

November 16, 2017
Revised November 17, 2017
Revision 2 November 17, 2017



Mr. Miguel Detres
Architecture Program Manager
Saint-Gobain Solar Gard®
4540 Viewridge Avenue
San Diego, CA 92123

**Subject: Dynamic Small-Scale Chamber Emissions Testing
 Revised Compliance Report per California Department of Public Health Standard
 Method Version 1.2
 Solar Gard® Safety Pressure Sensitive Adhesive
 MAS Project No.: 1701462**

Dear Mr. Detres:

Materials Analytical Services, LLC (MAS) is pleased to submit this report with results of VOC testing from an application of Solar Gard® Safety Pressure Sensitive Adhesive. This report was revised to reflect a change in your title and address.

This project was conducted in general accordance with the emission testing guidelines specified under ASTM D 5116 and 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 1.2*. This testing protocol was implemented to bracket a broad range of similarly formulated, lower emitting products under a single test.

Based on the test results, the Safety Pressure Sensitive Adhesive is compliant with the performance standards established for low-emitting materials under the CDPH, the Collaborative for High Performance Schools (CHPS) and the LEED v4 programs. Qualified project uses of this product may be eligible for credit points under CHPS and LEED programs.

MAS is pleased to have been of service to you. If you have any questions or comments, or if we can be of further assistance, please contact us.

Sincerely,
MAS, LLC

Manager, Emissions Group

Senior Analytical Chemist

Appendices: Appendix A – Chain-of-Custody
 Appendix B – Compliant and Bracketed Products
 Appendix C – General Testing Parameters and Data

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Testing Cert. #2925.01



EMISSIONS COMPLIANCE TEST

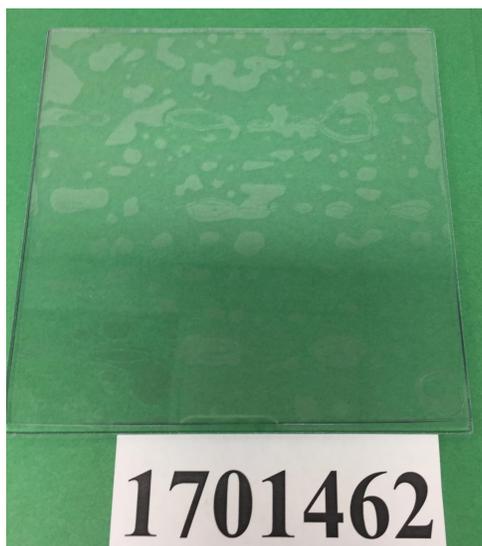
California Dept. of Public Health Standard Method Version 1.2

Window Treatment Evaluation

SAMPLE DESCRIPTION & TESTING PARAMETERS

Sample specifics as described in the chain-of-custody (see Appendix A) and a timeline of milestones dates relative to sampling and analysis are summarized below.

Product Name: Safety Pressure Sensitive Adhesive	MAS Assigned ID: 1701462
Manufacturer: Solar Gard® 4540 Viewridge Avenue San Diego, CA 92123	Product Description: self-adhering window film with pressure sensitive adhesive backing
Manufacture Date: October 10, 2017	Testing Period: Oct. 20 – Nov. 3, 2017
Collection Date: October 10, 2017	In-Chamber Sampling Dates: Oct. 31 @ 24 hrs.; Nov. 1 @ 48 hrs.; Nov. 3 @ 96 hrs.
Shipping Date: October 13, 2017	Date of Sample Analysis: Nov. 11 – 15, 2017
Laboratory Arrival Date: Oct. 16, 2017	Age of Sample at Testing: 10 days



Solar Gard® Safety Pressure Sensitive Adhesive as tested

The sample was prepared for testing by cutting a six inch by six inch piece of the window film from the submitted roll, removing the plastic to expose the adhesive backing, and adhering the sample to a 6” x 6” glass plate. Immediately following preparation, the glass plate was placed inside one of MAS’s small-scale emissions chambers beneath a ceiling-mounted fan to facilitate even air circulation around the sample.

Sample conditioning, collection of samples, and analysis of compounds of interest were conducted in accordance with ASTM D5116 *Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products*, and 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 1.2*, for comparison to the Leadership in Energy



and Environmental Design (LEED) standard, and the Collaborative for High Performance Schools (CHPS) criteria for low emitting materials. General testing parameters and data are presented in Appendix C.

