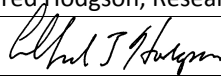


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### VOC Emissions from Building Products

#### Customer & Building Product Sample Information

Report Certification	
Report number	199-009-01A-May2711
Report date	May 27, 2011
Certified by (Name/Title)	Alfred Hodgson, Research Director
Signature	
Date	May 27, 2011

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	Flooring

Customer Information	
Manufacturer or organization	Altro LTD
City/State/Country	Hertfordshire, United Kingdom
Contact name/Title	Greg Veale
Phone number	978-657-6464

Product Sample Information*	
Manufacturer (if not customer)	TAJIMA, Inc.
Product name / Number	Dolce
Product CSI category	Resilient Tile Flooring (09 65 19)
Customer sample ID	685-528 1105G01
Manufacturing location	Tsurugasima, Saitama Prefecture
Date sample manufactured	May 7, 2011
Date sample collected	May 7, 2011
Date sample shipped	May 9, 2011
Date sample received by lab	May 10, 2011
Condition of received sample	No observed problems
Lab sample tracking number	<b>199-009-01A</b>
Conditioning start date & duration	May 13, 2011; 10 days
Chamber test start date & duration	May 23, 2011; 4 days (96 hours)
Total test start date & duration	May 13, 2011; 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 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).

CDPH/EHLB/Standard Method Version 1.1 updates the earlier standard, CA/DHS/EHLB/R-174, 2004. The acceptance criteria are unchanged except for acetaldehyde. The previous acceptance criterion for acetaldehyde was 9 µg/m<sup>3</sup>; the Standard Method V1.1 criterion is 70 µg/m<sup>3</sup> based on the latest noncancer Chronic Reference Exposure Level (CREL) of 140 µg/m<sup>3</sup>. Thus, to determine compliance of the test results reported herein with CA/DHS/EHLB/R-174, the previous acetaldehyde acceptance criterion should be utilized. This may alter the pass/fail conclusion. Also note that the acceptance criterion for formaldehyde will be reduced from 16.5 µg/m<sup>3</sup> to 9 µg/m<sup>3</sup> on January 1, 2012. Until then, a product sample meeting this new criterion may qualify the product for a claim of compliance with the 9 µg/m<sup>3</sup> formaldehyde CREL.

**Table 1.** Pass/Fail results based on the test method and identified modeling scenarios. Only detected individual VOCs with defined acceptance criteria are listed

Chemical	CAS No	½ CREL* (µg/m <sup>3</sup> )	Predicted Concentration (Pass/Fail)	
			Classroom	Office
No formaldehyde or other CREL VOCs were detected	--	--	Pass	Pass

\*See criterion for formaldehyde described above

**Test Method for Building Product Samples**

**Test Specimen Preparation** – Cut a specimen from the received product sample and taped it to a stainless steel plate using aluminum tape to seal all edges and the bottom surface, leaving a 17.7 cm by 17.7 cm top surface exposed for testing. 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 <sub>S</sub>	m <sup>2</sup>	0.031
Chamber volume	V <sub>C</sub>	m <sup>3</sup>	0.067
Loading ratio	L	m <sup>2</sup> /m <sup>3</sup>	0.468
Avg. Inlet gas flow rate & Range	Q <sub>C</sub>	m <sup>3</sup> /h	0.067 (0.064-0.070)
Avg Temperature & Range		°C	23.1 (22-24)
Avg Relative humidity & Range		%	47 (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	$A_{p_B}$	$m^2$	89.2	11.1
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	$q_A$	$m^3/m^2-h$	2.14	1.86

**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 <sup>3</sup> )
Acetaldehyde	75-07-0	LQ
Formaldehyde	50-00-0	LQ
TVOC	--	LQ

**Emitted VOCs** – Individual VOCs (iVOCs) detected in the test above lower limits of quantitation are reported in Table 5. 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 5.** Listed and abundant iVOCs detected above lower limits of quantitation in 96-h air sample

Chemical	CAS No	Surrogate?*	CREL (µg/m <sup>3</sup> )	CARB TAC Category	Prop 65 List?
No individual VOCs detected above their quantitation levels	--	--	--	--	--

\*"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 (µg/m <sup>3</sup> )	Emission Factor (µg/m <sup>2</sup> -h)	Estimated Indoor Air Concentration (µg/m <sup>3</sup> )	
			Classroom	Office
No formaldehyde or other CREL VOCs were detected	LQ	LQ	LQ	LQ

**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. TVOC emission factors 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.

