



COMPLIANCE EMISSIONS TEST

California Dept. of Public Health Standard Method Version 1.1 and FloorScore®
Flooring Evaluation

SAMPLE DESCRIPTION & TESTING PARAMETERS

Tesoro Woods submitted exemplars of their flooring products identified as Adhesive 3339 and Adhesive 802 to MAS for emissions testing. The manufacturer and sample specifics as described in the accompanying chain-of-custody (see Appendix A) and a timeline of milestones dates relative to sampling and analysis are summarized for each sample.

SAMPLE HANDLING & EMISSIONS TESTING

Each sample was prepared for testing by cutting the original flooring board to a 6 inch x 7 inch size and taping the board to a stainless steel plate using a non-emitting aluminum tape with an approximate one-quarter inch overlap of the tape onto the sample. The samples were then placed inside one of MAS's small-scale (53 liter) stainless steel emissions chambers on the chamber floor beneath a fan to facilitate even air circulation around the sample.

Emissions from each sample were collected and analyzed in general accordance with ASTM D5116 *Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products*. Sample conditioning, collection of samples, and analysis of compounds of interest were conducted in accordance with the California Department of Public Health (CDPH) *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1* and the FloorScore® criteria. General testing parameters and data are presented in Appendix B.

In order to compare the chamber derived data to the standards established under CDPH Standard Method and the FloorScore® criteria for low emitting materials an emission factor for each tested sample is calculated based on the 96 hour data following ten days of in-chamber conditioning. This emission factor is then applied to the defined parameters of that products use in a typical classroom and private office environment accounting for the specified room sizes and ventilation rates.

CDPH modeling parameters define a typical classroom as having a total floor area of 89.2 square meters, and a typical private office as having a total floor area of 11.15 square meters. For purposes of this report, a typical application was assumed to be the entire floor for each setting. The results of the modeling data are presented in Table I.



TESTING RESULTS

Part A: Adhesive 3339 Flooring (1501780-01)

Product Name: Adhesive 3339	MAS Assigned ID: 1501780-01
Manufacturer: [REDACTED] [REDACTED] [REDACTED] Guatemala, Guatemala, 01010 CA	Product Description: white oak; 13 mm thickness; single strip; three layers Approx. 12" x 7" x 9/16" thick as received
Manufacture Date: Oct. 14, 2015	Testing Period: Oct. 22 – Nov. 5, 2015
Collection Date: Oct. 14, 2015	In-Chamber Sampling Dates: Nov. 2 @ 24 hrs.; Nov. 3 @ 48 hrs.; Nov. 5 @ 96 hrs.
Shipping Date: Oct. 14, 2015	Date of Sample Analysis: Nov. 6 – 9, 2015
Laboratory Arrival Date: Oct. 19, 2015	Age of Sample at Testing: 8 days



Tesoro Woods Adhesive 3339 Flooring as submitted and tested (right)

Table I
Emission Factors and Predicted 96-Hour Airborne Concentrations for the Adhesive 3339 Flooring in Typical Building Environments

VOC Name	Calculated Emission Factor (µg/m ² hr)	Predicted Airborne Concentration (µg/m ³)		Maximum Concentration Limits (µg/m ³)	Testing Comment
	96 th hour (4 days)	Classroom*	Private Office**		
Total VOCs (TVOC)	250	120	130	NA	NA
formaldehyde	2.3	1.1	1.2	9	Compliant
acetaldehyde	68	32	36	70	Compliant