TEST RESULTS

To compare the chamber-derived data to the standards established under CDPH Standard Method and the CHPS criteria an emission factor for the tested sample is calculated based on the 96 hour test point data following ten days of in-chamber conditioning. This emission factor is used to predict airborne concentrations of target compounds in a CDPH-defined classroom with a total window surface area of 4.46 square meters, and a typical private office with a total window surface area of 1.49 square meters. For purposes of this report, a typical application was assumed to be the sum of the total window surface area. The results of the modeled data are presented in Table I.

Table I
Comparison of Emission Factors and Predicted 96-Hour Airborne Concentrations
from the Safety Pressure Sensitive Adhesive 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
		Classroom	Private Office		
Total VOCs (TVOC)	<2.9	<0.069	<0.21	NA	NA
Formaldehyde ^{1,2}	<3.2	<0.076	<0.23	9	Compliant
Acetaldehyde ^{1,2}	<4.3	<0.10	<0.31	70	Compliant
Isopropanol	<2.9	<0.069	<0.21	3500	Compliant
1,1-dichloroethylene	<2.9	<0.069	<0.21	35	Compliant
Methylene chloride ²	<2.9	<0.069	<0.21	200	Compliant
Carbon disulfide ^{1,2}	<2.9	<0.069	<0.21	400	Compliant
MTBE ²	<2.9	<0.069	<0.21	4000	Compliant
Vinyl acetate ²	<2.9	<0.069	<0.21	100	Compliant
Hexane ²	<2.9	<0.069	<0.21	3500	Compliant
Chloroform ^{1,2}	<2.9	<0.069	<0.21	150	Compliant
2-methoxyethanol ¹	<2.9	<0.069	<0.21	30	Compliant
1,1,1-trichloroethane ²	<2.9	<0.069	<0.21	500	Compliant
Benzene ^{1,2}	<2.9	<0.069	<0.21	1.5	Compliant
1-methoxy-2-propanol	<2.9	<0.069	<0.21	3500	Compliant
Carbon tetrachloride ^{1,2}	<2.9	<0.069	<0.21	20	Compliant
Ethylene glycol ²	<2.9	<0.069	<0.21	200	Compliant
1,4-dioxane ^{1,2}	<2.9	<0.069	<0.21	1500	Compliant
Trichloroethylene ^{1,2}	<2.9	<0.069	<0.21	300	Compliant
Epichlorohydrin ^{1,2}	<1.5	<0.036	<0.11	1.5	Compliant
2-ethoxyethanol ¹	<2.9	<0.069	<0.21	35	Compliant
n,n-dimethylformamide ²	<2.9	<0.069	<0.21	40	Compliant
Toluene ^{1,2}	<2.9	<0.069	<0.21	150	Compliant



2-methoxyethanol acetate ¹	<2.9	<0.069	<0.21	45	Compliant
Tetrachloroethylene ^{1,2}	<2.9	<0.069	<0.21	17.5	Compliant
Chlorobenzene ²	<2.9	<0.069	<0.21	500	Compliant
Ethylbenzene ^{1,2}	<2.9	<0.069	<0.21	1000	Compliant
m & p-xylene ²	<2.9	<0.069	<0.21	350	Compliant
Styrene ^{1,2}	<2.9	<0.069	<0.21	450	Compliant
2-ethoxyethyl acetate ¹	<2.9	<0.069	<0.21	150	Compliant
o-xylene ²	<2.9	<0.069	<0.21	350	Compliant
Phenol ²	<2.9	<0.069	<0.21	100	Compliant
1,4-dichlorobenzene ^{1,2}	<2.9	<0.069	<0.21	400	Compliant
Isophorone ²	<2.9	<0.069	<0.21	1000	Compliant
Naphthalene ^{1,2}	<1.5	<0.036	<0.11	4.5	Compliant

* Assumes a 24' x 40' x 8.5' classroom with a ventilation rate of 0.82 h⁻¹ and a 10' x 12' x 9' private office with a ventilation rate of 0.68 h⁻¹ as defined by CDPH/EHLB/Standard Method V.1.2

1 Compound included on Cal/EPA OEHHA Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65)

2 Compound included on Cal/EPA ARB list of Toxic Air Contaminants (TAC)

CONCLUSIONS

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

- Predicted airborne concentrations of the CDPH Standard Method target compounds at the 14-day test point in both a classroom and private office setting are compliant with the maximum concentration limits.
- By virtue of compliance with the CDPH Standard Method, the product is compliant with the performance standards established for low-emitting materials under the Collaborative for High Performance Schools (CHPS) EQ7.1.6 for Ceiling and Wall Systems.
- By virtue of compliance with the CDPH Standard Method, the product is also compliant with the LEED v4 EQ Credit: Low-Emitting Materials general emissions evaluation criteria. In accordance with LEED v4 reporting requirements, the estimated TVOC concentration is 0.5 mg/m³ or less.

