

Dynamic Small-Scale Chamber Emissions Testing



Compliance Report per
California Department of Public
Health Standard Method
Version 1.1

Solar Gard® Safety Window Film with Pressure Sensitive Adhesive

Prepared for:



4540 Viewridge Avenue
San Diego, CA 92123

Submitted by:

Materials Analytical Services, LLC

3945 Lakefield Court
Suwanee, Georgia 30024

December 31, 2013

Revised January 3, 2014

MAS Project No.: 1301689



Testing Cert. #2925.01



December 31, 2013
Revised January 3, 2014

Miguel Detres
Technical Service Representative
Solar Gard
8575 A Somerset Drive
Largo, FL 33773



**Subject: Dynamic Small-Scale Chamber Emissions Testing
 Compliance Report per California Department of Public Health Standard Method
 Version 1.1 -- Revised
 Solar Gard® Safety Window Film with Pressure Sensitive Adhesive
 MAS Project No.: 1301689**

Dear Mr. Detres:

Materials Analytical Services, LLC (MAS) is pleased to submit this report for emissions testing relative to potential VOC off-gassing from an application of Safety Window Film with Pressure Sensitive Adhesive submitted in December 2013. This report summarizes our testing procedures and the results of our analytical measurements. Revisions to this report reflect the client's wishes for simplified reporting.

This project was conducted in general accordance with the emission testing guidelines specified under ASTM D 5116-10. Specific testing parameters and VOC emission limits were based on the California Department of Public Health (CDPH) *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Test Chambers Version 1.1* (Section 01350). This testing protocol was implemented to bracket a broad range of similarly formulated, lower emitting products under a single test.

Based on our test results, the Safety Window Film with Pressure Sensitive Adhesive and all bracketed products are **compliant** with the performance standard established for low-emitting wall systems under the Collaborative for High Performance Schools (CHPS) and the LEED v4 programs. Qualified project uses of these window films may be eligible for credit points under Ceiling and Wall Systems Program. By successful conformance with the CHPS & LEED standards, the window films also meet the criteria of **MAS Certified Green®** Program.

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 to you, please do not hesitate to contact us.

Sincerely,

MATERIALS ANALYTICAL SERVICES, LLC

A handwritten signature in black ink, appearing to read 'Robert D. Schmitter'.

Robert D. Schmitter
Manager, Emissions Group

A handwritten signature in black ink, appearing to read 'William R. Stapleton'.

William R. Stapleton
Senior Chemist

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

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COMPLIANCE EMISSIONS TEST

By California Dept. of Public Health Standard Method Version 1.1

Window Film and Adhesive Evaluation

MAS Project No.: 1301689

SAMPLE DESCRIPTION & TESTING PARAMETERS

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

Product Name: Safety Window Film with Pressure Sensitive Adhesive	MAS Assigned ID: 1301689-02
Manufacturer: Solar Gard® 4540 Viewridge Avenue San Diego, CA 92123	Product Description: self-adhering window film with pressure sensitive adhesive
Manufacture Date: December 5, 2013	Testing Period: December 16-30, 2013
Collection Date: December 6, 2013	In-Chamber Sampling Dates: December 27 @ 24 hrs, December 28 @ 48 hrs, and December 30 @ 96 hrs
Shipping Date: December 6, 2013	Date of Sample Analysis: Dec. 30-31, 2013
Laboratory Arrival Date: December 9, 2013	Age of Sample at Testing: 11 days



Solar Gard® Safety Window Film with Pressure Sensitive Adhesive as tested

SAMPLE HANDLING & EMISSIONS TESTING

The window film and adhesive sample was prepared for testing by cutting a 15 cm x 15 cm section from the submitted roll. The film's protective coating was peeled away from the film, and the film was applied to a clean glass plate according to instructions submitted by Solar Gard®. The plate was placed inside MAS's small-scale (53 liter) stainless steel emissions chamber and positioned on the floor in the center of the chamber to facilitate even air circulation around the sample.