isopropanol	<2.4	<1.1	<1.3	3500	Compliant
1,1-dichloroethylene	<2.4	<1.1	<1.3	35	Compliant
methylene chloride	<2.4	<1.1	<1.3	200	Compliant
carbon disulfide	<2.4	<1.1	<1.3	400	Compliant
MTBE	<2.4	<1.1	<1.3	4000	Compliant
vinyl acetate	<2.4	<1.1	<1.3	100	Compliant
hexane	<2.4	<1.1	<1.3	3500	Compliant
chloroform	<2.4	<1.1	<1.3	150	Compliant
2-methoxyethanol	<2.4	<1.1	<1.3	30	Compliant
1,1,1-trichloroethane	<2.4	<1.1	<1.3	500	Compliant
benzene	<2.4	<1.1	<1.3	1.5	Compliant
1-methoxy-2-propanol	<2.4	<1.1	<1.3	3500	Compliant
carbon tetrachloride	<2.4	<1.1	<1.3	20	Compliant
1,4-dioxane	<2.4	<1.1	<1.3	1500	Compliant
trichloroethylene	<2.4	<1.1	<1.3	300	Compliant
epichlorohydrin	<1.2	<0.57	<0.65	1.5	Compliant
2-ethoxyethanol	<2.4	<1.1	<1.3	35	Compliant
n,n-dimethylformamide	<2.4	<1.1	<1.3	40	Compliant
toluene	<2.4	<1.1	<1.3	150	Compliant
2-methoxyethanol acetate	<2.4	<1.1	<1.3	45	Compliant
tetrachloroethylene	<2.4	<1.1	<1.3	17.5	Compliant
chlorobenzene	<2.4	<1.1	<1.3	500	Compliant
ethylbenzene	<2.4	<1.1	<1.3	1000	Compliant
m & p-xylene	<2.4	<1.1	<1.3	350	Compliant
styrene	<2.4	<1.1	<1.3	450	Compliant
o-xylene	<2.4	<1.1	<1.3	350	Compliant
phenol	3.9	1.9	2.1	100	Compliant
1,4-dichlorobenzene	<2.4	<1.1	<1.3	400	Compliant
isophorone	<2.4	<1.1	<1.3	1000	Compliant
naphthalene	<1.2	<0.57	<0.65	4.5	Compliant

* Assumes a classroom size of 24' x 40' x 8.5' with a ventilation rate of 0.82 h⁻¹ as defined by CDPH/EHLB/Standard Method V.1.1

** Assumes a private office size of 10' x 12' x 9' with a ventilation rate of 0.68 h⁻¹ as defined by CDPH/EHLB/Standard Method V.1.1



Part B: Adhesive 802 Flooring (1501780-02)

Product Name: Adhesive 802	MAS Assigned ID: 1501780-02
Manufacturer: [REDACTED] [REDACTED] [REDACTED] Guatemala, Guatemala, 01010 CA	Product Description: white oak; 13 mm thickness; single strip; three layers Approx. 12” x 7” x 9/16” thick as received
Manufacture Date: Oct. 14, 2015	Testing Period: Oct. 22 – Nov. 5, 2015
Collection Date: Oct. 14, 2015	In-Chamber Sampling Dates: Nov. 2 @ 24 hrs.; Nov. 3 @ 48 hrs.; Nov. 5 @ 96 hrs.
Shipping Date: Oct. 14, 2015	Date of Sample Analysis: Nov. 6 – 9, 2015
Laboratory Arrival Date: Oct. 19, 2015	Age of Sample at Testing: 8 days



Tesoro Woods Adhesive 802 Flooring as submitted and tested (right)

Table II
Emission Factors and Predicted 96-Hour Airborne Concentrations for the Adhesive 802 Flooring in Typical Building Environments

VOC Name	Calculated Emission Factor (µg/m ² hr)	Predicted Airborne Concentration (µg/m ³)		Maximum Concentration Limits (µg/m ³)	Testing Comment
	96 th hour (4 days)	Classroom*	Private Office**		
Total VOCs (TVOC)	510	240	280	NA	NA
formaldehyde	7.0	3.3	3.7	9	Compliant
acetaldehyde	43	20	23	70	Compliant
isopropanol	<2.4	<1.1	<1.3	3500	Compliant
1,1-dichloroethylene	<2.4	<1.1	<1.3	35	Compliant