Qualified project uses of the Safety Pressure Sensitive Adhesive may be eligible for credit points under the CHPS and LEED programs.

Note: all data, including but not limited to raw instrument files, calibration fits, and quality control checks used to generate the test results are available to the client upon request.

LIMITATIONS

This report is intended for the use of Solar Gard® only. If other parties wish to rely on this report, please contact MAS so an agreement on the terms and conditions for our services can be established prior to the use of this information. 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 sample was received.



APPENDIX A Chain-of-Custody



Materials Analytical Services LLC
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 Suwanee, Georgia 30024
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 Fax: 770-866-3259

California Department of Public Health
Standard Method (section 01350)
 Emission Testing
 Chain-of-Custody

Client Information	Testing Specifications (per MAS) check appropriate test below			
Company: Solar Gard®	<input type="checkbox"/> R&D (custom): Specify Details			
Street Address: 4540 Viewridge Avenue	<input type="checkbox"/> 24-hour Comparative R&D Test			
City/State: San Diego, CA	<input type="checkbox"/> 72-hour Comparative R&D Test			
Zip/Postal Code: 92123	<input checked="" type="checkbox"/> 14-day CDPH Compliance Test			
Country: United States				
Contact Name: Miguel Detres				
Title: Technical Services Representative				
Phone Number: O 727-437-1025 M 813-760-9026				
Fax Number: 727-437-1001				
Email Address: miguel.detres@saint-gobain.com				
Manufacturer Information (if different than client)	Construction Details (as applicable)			
Company: Same as above	Covering Type: Fabric <input type="checkbox"/> (Primary Fiber type: _____), Vinyl <input type="checkbox"/> , Leather <input type="checkbox"/>			
City/State/Country:	Plastic Type(s): Nylon <input type="checkbox"/> , PVC <input type="checkbox"/> , PE <input type="checkbox"/> , PP <input type="checkbox"/> , PU <input type="checkbox"/> , PS <input type="checkbox"/> , PC <input type="checkbox"/> , ABS <input type="checkbox"/> , Acrylic <input type="checkbox"/> , Lexan <input type="checkbox"/>			
Contact Name/Title:	Substrate Type(s): MDF <input type="checkbox"/> , Particle Board <input type="checkbox"/> , Plywood <input type="checkbox"/> , Solid Wood <input type="checkbox"/> , Other <input type="checkbox"/>			
Phone Number:	Outer Finish Type(s): Oil Base <input type="checkbox"/> , Water Base <input type="checkbox"/> , Catalyzed/Conversion Var <input type="checkbox"/> , Polyurethane <input type="checkbox"/> , Plastic Laminate <input type="checkbox"/> , Melamine <input type="checkbox"/> , UV <input type="checkbox"/> , Other <input type="checkbox"/>			
	Foam Type: Polyurethane <input type="checkbox"/> , Memory <input type="checkbox"/> , Latex <input type="checkbox"/> , Evlon <input type="checkbox"/> , High Resilience <input type="checkbox"/> , High Density <input type="checkbox"/>			
	Paint Type: Latex <input type="checkbox"/> , Oil <input type="checkbox"/> , Low VOC <input type="checkbox"/> , No VOCs <input type="checkbox"/> , PowderCoat <input type="checkbox"/> , Chrome <input type="checkbox"/>			
Sample Details	Special Notes or Comments from Manufacturer:			
Unique Sample ID (if applicable): Solar Gard Safety Pressure Sensitive Adhesive				
Product Name & Catalog #: Solar Gard				
Product Type: Ceiling/Wall Panels <input type="checkbox"/> , Flooring <input type="checkbox"/> , Trim <input type="checkbox"/> , Wall Paint <input type="checkbox"/> , Wall Coverings <input type="checkbox"/> , Thermal Insulation <input type="checkbox"/> , Adhesives <input type="checkbox"/> , Ceiling Tiles <input type="checkbox"/> , Other <input checked="" type="checkbox"/>				
Date of Product Manufacturing Completion: 10-10-2017				
Sample Location: Factory <input type="checkbox"/> , Warehouse <input type="checkbox"/> , Production Stack/Roll X, Container <input type="checkbox"/>				
Sample Submitted by: Miguel Detres				
Date of Sample Shipment: 10-12-2017 10-13-2017				
Number of Boxes or Pallets: 1				
Shipping Details	Laboratory Receipt (to be completed by Laboratory Representative)			
Packed By: Jose Pichardo Jan Mitchell	Received By: <i>WThorp</i>			
Shipping Date: 10-12-2017 10-13-2017	Received Date: 10-16-17			
Carrier/Airbill Number:	Condition of Shipping Package: <i>OK</i>			
	Condition of Sample: <i>OK</i>			
	Remarks:			
Sample Handling				
Relinquished By	Company	Received By	Company	Date/Time
		<i>WThorp</i>	MAS	10-16-17