**Table 7.** TVOC chamber concentrations at 24, 48, and 96 h with corresponding emission factors

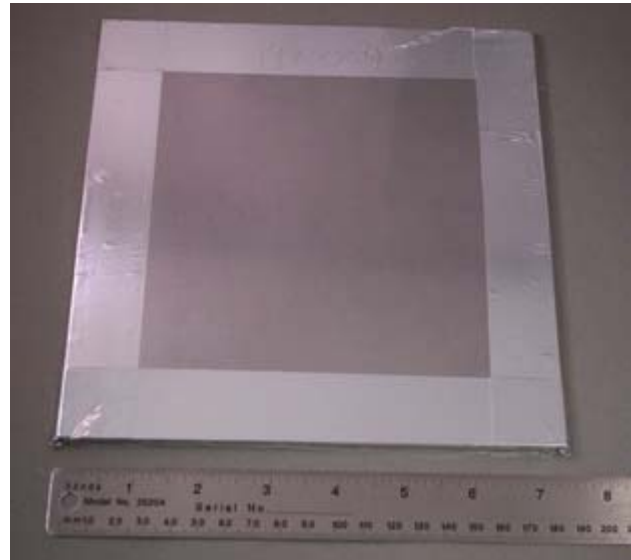
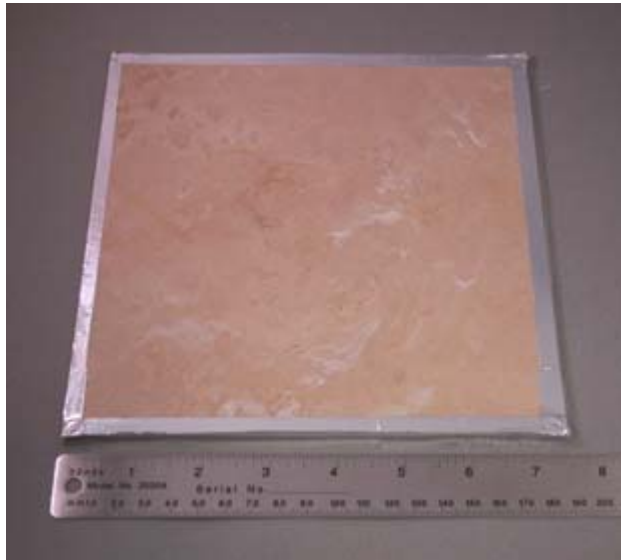
Elapsed Time (h)	Chamber Concentration ( $\mu\text{g}/\text{m}^3$ )	Emission Factor ( $\mu\text{g}/\text{m}^2\text{-h}$ )
24	LQ	LQ
48	LQ	LQ
96	LQ	LQ

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

Elapsed Time (h)	Chamber Concentration ( $\mu\text{g}/\text{m}^3$ )	Emission Factor ( $\mu\text{g}/\text{m}^2\text{-h}$ )
24	LQ	LQ
48	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 <sup>3</sup> 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 ( <a href="http://www.OEHHA.ca.gov/air/allrels.html">http://www.OEHHA.ca.gov/air/allrels.html</a> )
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 1.2 µg/m <sup>3</sup> and 1.3 µg/m <sup>3</sup> , 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 <sup>3</sup> 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 <sup>3</sup>
“na”	Not applicable
“<”	Less than value established by LQ

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

$$EF = (Q_c (C - C_o)) / A_s \quad (1)$$

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

**Definitions, Equations, and Comments, Continued**

The indoor air concentration ( $C_B$ ) for the modeled space in  $\mu\text{g}/\text{m}^3$  is estimated using Equation 2 and the parameters defined in Table 3:

$$C_B = (EF \times A_{p_B}) / Q_B \quad (2)$$

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

**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	Model 1050, UV-VIS detector, Hewlett-Packard
Analytical column	Symmetry™ C18, Waters Corp.
Column dimensions	2.1 mm x 150 mm
Thermal desorber	Unity / Ultra TD, Markes International, Ltd.
Gas chromatograph	Model 6890N, Agilent
Analytical column	DB-1701, J&W Scientific
Column dimensions	1 µm film, 0.25 mm ID, 30 m
Mass spectrometer	Model 5973N MSD, Agilent