methylene chloride	<2.4	<1.1	<1.3	200	Compliant
carbon disulfide	<2.4	<1.1	<1.3	400	Compliant
MTBE	<2.4	<1.1	<1.3	4000	Compliant
vinyl acetate	4.6	2.2	2.5	100	Compliant
hexane	<2.4	<1.1	<1.3	3500	Compliant
chloroform	<2.4	<1.1	<1.3	150	Compliant
2-methoxyethanol	<2.4	<1.1	<1.3	30	Compliant
1,1,1-trichloroethane	<2.4	<1.1	<1.3	500	Compliant
benzene	<2.4	<1.1	<1.3	1.5	Compliant
1-methoxy-2-propanol	<2.4	<1.1	<1.3	3500	Compliant
carbon tetrachloride	<2.4	<1.1	<1.3	20	Compliant
1,4-dioxane	<2.4	<1.1	<1.3	1500	Compliant
trichloroethylene	<2.4	<1.1	<1.3	300	Compliant
epichlorohydrin	<1.2	<0.58	<0.65	1.5	Compliant
2-ethoxyethanol	<2.4	<1.1	<1.3	35	Compliant
n,n-dimethylformamide	<2.4	<1.1	<1.3	40	Compliant
toluene	<2.4	<1.1	<1.3	150	Compliant
2-methoxyethanol acetate	<2.4	<1.1	<1.3	45	Compliant
tetrachloroethylene	<2.4	<1.1	<1.3	17.5	Compliant
chlorobenzene	<2.4	<1.1	<1.3	500	Compliant
ethylbenzene	<2.4	<1.1	<1.3	1000	Compliant
m & p-xylene	<2.4	<1.1	<1.3	350	Compliant
styrene	<2.4	<1.1	<1.3	450	Compliant
o-xylene	<2.4	<1.1	<1.3	350	Compliant
phenol	<2.4	<1.1	<1.3	100	Compliant
1,4-dichlorobenzene	<2.4	<1.1	<1.3	400	Compliant
isophorone	<2.4	<1.1	<1.3	1000	Compliant
naphthalene	<1.2	<0.58	<0.65	4.5	Compliant

* Assumes a classroom size of 24' x 40' x 8.5' with a ventilation rate of 0.82 h⁻¹ as defined by CDPH/EHLB/Standard Method V.1.1

** Assumes a private office size of 10' x 12' x 9' with a ventilation rate of 0.68 h⁻¹ as defined by CDPH/EHLB/Standard Method V.1.1

CONCLUSIONS

Based on the emissions test data, MAS offers the following findings and conclusions:

- Predicted airborne concentrations of the CDPH target compounds at the 14-day test point for both the Adhesive 3339 and Adhesive 802 flooring products in both a classroom and private office setting are compliant with the maximum concentration limits.



LIMITATIONS

This report is intended for the use of Tesoro Woods and SCS Global Services only. If other parties wish to rely on this report, please have them contact us so that a mutual understanding and agreement of the terms and conditions for use of the data and information can be established prior to its use. This report shall not be reproduced, except in full, without the written approval of Materials Analytical Services, LLC.

Emissions generally decay over time, and the representativeness of the analytical data reported is directly dependent upon the age and conditions under which the tested samples were received.



APPENDIX B

GENERAL TESTING PARAMETERS AND DATA

Under the provisions of the testing method referenced in this report, testing consisted of the following procedural steps:

- Specific procedures for specimen receiving, handling, and preparation.
- Storage of test specimens in original shipping containers prior to emissions testing for up to 10 days in a ventilated and conditioned room maintained at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50\% \pm 15\%$.
- For quality assurance purposes the emission chamber was purged and the interior thoroughly cleaned prior to all new product tests. Air samples were collected and analyzed from the chamber exhaust prior to loading to establish background levels.
- Collection of air samples at method-specified intervals from the chamber exhaust port utilizing mass flow controllers calibrated at 150 cc/min for VOCs and at 180 cc/min for aldehydes.
- Tenax TA® tubes (drawn in duplicate) are used for VOC analysis which is performed by thermal desorption gas chromatography/mass spectrometry (TD-GC/MS) using a modified EPA TO-17 method. Duplicate samples are also collected on DNPH tubes for aldehyde analysis which is performed using high performance liquid chromatography (HPLC) using a modified NIOSH 2016 method.
- Instrument calibration, analysis of quality control samples and quantitation of the CDPH target list of 35 chemicals of concern.
- Reporting and speciation of top 10 tentatively identified compounds.

The operational parameters for the small emission chamber utilized for this project included:

Parameter	Value	Parameter	Value
Chamber Volume	0.053 m ³	Area Specific Flow Rate	1.956 m/h
Loading Factor	0.511 m ² / m ³	Temperature	23 ± 1 °C
Air Exchange Rate	1.0 ± 0.05 h ⁻¹	Relative Humidity	50 ± 5%

The emissions testing protocol was designed to measure the release of volatile organic compounds from a given material over time. The results of the emissions testing are summarized in the tables presented on the following pages.

Total volatile organic compounds (TVOC) are defined as the compounds eluting between hexane (*n*-C₅) and hexadecane (*n*-C₁₇) and in this protocol quantified as toluene (*note that there are no specific TVOC limits specified under CDPH*). The measured concentration of total volatile organic compounds (TVOC) obtained at each of the three sampling intervals is presented in Table B-I.