Shipping Package Inspected By:
 1. *WT* Date 10-16-17
 2. *AS* Date 10-16-17



APPENDIX B

CDPH, LEED, and CHPS Compliant Products Solar Gard®

Qualified Product and Options

Solar Gard® Window Films with Pressure Sensitive Adhesive

Solar Gard® Safety Window Films with Pressure Sensitive Adhesive*

Solar Gard® Window Films with Clear Dry Adhesive

Solar Gard® Graffitigard Window Films with Pressure Sensitive Adhesive

* Indicates product tested as a representative exemplar of the bracketing of the listed Solar Gard® products based on previous emissions testing and a review of the manufacturer's product information. Claims of compliant products are made under the criteria in Section 8 of the CDPH Standard Method and/or Section 3.1 of ANSI/BIFMA X7.1-2011.

Per ANSI/BIFMA and CDPH standards, products must be re-evaluated if significant changes to materials, processes, or the facility occur that affect the eligibility of the products for any credits available under these or other applicable standards. Regardless, the frequency of compliance assessment for ANSI/BIFMA shall not exceed three years. Third-party certification programs may require more frequent compliance testing.



APPENDIX C

GENERAL TESTING PARAMETERS AND DATA

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

- 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 180 cc/min for VOCs and 150 cc/min for aldehydes.
- Tenax TA® tubes 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. 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. All samples are drawn and analyzed in duplicate.
- Instrument calibration, analysis of quality control samples and quantitation of the CDPH target list of 35 chemicals of concern, and reporting and speciation of top 10 tentatively identified compounds.

The operational parameters for the small-scale emissions chamber used for this project included:

Parameter	Value	Parameter	Value
Chamber Volume	0.053 m ³	Area Specific Flow Rate	2.4 m/h
Loading Factor	0.425 m ² /m ³	Temperature	23 ± 1 °C
Air Exchange Rate	1.0 ± 0.05 h ⁻¹	Relative Humidity	50 ± 5%

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. The measured concentration and emission factor of TVOC at each of the three sampling intervals is presented in Table C-I.

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

Sample Interval (hours)	TVOC Concentration (µg/m ³)	TVOC Emission Factor (µg/m ² h)
24	<1.2	<2.9
48	<1.2	<2.9
96	<1.2	<2.9

*TVOC values are background corrected



Measured concentrations and emission factors of formaldehyde and acetaldehyde at each of the three sampling intervals are presented in Table C-II.

Table C-II
Formaldehyde and Acetaldehyde Concentrations and Emission Factors as Measured by HPLC

Sample Interval hours	Target Compound	Concentration ($\mu\text{g}/\text{m}^3$)	Emission Factor ($\mu\text{g}/\text{m}^2 \text{ h}$)
24	Formaldehyde	<1.4	<3.2
48	Formaldehyde	2.1	4.9
96	Formaldehyde	<1.4	<3.2
24	Acetaldehyde	<1.8	<4.3
48	Acetaldehyde	<1.8	<4.3
96	Acetaldehyde	<1.8	<4.3

No individual volatile organic compounds (IVOC) were identified by GC/MS after 96 hours in concentrations exceeding the detection limits of laboratory instrumentation.