Emissions from the sample were collected and analyzed in general accordance with ASTM D 5116-10 *Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products*. The specific parameters for 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*, 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; and **MAS Certified Green®** Program standard chamber emissions testing procedures. General testing parameters and data are presented in Appendix C.

TESTING RESULTS

In order to compare the chamber derived data to the standards established under CDPH Standard Method Version 1.1 and the CHPS criteria for Low Emitting Materials an emission factor for the 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 product in a typical school classroom and/or private office environment accounting for the specified room sizes and ventilation rates.

CDPH modeling parameters define a typical classroom as having a total window surface area of 4.46 square meters, and a typical private office as having a total window surface area of 1.49 square meters. For purposes of this report, a typical application was assumed to be the total window surface area. The results of the modeling data are presented in Table I.

Table I
Emission Factors and Predicted 96-Hour Airborne Concentrations for the
Safety Window Film in Typical Building Environments

VOC Name	Calculated Emission Factor ($\mu\text{g}/\text{m}^2\text{hr}$)	Predicted Airborne Concentration ($\mu\text{g}/\text{m}^3$)		Target CREL Limits ($\mu\text{g}/\text{m}^3$)	Testing Comment
	96 th hour (4 days)	Classroom*	Private Office**		
Total VOCs (TVOC)	<3.1	<0.075	<0.23	NA	NA
formaldehyde	<3.6	<0.085	<0.26	9	PASS/PASS
acetaldehyde	<3.3	<0.077	<0.23	70	PASS/PASS
isopropanol	<3.1	<0.074	<0.22	3500	PASS/PASS
1,1-dichloroethylene	<3.1	<0.074	<0.22	35	PASS/PASS
methylene chloride	<3.1	<0.074	<0.22	200	PASS/PASS
carbon disulfide	<3.1	<0.074	<0.22	400	PASS/PASS
MTBE	<3.1	<0.074	<0.22	4000	PASS/PASS
vinyl acetate	<3.1	<0.074	<0.22	100	PASS/PASS
hexane	<3.1	<0.074	<0.22	3500	PASS/PASS
chloroform	<3.1	<0.074	<0.22	150	PASS/PASS
2-methoxyethanol	<3.1	<0.074	<0.22	30	PASS/PASS



1,1,1-trichloroethane	<3.1	<0.074	<0.22	500	PASS/PASS
benzene	<3.1	<0.074	<0.22	30	PASS/PASS
1-methoxy-2-propanol	<3.1	<0.074	<0.22	3500	PASS/PASS
carbon tetrachloride	<3.1	<0.074	<0.22	20	PASS/PASS
1,4-dioxane	<3.1	<0.074	<0.22	1500	PASS/PASS
trichloroethylene	<3.1	<0.074	<0.22	300	PASS/PASS
epichlorohydrin	<1.6	<0.038	<0.12	1.5	PASS/PASS
2-ethoxyethanol	<3.1	<0.074	<0.22	35	PASS/PASS
n,n-dimethylformamide	<3.1	<0.074	<0.22	40	PASS/PASS
toluene	<3.1	<0.074	<0.22	150	PASS/PASS
2-methoxyethanol acetate	<3.1	<0.074	<0.22	45	PASS/PASS
tetrachloroethylene	<3.1	<0.074	<0.22	17.5	PASS/PASS
chlorobenzene	<3.1	<0.074	<0.22	500	PASS/PASS
ethylbenzene	<3.1	<0.074	<0.22	1000	PASS/PASS
m & p-xylene	<3.1	<0.074	<0.22	350	PASS/PASS
styrene	<3.1	<0.074	<0.22	450	PASS/PASS
o-xylene	<3.1	<0.074	<0.22	350	PASS/PASS
phenol	<3.1	<0.074	<0.22	100	PASS/PASS
1,4-dichlorobenzene	<3.1	<0.074	<0.22	400	PASS/PASS
isophorone	<3.1	<0.074	<0.22	1000	PASS/PASS
naphthalene	<1.6	<0.038	<0.12	4.5	PASS/PASS

* Assumes a classroom window area of 4' x 4' and 4' x 8' with a ventilation rate of 0.82 h⁻¹ as defined by CDPH/EHLB/Standard Method V.1.1

