

**BERKELEY ANALYTICAL**

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**VOC Emissions from Building Products,  
Test Method CA DHS "Standard Practice" (CA/DHS/EHLB/R-174)**

***Customer & Product Sample Information***

**Report Certification**

Report number & date: 469-002-01A-Feb2410 - 2/24/2010  
Certified by (name/title): Raja S. Tannous, Laboratory Director  
Signature   
Date February 24, 2010

**Methods**

Test method: CA/DHS/EHLB/R-174 (Standard Practice [Sect. 01350])  
Acceptance criteria: CA/DHS/EHLB/R-174 (Standard Practice, 14 days)  
Modeling scenario(s): CA/DHS/EHLB/R-174 Standard Classroom & Office

**Customer Information**

Customer: International Fireproof Technology Inc  
City/State/Country: Irvine, CA USA  
Contact name/Title: Chris Hsu, President  
Address: 17528 Von Karman Ave, Irvine CA 92614  
Phone number: 949-975-8588

**Product Sample Information\***

Manufacturer (if not customer): International Carbide Technology Co., Ltd.  
Product name: DC315  
Product number: DC315  
Product ARCAT category: Paints and Coatings (09900)  
Customer sample ID: DC315  
Date sample manufactured: 1/29/2010  
Date sample collected: 1/29/2010  
Date sample shipped: 1/29/2010  
Date sample received by lab: 2/2/2010

**Specimen/Testing Information**

Specimen tracking number: **469-002-01A**  
Conditioning start date & duration: Feb 5, 10 days  
Test start date & duration: Feb 15, 96 hours

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

**Summary of Emission Test Results**

**VOC Emission Test Results** – The pass/fail results of the test with respect to the procedures and acceptance criteria given in the CA DHS *Standard Practice* and the modeling scenario(s) from the *Standard Practice* detailed in Table 3 of this report are summarized in Table 1. These results are based on predicted indoor air concentrations of individual VOCs in the modeled scenario(s). The concentration limits are one half the noncancer Chronic Reference Exposure Levels (CRELs) established by California OEHHA for a list of toxic chemicals with the exception of formaldehyde, for which the guideline concentration is one-half the indoor REL of 33 µg/m<sup>3</sup>, i.e., 16.5 µg/m<sup>3</sup> as described in the CA DHS *Standard Practice* and its Addendum 2004-01. Note that OEHHA published a new hazard assessment for acetaldehyde in December 2008, setting the CREL for this compound at 140 µg/m<sup>3</sup>. These test results are specific to the test item.

**Table 1.** Pass/fail results of test based on test method and identified modeling parameters. Only detected individual VOCs with CRELs are listed

Chemical	CAS No.	½ CRE µg m <sup>-3</sup>	Predicted Conc. by Building Type µg m <sup>-3</sup>
			Standard Classroom and/or Office Space
No formaldehyde or other CREL VOCs were detected	None	None	<b>PASS</b>

**Test Methods**

**Test Protocol Summary** – The emission test was performed following California Department of Health Services (CA DHS) “*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers*” CA/DHS/EHLB/R-174. Note: the *Standard Practice* derives from California Specification 01350 and frequently is referred to as “*Section 01350*.” Chemical sampling and analyses were performed following U.S. EPA Compendium Methods TO-1 and TO-17 and ASTM Standard Method D 5197-03. All four of these methods are included in Berkeley Analytical Associate’s scope of ISO/IEC 17025:2005 accreditation, Testing Laboratory TL-383, International Accreditation Service ([www.iasonline.org](http://www.iasonline.org)). 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 as described in the *Standard Practice*. 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 1. Air samples were collected from the chamber at 24 h, 48 h and 96 h after initiating the test. 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 XPOsure Aldehyde Samplers (Waters Corp.). 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) 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.

**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*
Specimen exposed area	A <sub>s</sub>	m <sup>2</sup>	0.0312
Chamber volume	V <sub>c</sub>	m <sup>3</sup>	0.067
Loading ratio	L <sub>c</sub>	m <sup>2</sup> m <sup>-3</sup>	0.465
Inlet air flow rate	Q <sub>c</sub>	m <sup>3</sup> h <sup>-1</sup>	0.067
Ventilation rate	a <sub>c</sub>	h <sup>-1</sup>	1.00
Avg. Temperature		°C	23.2
Avg. Relative humidity		%	49.7

\* Specified ranges: 22°C to 24°C, 45% to 55% RH, and 0.064 to 0.070 cubic meters per hour flow rate

**Modeling Parameters**

**Modeling Parameters** – The CA DHS *Standard Practice* describes the modeling 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 Standard Practice prescribes the dimensions and ventilation of the spaces and the exposed surface areas of major materials. The modeling scenario(s) and parameters applicable to this test are listed in Table 3.

