photo(s) of Collection Location:
Sample Collected by*: Dick van Bergen - shipped to Forbo Hazleton
Phone/Fax Numbers*: 800-342-0604 x 255 Fax:570-450-0330
Email Address*: tim.cole@forbo.com / kevin.makarewicz@forbo.com

Shipping Details*
Packed & Shipped By: Kevin Makarewicz
Shipping Date: May 27, 2009
Carrier/Airbill Number: Fed Ex Priority Overnight 9043 8874 1749

Test Protocol (Check One)*
CA DHS Section 01350 <input checked="" type="checkbox"/> 10 d conditioning, 24 h, 48 h, 96 h
BIFMA - small chamber <input type="checkbox"/> 72 h, 168 h
BIFMA - mid-size chamber <input type="checkbox"/> 72 h, 168 h
01350 Screening (specify test points)
BIFMA Screening (specify test points) <input type="checkbox"/>
Other, specify below: <input type="checkbox"/>

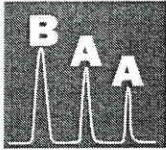
Test Data Application Program (Check if Applicable)
CHPS <input checked="" type="checkbox"/>
FloorScore <input type="checkbox"/>
CRI Greenlabel <input type="checkbox"/>
CRI Greenlabel Plus <input type="checkbox"/>
SCS Indoor Advantage, furniture <input type="checkbox"/>
SCS Indoor Advantage Gold, furniture <input type="checkbox"/>
SCS Indoor Advantage Gold, bldg product <input type="checkbox"/>

Copy to Certifier (If Applicable)
Organization:
Contact:

Notes or Comments from Client / Manufacturer
PLEASE TEST FLOORING MATERIAL & ADHESIVE IN ASSEMBLY FOR CHPS 01350 FOR BOTH OFFICE AND CLASSROOM CLASSIFICATION.

For BAA Use Only
Condition of Shipping Package:
Condition of Sample:
Lab Tracking Number: 135-025-02AA

Sample Handling				
Relinquished By*	Received By*	Signature*	Date*	Company*
	FARID MAJRI	MAJRI	5/28/09	BAA



Berkeley Analytical Associates, LLC

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CHAIN OF CUSTODY PRODUCT / MATERIAL VOC EMISSION TEST

2007 Update

(Note: a separate COC must be filled for each product sample)

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Company: FORBO FLOORING
Street Address: 8 MAPLEWOOD DRIVE
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Phone/Fax Numbers: 800-342-0604 X 238 OR 255 / FAX: 570-45-0330
Email Address: tim.cole@forbo.com / kevin.makarewicz@forbo.com

Manufacturer Information (if different from client)
Company:
City/State/Country:
Contact Name/Title:
Phone Number:

Sample Details
Product Name*: Forbo V-920 Adhesive
Manufacturer Product ID #*: V-920
Sample Internal ID #: Production SCA9E102
Date Manufactured*: May 10, 2009
Product Category & Use*: Floor Covering Adhesive
Sample Construction Material*: Water Based Acrylic
Plant Name & Location*: Para Chem & South Carolina
Collection Location within Plant: Forbo Flooring Warehouse
Date & Time Collected* : May 27, 2009
Number of Sample Pieces*: (1 gal) Photo(s) of Collection Location:
Sample Collected by*: Kevin Makarewicz
Phone/Fax Numbers*: 800-342-0604 x 255 Fax:570-450-0330
Email Address*: tim.cole@forbo.com / kevin.makarewicz@forbo.com

Shipping Details*
Packed & Shipped By: Kevin Makarewicz
Shipping Date: May 27, 2009
Carrier/Airbill Number: Fed Ex Priority Overnight 9043 8874 1738

Test Protocol (Check One)*		
CA DHS Section 01350	<input checked="" type="checkbox"/>	10 d conditioning, 24 h, 48 h, 96 h
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BIFMA - mid-size chamber	<input type="checkbox"/>	72 h, 168 h
01350 Screening (specify test points)		
BIFMA Screening (specify test points)	<input type="checkbox"/>	
Other, specify below:	<input type="checkbox"/>	

Test Data Application Program (Check if Applicable)		
CHPS	<input checked="" type="checkbox"/>	
FloorScore	<input type="checkbox"/>	
CRI Greenlabel	<input type="checkbox"/>	
CRI Greenlabel Plus	<input type="checkbox"/>	
SCS Indoor Advantage, furniture	<input type="checkbox"/>	
SCS Indoor Advantage Gold, furniture	<input type="checkbox"/>	
SCS Indoor Advantage Gold, bldg product	<input type="checkbox"/>	

Copy to Certifier (If Applicable)
Organization:
Contact:

Notes or Comments from Client / Manufacturer
PLEASE TEST FLOORING MATERIAL & ADHESIVE IN ASSEMBLY FOR CHPS 01350 FOR BOTH OFFICE AND CLASSROOM CLASSIFICATION.

For BAA Use Only
Condition of Shipping Package:
Condition of Sample:
Lab Tracking Number: 135-025-03A

Sample Handling				
Relinquished By*	Received By*	Signature*	Date*	Company*
	FAHID MAIRE	MAIRE	5/28/09	BAA