** Assumes a private office window area of 4' x 4' 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 California Department of Public Health (CDPH) target compounds in both a classroom and private office environment at the 14-day test point are **compliant** with the specified CDPH emission limits.
- Based on the findings presented in Table I, the Safety Window Film with Pressure Sensitive Adhesive is **compliant** with the performance standards established for low-emitting materials under the Collaborative for High Performance Schools (CHPS).
- In accordance with LEED v4 reporting requirements, the estimated TVOC emissions for the window film are less than 0.5 mg/m³.
- Qualified project uses of the Safety Window Film may be eligible for credit points under CHPS EQ2.2.6 for Ceiling and Wall Systems and the LEED v4 program. By successful conformance with the CHPS & LEED standards, the window film also meets the criteria of **MAS Certified Green®** Program.



LIMITATIONS

This report is intended for the use of Solar Gard® 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 our services can be established prior to their 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 dependant upon the age and conditions under which the tested sample was received.

All MAS-issued certifications for product emissions testing are valid for a period of one year from the date of this report. Compliance certifications are strictly limited to only the referenced product tested and/or specific variations explicitly referenced in this report.

APPENDIX A

Chain-of-Custody



Materials Analytical Services LLC

3945 Lakefield Court
Suwanee, Georgia 30024
Phone: 770-866-3200
Fax: 770-866-3259



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 613-760-9026				
Fax Number: 727-437-1002				
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: 12-5-2013				
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: 12-6-13		Laboratory Receipt (to be completed by Laboratory Representative)		
Number of Boxes or Pallets: 1		Received By: <i>Seals</i>		
		Received Date: <i>12/9/13</i>		
		Condition of Shipping Package: <i>ok</i>		
		Condition of Sample: <i>ok but bag open</i>		
		Remarks:		
Shipping Details				
Packed By: Jose Pichardo				
Shipping Date: 12-6-13				
Carrier/Airbill Number:				
Sample Handling				
Relinquished By	Company	Received By	Company	Date/Time
<i>Miguel Detres</i>	<i>Solar Gard</i>	<i>Seals</i>	<i>MAS</i>	<i>12/9/13</i>

APPENDIX B

Emissions Testing & Bracketing Program for Solar Gard® Window Treatments

Qualified Products and Options* *Effective January 2014 through January 2015*

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

* Solar Gard® Safety Window Film with Pressure Sensitive Adhesive was tested as a representative sample for the bracketing of the listed Solar Gard® products based on previous emissions testing and a review of the manufacturer's product information.

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:

- 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 200 cc/min for VOCs and at 300 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. 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	2.4 m h ⁻¹
Loading Factor	0.425 unit/ 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. Actual emissions measured are characterized as a concentration in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and as an emission factor in micrograms emitted per square meter of material per hour ($\mu\text{g}/\text{m}^2\text{hr}$).

Total volatile organic compounds (TVOC) are defined as the compounds eluting between hexane ($n\text{-C}_5$) and hexadecane ($n\text{-C}_{17}$) 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 C-I.

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

Sample ID#	Sample Interval in hours	TVOC Concentration in $\mu\text{g}/\text{m}^3$	TVOC Emission Factor in $\mu\text{g}/\text{m}^2 \text{ h}$
1301689-02	24	8.2	19
	48	2.3	5.4
	96	<1.3	<3.1

*TVOC values are background corrected

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

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

Sample ID#	Sample Interval in hours	Target Compound	Concentration in $\mu\text{g}/\text{m}^3$	Emission Factor in $\mu\text{g}/\text{m}^2 \text{ h}$
1301689-02	24	Formaldehyde	<1.5	<3.6
	48	Formaldehyde	<1.5	<3.6
	96	Formaldehyde	<1.5	<3.6
	24	Acetaldehyde	3.5	8.2
	48	Acetaldehyde	<1.4	<3.3
	96	Acetaldehyde	<1.4	<3.3

There were no individual volatile organic compounds (IVOCs) detected above laboratory limits after 96 hours.