Table B-I
Total Volatile Organic Compounds (TVOC) between n-C₅ and n-C₁₇ Measured by GC/MS*

Adhesive 3339

Sample Interval (hours)	TVOC Concentration (µg/m ³)	TVOC Emission Factor (µg/m ² h)
24	140	270
48	120	230
96	130	250

Adhesive 802

Sample Interval (hours)	TVOC Concentration (µg/m ³)	TVOC Emission Factor (µg/m ² h)
24	280	540
48	280	540
96	260	510

*TVOC values are background corrected

The measured concentrations of formaldehyde and acetaldehyde obtained at each of the three sampling intervals are presented in Table B-II.

Table B-II
Formaldehyde and Acetaldehyde Concentrations as Measured by HPLC

Adhesive 3339

Sample Interval (hrs)	Target Compound	Concentration (µg/m ³)	Emission Factor (µg/m ² h)
24	Formaldehyde	<1.4	<2.6
48	Formaldehyde	<1.4	<2.6
96	Formaldehyde	<1.4	<2.6
24	Acetaldehyde	38	74
48	Acetaldehyde	33	65
96	Acetaldehyde	35	68

Adhesive 802

Sample Interval (hrs)	Target Compound	Concentration (µg/m ³)	Emission Factor (µg/m ² h)
24	Formaldehyde	2.7	5.2
48	Formaldehyde	0.74	1.4
96	Formaldehyde	3.6	7.0
24	Acetaldehyde	23	45
48	Acetaldehyde	18	35
96	Acetaldehyde	22	43



Ten individual volatile organic compounds (IVOC) were identified by GC/MS after 96 hours of off-gassing from each sample. These are presented in Table B-III.

Table B-III
Speciation of all Tentatively Identified IVOCs* by GC/MS after 96 hours

Adhesive 3339

CAS Number	Tentatively Identified Compounds	Library Match Percent	Concent. ($\mu\text{g}/\text{m}^3$)	Emission Factor ($\text{mg}/\text{m}^2 \text{ h}$)	Match Quality
80-56-8	a-pinene	NA	67	130	Confirmed
475-20-7	junipene‡	96	7.8	15	Good
66-25-1	hexanal	NA	6.2	12	Confirmed
127-91-3	beta-pinene‡	95	3.5	6.9	Good
100-52-7	benzaldehyde‡	96	2.0	3.9	Good
71-36-3	1-butanol	NA	<1.2	<2.4	Confirmed
110-62-3	pentanal	NA	2.1	4.1	Confirmed
108-95-2	phenol	NA	2.0	3.9	Confirmed
108-05-4	vinyl acetate	NA	<1.2	<2.4	Confirmed
5989-27-5	limonene	NA	1.9	3.7	Confirmed

Adhesive 802

CAS Number	Tentatively Identified Compounds	Library Match Percent	Concent. ($\mu\text{g}/\text{m}^3$)	Emission Factor ($\text{mg}/\text{m}^2 \text{ h}$)	Match Quality
80-56-8	a-pinene	NA	110	210	Confirmed
475-20-7	junipene‡	99	11	22	Good
66-25-1	hexanal	NA	9.3	18	Confirmed
127-91-3	beta-pinene‡	95	8.9	17	Good
110-62-3	pentanal	NA	4.3	8.4	Confirmed
5989-27-5	limonene	NA	3.1	6.1	Confirmed
108-05-4	vinyl acetate	NA	2.4	4.6	Confirmed
79-92-5	camphene‡	95	2.7	5.2	Good
124-13-0	octanal	NA	1.7	3.3	Confirmed
141-78-6	ethyl acetate	NA	1.7	3.4	Confirmed

*All IVOCs detected were identified using the average response factor of toluene calibration standards. Match qualities of less than 85% are not considered to be proof of chemical identity per EPA protocols.

The Library Match Percent is a comparison of mass spectra by the library search algorithm of the Chemstation G1701DA mass spectrometry software package with the Wiley and NBS 75K mass spectral database. The search methods that we use apply a “match quality” to the search result, based upon a scale of 100%. MAS tentatively identifies compounds with a minimal match quality of $\geq 85\%$. The sum concentration of the IVOC’s does not necessarily correlate with the TVOC concentration under the analytical conditions.