**Table 3.** Parameters used for estimating air concentrations in a standard classroom and a standard office space

<b>Bldg. Component/ Product: Wall / Wall Covering (any)</b>			
<b>Parameter</b>	<b>Symbol</b>	<b>Units</b>	<b>Building Type</b>
<u>Standard Classroom</u>			
Product exposed area	A <sub>B</sub>	m <sup>2</sup>	94.6
Building volume	V <sub>B</sub>	m <sup>3</sup>	231.0
Ceiling height		m	2.59
Loading ratio	L <sub>B</sub>	m <sup>2</sup> m <sup>-3</sup>	0.410
Ventilation rate	a <sub>B</sub>	1/h	0.90
Ventilation vol. fraction	Vf <sub>B</sub>	--	0.90
OA* flow rate	Q <sub>B</sub>	m <sup>3</sup> /h	187.1
OA* flow rate per area	--	m/h	1.98
<u>Standard Office Space</u>			
Product exposed area	A <sub>B</sub>	m <sup>2</sup>	34.8
Building volume	V <sub>B</sub>	m <sup>3</sup>	30.6
Ceiling height		m	2.70
Loading ratio	L <sub>B</sub>	m <sup>2</sup> m <sup>-3</sup>	1.137
Ventilation rate	a <sub>B</sub>	1/h	0.75
Ventilation vol. fraction	Vf <sub>B</sub>	--	0.90
OA* flow rate	Q <sub>B</sub>	m <sup>3</sup> /h	20.7
OA* flow rate per area	--	m/h	0.59

\* Outside air

**VOC Emission Test Results**

**Emitted VOCs** – Individual VOCs (iVOCs) detected in the test above lower limits of quantitation are reported in Table 4. iVOCs with CRELs and/or on other lists of toxicants of concern are listed first, followed by unlisted compounds. The 10 most abundant iVOCs are listed if their concentrations were above the lower limits of quantitation. Reporting of fewer than 10 iVOCs indicates that fewer than 10 chemicals met this requirement.

**Table 4.** iVOCs detected above lower limits of quantitation in 96-h air sample

Chemical	CAS No.	Surrogate?	CREL $\mu\text{g m}^{-3}$	CARB TAC Category	Prop 65
1-Butanol	71-36-3			T-IVb	
C15 Branched alkane HC		Yes			

**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. Emission factors for iVOCs were calculated from the chamber parameters, the exposed area of the test specimen and the measured 96-h chamber concentrations (see equations). The emission factors were used to predict the indoor air concentrations of iVOCs for the modeling scenario(s) applicable to this test.

**Table 5.** Measured chamber concentrations at 96 h, calculated emission factors, and estimated indoor air concentrations for individual VOCs

<b>Chemical</b>	<b>Chamber Concentration <math>\mu\text{g m}^{-3}</math></b>	<b>Emission Factor <math>\mu\text{g m}^{-2} \text{h}^{-1}</math></b>	<b>Estimated Indoor Air Concentration <math>\mu\text{g m}^{-3}</math></b>
			<u>Standard Classroom</u>
1-Butanol	22.8	49.3	24.9
C15 Branched alkane HC	7.0	15.1	7.7
<b>Chemical</b>	<b>Chamber Concentration <math>\mu\text{g m}^{-3}</math></b>	<b>Emission Factor <math>\mu\text{g m}^{-2} \text{h}^{-1}</math></b>	<b>Estimated Indoor Air Concentration <math>\mu\text{g m}^{-3}</math></b>
			<u>Standard Office Space</u>
1-Butanol	22.8	49.3	83.0
C15 Branched alkane HC	7.0	15.1	25.5

**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 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. Aldehyde samples collected at 24, 48 and 96 hours were analyzed for formaldehyde as another quality measure.

**Table 6.** TVOC chamber concentrations at 24, 48 and 96 h with corresponding emission factors and estimated indoor air concentrations

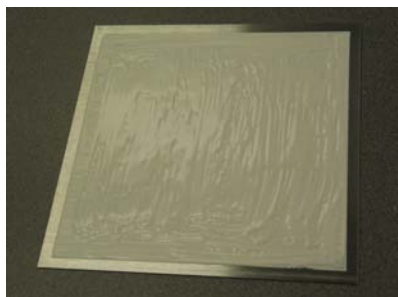
Test Duration	Chamber Conc. $\mu\text{g m}^{-3}$	Emission Factor $\mu\text{g m}^{-2} \text{ h}^{-1}$	Estimated Indoor Air Concentration $\mu\text{g m}^{-3}$
			<u>Standard Classroom</u>
24-h	51	111	56
48-h	42	90	46
96-h	33	72	36
			<u>Standard Office Space</u>
24-h	51	111	187
48-h	42	90	152
96-h	33	72	121

**Table 7.** Formaldehyde chamber concentrations at 24, 48 and 96 h with corresponding emission factors and estimated indoor air concentrations

Test Duration	Chamber Conc. $\mu\text{g m}^{-3}$	Emission Factor $\mu\text{g m}^{-2} \text{ h}^{-1}$	Estimated Indoor Air Concentration $\mu\text{g m}^{-3}$
			<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

***VOC Emission Test Results, Continued***

**Photographs of Test Specimen** – Photograph(s) of the test specimen (typically front and back views) that was prepared from the product sample are shown below.





