

# ENVIRONMENTAL CRITERIA FOR DETERMINATION OF VOLATILE ORGANIC COMPOUND (VOC) CONTENT AND EMISSIONS OF ADHESIVES AND SEALANTS

## EC105

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ICC-ES issues Environmental Criteria (ECs) to provide interested parties with information on the requirements for obtaining an ICC-ES Verification of Attributes Report (VAR). An ICC-ES VAR provides independent verification of a manufacturer's environmental claims and product attributes. ECs address the production stage of the report subject, beginning with raw material acquisition through final manufacturing and packaging, and may also include information on projections for installation, use, reuse, and end-of-life, where specifically stated therein. This EC is effective as of the date referenced above and may be amended from time to time.

All VARs must comply with the applicable EC in effect on the date of issuance or reissuance of the report. Any technical changes to the EC will be marked within the EC. A solid vertical line (|) shall be placed in the margin within the EC to indicate a change, addition, or deletion from the previous edition. A deletion indicator (➔) shall be placed in the margin where wording has been deleted.

ICC-ES may consider alternate approaches to those contained in this EC, provided the applicant submits valid data demonstrating that the alternate approach is at least equivalent to the requirements set forth in this EC, subject to approval by ICC-ES staff. Notwithstanding that a product, material, or type or method of construction meets the requirements set forth in this EC, or that it can be demonstrated that valid alternate ECs are equivalent to the requirements in this document, ICC-ES retains the right to refuse to issue or renew a VAR, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

This EC is limited to the scope statement in Section 1.2 and is not intended to construe a comprehensive environmental claim where considerations are given to other environmental trade-offs, impacts or full life cycle assessment.

*Environmental Criteria are developed for use solely by ICC-ES for purpose of issuing ICC-ES VARs.*

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# ENVIRONMENTAL CRITERIA FOR DETERMINATION OF VOLATILE ORGANIC COMPOUND (VOC) CONTENT AND EMISSIONS OF ADHESIVES AND SEALANTS (EC105)

## 1.0 INTRODUCTION

**1.1 Purpose:** This document provides a procedure for determination of the type and amount of *volatile organic compound (VOC) content* and emissions in adhesives and sealants for evaluation in an ICC-ES Sustainable Attributes Verification and Evaluation, Verification of Attributes Report (VAR).

**1.2 Scope:** This document is limited to adhesives and sealants used inside buildings and applied on-site. Reports issued under this Environmental Criteria (EC) address raw material acquisition and production stages. Life cycle assessment considerations are outside the scope of this EC. Report users are responsible for determining compliance with applicable codes, standards and environmental regulations.

**1.3 Applicability:** VOC content limits of adhesives and sealants shall be based on the criteria in the following:

**1.3.1** 2021 and 2018 IgCC Section 801.4.2.1 (2015 and 2012 IgCC Section 806.2)

**1.3.2** CALGreen Sections 4.504.2.1, 5.504.4.1 and A5.504.4.1

**1.3.3** ICC 700-2020, ICC 700-2015 and ICC 700-2012 Section 901.10 (ICC 700 Section 901.9)

**1.3.4** ASHRAE Standard 189.1 Section 8.4.2.1

**1.3.5** ANSI/GBI 01-2021 and -2019 Section 11.2.1.1 (-2010 Section 12.2.1-A)

**1.3.6** LEED Credit IEQ4.1

**1.3.7** LEED Homes Credit MR2.2

**1.3.8** LEED 2014 (v4) for Building Design & Construction EQ Credit: Low-Emitting Materials

**1.3.9** LEED 2014 (v4) for Building Operations and Maintenance MR Credit: Facility Maintenance and Renovations

**1.3.10** LEED 2014 (v4) for Homes Design and Construction EQ Credit: Low-Emitting Product

**1.3.11** LEED 2014 (v4) for Interior Design and Construction EQ Credit: Low-Emitting Materials

### 1.4 Reference Documents:

**1.4.1** 2021, 2018, 2015 and 2012 *International Green Construction Code*<sup>TM</sup> (IgCC), International Code Council.

**1.4.2** 2022 California Green Building Standards Code (CALGreen), California Building Standards Commission.

**1.4.3** 2020, 2015, 2012 and 2008 National Green Building Standard<sup>TM</sup> (ICC 700), National Association of Homebuilders.