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

Parameter	Value
Solvent A	65/35% H <sub>2</sub> O/Acetonitrile
Solvent B	100% Acetonitrile
Flow rate	0.3 mL/min
End time	17 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	-6 °C
Trap desorb temperature	300 °C
Trap desorb split ratio	2:1
Gas chromatograph	
Initial temperature	1 °C
Initial temperature time	6.5 min
Temperature ramp rate 1	5 °C /min
Final temperature 1	100 °C
Temperature ramp rate 2	12 °C /min
Final temperature 2	225 °C
Final temperature 2 time	2 min
Mass spectrometer	
Low scan mass, <i>m/z</i>	30 amu
High scan mass, <i>m/z</i>	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. <sup>a</sup> ( $\mu\text{g}/\text{m}^3$ )
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	16.5 <sup>b</sup>
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

- a. All maximum allowable concentrations are one half the corresponding CREL adopted by Cal/EPA OEHHA with the exception of formaldehyde. For any future changes in the CREL list by OEHHA, values in Table 4.1 shall continue to apply until these changes are published in the Standard Method.
- b. Formaldehyde has a CREL of  $9 \mu\text{g}/\text{m}^3$  (Dec. 2008); guidance value established by this standard at  $16.5 \mu\text{g}/\text{m}^3$  before Dec 31, 2011 and at  $9 \mu\text{g}/\text{m}^3$  starting Jan 1, 2012.

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**Customer Information\***

Company: Compass Concepts, Inc.  
 Street Address: 80 Industrial Way  
 City/State/Zip(postal code): Wilmington, MA 01887  
 Country: USA  
 Contact Name & Title (for reporting): Mr. Greg Veale  
 Contact Phone/Fax Numbers: 978 657 6464/Fax: 978 694 0433  
 Contact E-mail Address: gveale@altrofloors.com  
 Financially Responsible Co. (if different):

**Manufacturer Information (if different from customer)**

Company: TAJIMA, Inc.  
 City/State/Country: 1-25-1, Miyagi, Adachi-ku Tokyo 1208526 Japan  
 Contact Name/Title: S. Isazawa /Asst Manager  
 Phone Number/E-mail Address: +813-39136161/s\_isazawa@tajima.co.jp


**Sample Details**

Product Commercial Name\*: Dolce  
 Product Commercial Part No. (if not part of the name)\*:  
 Manufacturer Sample Tracking ID: 685-528 1105G01  
 Date Manufactured\*: May 7th  
 Product Category & Use\*: Reilient floor coverings  
 Sample Construction Material\*: PVC resin, Plasticizer and Filler  
 Plant Name & Location\*: SAITAMA factory/ Tsurugasima, Saitama Prefecture  
 Collection Location within Plant: Inspection area of production line No.7  
 Date & Time Collected\* : May 7th 10:00 a.m.  
 Number of Sample Pieces\*: 4 | Photo(s) of Collection Location: *Attach*  
 Sample Collected by\*: Mr. Ito  
 Phone/Fax Numbers\*: +81492-85-2151  
 E-mail Address\*: m\_ito@tajima.co.jp

**Shipping Details\***

Packed & Shipped By: Mr. Ito  
 Shipping Date: May 9th  
 Carrier/Airbill Number: **9769 4100 8954**

**Sample Handling**

Relinquished By*	Received By*	Signature*	Date*	Company*
	Tim Cheng		5/10/11	BAA

**Chain of Custody for 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 for testing, customer acknowledges and accepts these terms & conditions unless a prior written contract is in effect.

Berkeley Analytical Quotation Number:

Purchase Order (enter company & number):

**Requested Test (use the included worksheet under "Requested Test" tab)**

METHOD	Test Code(s)*	Modeling Code*
ANSI/BIFMA M7.1-2007, Mid-scale chamber		
Calif Std Practice (Sect 01350), CA/DHS/EHLB/R-174, 2004	C-3	OFF+CL
ASTM D 6007-02 (2008) Formaldehyde Small chamber		
ASTM D 5116-06 Small chamber		
ASTM D 6670-01 (2007) Large chamber		

*All methods are included in scope of Berkeley Analytical's ISO/IEC 17025 accreditation*

**Customer Explanations & Specifications for Test**

Specify certification program, non-standard specimen preparation, analytical requirements, data analysis/modeling, etc.

**Customer Request for Laboratory Certificate of Compliance**

Indicate if you are ordering a Laboratory Certificate of Compliance:

Note: Laboratory certificates are available for those tests indicated on the Work Sheet. Berkeley Analytical's laboratory test results and associated certificates are specific to the test 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: **199-009-01A**