**Definitions**

**Table 8.** 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, Dec. 2008 and adopted by Section 01350 as target IAQ limit for building; for formaldehyde, IAQ limit is 33 $\mu\text{g m}^{-3}$ . No product may contribute more than 1/2 IAQ limit for an REL compound
CARB TAC Cat.	Toxic Air Contaminant (TAC) on Calif. Air Resources Board list, Feb. 2008, 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), Aug. 2005
Chamber Conc.	Measured chamber VOC concentration at specific 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 $\mu\text{g m}^{-3}$ . 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 Conc.	Concentrations for std. school classroom, std. small office (individual), or specific project building space calculated using parameters given in Table 2 (see calculations on next page)
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 5197-03. LOQs 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 Compendium 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, Specimen Preparation, and Comments*

**Equations Used in Calculations** – An emission factor (EF) in  $\mu\text{g}/\text{m}^2\text{-h}$  for a chemical in a chamber test of is calculated using Equation 1:

$$EF = (Q_C (C - C_0)) / A_S \quad (1)$$

where  $Q_C$  is the chamber inlet air flow rate ( $\text{m}^3/\text{h}$ ),  $C$  is the VOC chamber concentration ( $\mu\text{g}/\text{m}^3$ ), and  $C_0$  is the corresponding chamber background VOC concentration ( $\mu\text{g}/\text{m}^3$ ).  $A_S$  is the specimen exposed area ( $\text{m}^2$ ).

A building indoor air concentration ( $C_B$ ) in  $\mu\text{g m}^{-3}$  is estimated using Equation 2 and parameters defined in Table 3:

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

#### **Specimen Preparation**

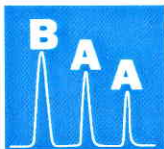
Used a brush to apply 17.87grams of the paint product to a stainless steel plate, leaving a 17.5 cm by 17.5 cm painted area exposed for testing.

#### **Comments**

Loading was 572.8 grams of paint per square meters of substrate. The emission factors calculations are based on the painted surface.

**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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## CHAIN OF CUSTODY PRODUCT / MATERIAL VOC EMISSION TEST

August, 2008 Update

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

Client Information*
Company: <u>International Fireproof Technology Inc.</u>
Street Address: <u>17528 Von Karman Ave</u>
City/State: <u>Irvine CA</u>
Zip/Postal Code: <u>92614</u>
Country: <u>USA</u>
Contact (for reporting): <u>Chris Hsu</u>
Contact Title: <u>President</u>
Phone/Fax Numbers: <u>949-975-8588 / 949-724-8898</u>
Email Address: <u>ptp@painttoprotect.com</u>

Test Protocol (Check One)*		
CA DHS Section 01350	<input 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)	<input type="checkbox"/>	
BIFMA Screening (specify test points)	<input type="checkbox"/>	
CA Office Furniture Bid (chamber/test points)	<input type="checkbox"/>	
Other, specify below:	<input type="checkbox"/>	
<b>CAL Section 1350</b>		

Manufacturer Information (if different from client)
Company: <u>International Carbide Technology Co., Ltd.</u>
City/State/Country: <u>Taoyuan, Taiwan</u>
Contact Name/Title: <u>Johnny Chang / General Manager</u>
Phone Number: <u>886-3-3240001</u>

Check Below if Test Data are For Product Certification		
CHPS	<input 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"/>	

Sample Details	
Product Name*: <u>DC315</u>	
Manufacturer Product ID #: <u>DC315</u>	
Sample Internal ID #: <u>DC315</u>	
Date Manufactured*: <u>Jan. 29th 2009</u>	
Product Category & Use*: <u>Thermal Protection</u>	
Sample Construction Material*: <u>water base latex paint</u>	
Plant Name & Location*: <u>International Carbide Technology, in Taiwan</u>	
Collection Location within Plant: <u>Production field</u>	
Date & Time Collected* : <u>Jan. 29th 2009</u>	
Number of Sample Pieces*: <u>One quart</u>	Photo(s) of Collection Location: <u>Attach</u>
Sample Collected by*: <u>IFTI</u>	
Phone/Fax Numbers*: <u>949-975-8588 / 949-724-8898</u>	
Email Address*: <u>ptp@painttoprotect.com</u>	

Send Copy of Test Report to Certifier (If Applicable)
Organization:
Contact:

Sample Test Preparation Instructions and/or Comments from Client

Shipping Details*
Packed & Shipped By:
Shipping Date:
Carrier/Airbill Number: <u>DHL 7903348913</u>

For BAA Use Only
Condition of Shipping Package: <u>ok</u>
Condition of Sample: <u>ok</u>
Lab Tracking Number: <u>469-002-01A</u>

Sample Handling				
Relinquished By*	Received By*	Signature*	Date*	Company*
International Fireproof Technology Inc.	<u>FARSD MAJAL</u>	<u>MAJAL</u>	<u>2/2/10</u>	<u>BAA</u>