**1.4.4** ANSI/ASHRAE/USGBC/IES Standard 189.1-2020, -2017, -2014 and -2009 – Standard for the Design of

High-Performance Buildings (Except Low-Rise Residential Buildings), American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

**1.4.5** ANSI/GBI 01-2021, -2019 and -2010 Green Building Assessment Protocol, Green Building Initiative, Inc.

**1.4.6** LEED<sup>®</sup> 2009 for New Construction and Major Renovations, U. S. Green Building Council, Inc.

**1.4.7** LEED<sup>®</sup> 2009 for Schools New Construction and Major Renovations, U.S. Green Building Council, Inc.

**1.4.8** LEED<sup>®</sup> 2009 for Core and Shell, U.S. Green Building Council, Inc.

**1.4.9** LEED<sup>®</sup> 2009 for Commercial Interiors, U.S. Green Building Council, Inc.

**1.4.10** LEED<sup>®</sup> for Homes Rating System, Version 2008, U.S. Green Building Council, Inc.

**1.4.11** LEED<sup>®</sup> 2014 (v4) for Building Design & Construction, U.S. Green Building Council, Inc.

**1.4.12** LEED<sup>®</sup> 2014 (v4) for Building Operations and Maintenance, U.S. Green Building Council, Inc.

**1.4.13** LEED<sup>®</sup> 2014 (v4) for Homes Design and Construction, U.S. Green Building Council, Inc.

**1.4.14** LEED<sup>®</sup> 2014 (v4) for Interior Design and Construction, U.S. Green Building Council, Inc.

**1.4.15** ASTM D3960-05(2018), Standard Practice of Determining Volatile Organic Compound (VOC) Content of Paints & Related Coatings, ASTM International.

**1.4.16** ASTM D5116-17, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products, ASTM International.

**1.4.17** SCAQMD Method 302-91 (revised February 1993), Distillation of Solvents from Paints, Coatings and Inks, South Coast Air Quality Management District<sup>1</sup>.

**1.4.18** SCAQMD Method 303-91 (revised February 1993), Determination of Exempt Compounds, South Coast Air Quality Management District<sup>1</sup>.

**1.4.19** SCAQMD Method 304-91 (revised February 1996), Determination of Volatile Organic Compounds (VOC) in Various Materials, South Coast Air Quality Management District<sup>1</sup>.

**1.4.20** SCAQMD Method 313-17, Determination of Residual Hydrocarbons in Rubber Crumb, South Coast Air Quality Management District<sup>1</sup>.

**1.4.21** SCAQMD Method 316A-92 (revised October 1996), Determination of Volatile Organic Compounds VOC in Materials Used for Pipes and Fittings, South Coast Air Quality Management District<sup>1</sup>.

<sup>1</sup> Available from the South Coast Air Quality Management District web site at <http://www.aqmd.gov/home/research/methods-procedures>

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**1.4.22** SCAQMD Method 316B-97, Determination of Volatile Organic Compounds VOC in Adhesive Containing Cyanoacrylates, South Coast Air Quality Management District<sup>1</sup>.

**1.4.23** SCAQMD Rule 1168 (Amended October 6, 2017 and January 7, 2005) – Adhesive and Sealant Applications, South Coast Air Quality Management District<sup>1</sup>.

**1.4.24** CDPH/EHLB/Standard Method, Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 (January 2017) and Version 1.1 (February 2010), California Department of Health Services<sup>2</sup>.

**1.4.25** U.S. EPA Method 24, Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings, United States Environmental Protection Agency<sup>3</sup>.

### 1.5 Terms and Definitions:

**1.5.1 Total Volatile Organic Compound (TVOC):** Sum of the concentrations of all identified and unidentified *volatile organic compounds* between and including n-pentane through n-heptadecane (i.e., C<sub>5</sub> – C<sub>16</sub>) as measured by gas chromatography/mass spectrometry total ion-current chromatogram method and are quantified by converting the total area of the chromatogram in that analytical window to toluene equivalents. (2015 and 2012 IgCC Section 202).

**1.5.2 Volatile Organic Compound (VOC):** A volatile chemical compound based on carbon chains or rings that typically contain hydrogen and sometimes oxygen, nitrogen and other elements and that has a vapor pressure greater than 0.1 mm of mercury at room temperature. (2015 and 2012 IgCC Section 202).

**1.5.3 Volatile Organic Compound Content (VOC Content):** Mass of the VOC present in a coating material, as determined under specified conditions.

### 2.0 REQUIRED DATA

**2.1 Product Description:** Information on the product to be evaluated. The information shall include the product name, style, part or model number, physical description, and a production flowchart with respect to amount and type of VOC-emitting components, as well as the overall manufacturing process. Additionally, all relevant specifications must be provided for the product, the components and/or constituents used to manufacture the product, and the components used with the product in the final assembly. Specifications must be consistent with the products as described in the submitted test reports and quality documentation. As an example, for mixed materials (wet and dry), the following must be provided:

- i. Specifications of incoming materials, or the date of the signed, controlled document that describes each constituent and its specifications.
- ii. Mix ratios of the constituents, or the date of the signed, controlled document that describes the mix ratio.
- iii. Finished product specifications (for example, for wet products, specific gravity and viscosity; for formed products, weight, compressive strength, etc.).

When agreed to by ICC-ES, in lieu of providing the actual specifications, the applicant may identify the controlled document that describes the product specifications, provided the document is identified by a revision level and/or date.

When the product specifications are not provided to ICC-ES except through reference to a controlled document as described in the preceding paragraph, the controlled document describing the product specifications shall be made available to the inspection agency for their review and their verification, during the qualifying inspection described in Section 3.3, that the product specifications are consistent with the product described in the original qualifying data.

**2.2 Packaging and Identification:** A description of the packaging method and field identification of the product shall be submitted. Identification shall include the ICC-ES VAR number.

**2.3 VOC Content:** The results of testing to determine the *VOC content* shall be provided. The *VOC content* shall be determined by one of the applicable test methods set forth in this section. The *TVOC* content shall be indicated in grams per liter (g/L) and shall exclude water and any colorants added at the point of sale. The test report shall state the method used to determine *VOC content* and contain the calculations indicating the *TVOC* content.

**2.3.1 Adhesives and Sealants – General:** The *VOC content* shall be determined in accordance with SCAQMD Rule 1168 for the 2021 and 2018 IgCC (U.S. EPA Method 24 or SCAQMD Method 304 for the 2015 and 2012 IgCC). The exempt compound content shall be determined by either SCAQMD Method 303 or ASTM D4457 in accordance with SCAQMD Rule 1168 for the 2021 and 2018 IgCC (Methods 302 and 303 or ASTM D 3960 for the 2015 and 2012 IgCC). The test report shall state the type and amount of any exempt compound content. **Exception:** The *VOC content* for PVC, CPVC, and ABS pipe solvent cements and primers for plastic pipes shall be determined as set forth in Section 2.3.2. The *VOC content* for cyanoacrylate adhesives shall be determined as set forth in Section 2.3.3.

<sup>2</sup> Available from the California Department of Public Health website at [https://www.cdph.ca.gov/programs/cdphp/deodc/ehlb/iaq/cdph%20document%20library/cdph-iaq\\_standardmethod\\_v1\\_2\\_2017\\_ada.pdf](https://www.cdph.ca.gov/programs/cdphp/deodc/ehlb/iaq/cdph%20document%20library/cdph-iaq_standardmethod_v1_2_2017_ada.pdf)

<sup>3</sup> Available from the U.S. EPA web site at <https://www.epa.gov/emc/method-24-surface-coatings>

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**2.3.2 PVC, CPVC, and ABS Pipe Solvent Cements and Adhesive Primers:** The *VOC content* shall be determined as set forth in SCAQMD Method 316A.

**2.3.3 Cyanoacrylate Adhesives:** The *VOC content* shall be determined as set forth in SCAQMD Method 316B.

**2.4 VOC Emissions (Optional):** Specific VOC emission rates, as determined by testing in accordance with ASTM D 5116 utilizing the requirements set forth in Sections 2.0, 3.1, 3.3 (for adhesives), 3.4 (for sealants) and 3.7 through 3.10 of CDPH/EHLB/Standard Method, shall be submitted when such evaluation under Section 801.4.2.1.1 of the 2021 and 2018 IgCC (Table 806.2(2) of the 2015 and 2012 IgCC) is sought.

### 3.0 QUALITY CONTROL

**3.1 Required Elements of the Quality System Documentation:** Quality system documentation shall be submitted that meets the following requirements:

**3.1.1** The documentation shall be signed and dated by an authorized representative of the manufacturer.

**3.1.2** The documentation shall clearly state the facility name of the manufacturing location, the street address and telephone number, and the name of the contact person at the facility.

**3.1.3** There shall be provisions for the quality system documentation to be reviewed at least annually. A record of revisions shall be maintained.

**3.1.4** The documentation shall indicate how the evaluated product is to be identified in the field. This information shall be consistent with the information in the "Identification" section of the VAR, and should include a copy of the product label or a description of what is included on the label. Product labeling shall include, at a minimum, the report holder's name, the VAR number (ICC-ES VAR-XXXX), and information required by the applicable environmental criteria.

**3.1.5** Based on the product labeling, the quality system shall provide a means to trace finished product back to the production and quality control records at the manufacturing facility.

**3.1.6** The documentation shall describe the manufacturing process.

**3.1.7** The documentation shall include provisions for the documenting of product changes, evaluation of product changes and notification to the appropriate parties.

**3.1.8 Incoming Materials:** The documentation shall include procedures regarding inspections or tests that are conducted on incoming materials, or other means used to determine that the materials meet specifications (for example, mill test reports, certificates of analysis, certificates of compliance, etc.). If incoming material requiring a certificate at the time of receipt does not carry a certificate, then the documentation shall contain provisions for the material to be segregated until it has been appropriately tested or inspected, or the certificate is received.

**3.1.9 In-process Quality Control:** The documentation shall describe in-process quality control procedures, including how manufacturing processes are monitored to ensure that the product is consistently manufactured within the allowable tolerances.

**3.1.10 Final Inspection:** The documentation shall detail any final inspections and/or tests that are conducted before the product is labeled and shipped, to ensure that the finished product complies with specifications and applicable design values.

**3.1.11 Nonconforming Materials:** The documentation shall specify how nonconforming materials—incoming materials, materials in production, and finished materials—are segregated from production until a decision is made as to their disposition.

**3.1.12** When products are manufactured at multiple locations, the report applicant shall submit quality system documentation for each of the manufacturing sites.

**3.1.13** When the product is manufactured by a party other than the report holder, a form provided by ICC-ES to the applicant to cover this circumstance shall be submitted.

**3.2** The following declarations shall be provided to ICC-ES in a signed and dated affidavit from the report holder:

**3.2.1** The ICC-ES name, mark, or report number will only be used on products that are in compliance with the VAR and the quality system documentation.

**3.2.2** The report holder will promptly investigate and respond to ICC-ES when apprised by ICC-ES of complaints concerning product performance.

**3.2.3** The report holder agrees to permit ICC-ES representatives to examine, at distribution points and the manufacturing plant, any product labeled as being in conformance with the VAR.

**3.2.4** ICC-ES will be notified in writing if there is a significant change in the product, manufacturing procedures or quality system documentation from what was evaluated upon issuance of the VAR.

**3.3** Prior to issuance of a VAR, an initial on-site inspection of the manufacturing facility shall be conducted by an ICC-ES representative or a representative of an accredited inspection agency with the proper technical disciplines.

**3.4** At the time of renewal of a VAR, a third-party inspection of the manufacturing facility shall be conducted as a condition of renewal of the report. This inspection shall verify that no changes to the manufacturing process, raw materials or quality program, as they relate to the *VOC content* or emissions of the finished product, have occurred.

### 4.0 VAR EVALUATION

**4.1** The VAR shall identify the specific product, style or model and colors for which data was submitted.

**4.2** The VAR shall state the determined *VOC content* (in grams per liter), the VOC emissions level (when evaluation is sought under Section 2.4), and the test method used.

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**4.3** Where the VAR subject is regulated by the scope of the International Building Code and/or International Residential Code, and is the subject of a current ICC-ES evaluation report, the following statement shall be included:

“See ICC-ES evaluation report ESR-XXXX for compliance with IBC and/or IRC code requirements.”

**4.4** Where the VAR subject is regulated by the scope of the International Building Code and/or International

Residential Code but is not the subject of a current ICC-ES evaluation report, the following statement shall be included:

“Evaluation of the VAR subject for compliance with the requirements of the IBC and/or IRC is outside the scope of this evaluation report and evidence of compliance must be submitted by the permit applicant to the Authority Having Jurisdiction for approval.” ■