

Proposal for Control of Volatile Organic Compound Emissions from Adhesives and Sealants



Environmental Protection Department
Hong Kong Special Administrative Region Government

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PURPOSE

This paper sets out the Hong Kong Special Administrative Region Government's proposed regulatory scheme to reduce emissions of Volatile Organic Compounds (VOCs) from adhesives and sealants used in Hong Kong. You are invited to take time to read this consultation paper to help shape the final scheme by sending us your views on or before **20 June 2008**.

BACKGROUND

VOCs and Air Pollution

2. VOCs are emitted as gases from certain solids or liquids. They are found in a wide array of products. Examples include solvent-borne paints, printing inks and many consumer products, adhesives and sealants. VOCs play a significant role in the formation of ozone and respirable suspended particulates (RSPs) in the atmosphere. Under sunlight, they react with nitrogen oxides (NO_x) to form ozone through a photochemical process. Ground level ozone is a highly reactive gas, and when in high concentration can irritate the eyes and bring upper and lower respiratory symptoms to healthy people. It may also provoke asthmatic attacks in people who already have asthma. There is also evidence that prolonged exposure to high concentration of ozone may cause permanent damage to lung tissue and interfere with functioning of the immune system. RSPs can penetrate deeply into the lung and interfere with functioning of the respiratory system. Apart from the long-term health effects, RSPs can also exacerbate smog phenomenon and impair visibility of the region, which is a very important factor in the public's perception of a city's environmental condition.

Overseas Practices

3. In view of the harmful effects of VOCs, some countries, including the United States (US), Canada and European Union (EU), have started years ago to introduce VOC limits on various VOC-containing products, including adhesives and sealants. The US Environmental Protection Agency (USEPA) sets VOC limits on adhesives in 1998 under the National Volatile Organic Compound Emissions Standards for Consumer Products. Among various states in the US, California has been pioneering on the most stringent VOC limits, driven by the adverse air quality in the South Coast areas in the past. The South Coast Air Quality Management District (SCAQMD) implemented a rule in 1989 to reduce VOC emissions from the use of adhesives and sealants.

The rule was amended in 2005 to lower the VOC limits for some product types (e.g. certain architectural adhesives and contact adhesives). Other states in the US and other countries (e.g. Canada and Australia) have followed California in establishing VOC limits on adhesives and sealants. In Canada, “A Program to Reduce Volatile Organic Compound Emissions by 40 Percent from Adhesives and Sealants” was published in 1994. The proposed Consumer Products Regulation to control the VOC emissions from adhesives and sealants is planned to be effective in 2009. In the EU, eco-labelling criteria for adhesive coating have been set since 2004. Guidance for adhesive coating including footwear manufacturing has been provided in 2004.

Regional Air Quality

4. To improve the air quality of the Pearl River Delta Region, the Hong Kong Special Administrative Region Government (the Government) and the Guangdong Provincial Government reached a consensus in April 2002 to reduce, on a best endeavour basis, the regional emissions of four major pollutants, namely sulphur dioxide, NO_x, RSPs and VOCs by 40%, 20%, 55% and 55% respectively by 2010, using the emission levels at 1997 as a base. Achieving the emission reduction targets will enable Hong Kong to meet its current air quality objectives. This will also significantly improve the smog problem.

5. The Government has been implementing a series of programmes to reduce pollutant emissions, including VOCs, from various major sources including motor vehicles. A regulation was introduced in 1999 and amended in 2005 to require the use of effective vapour recovery systems to reduce petrol vapour emissions (which are VOCs) during petrol unloading and vehicle refuelling at petrol filling stations. A regulation¹ was introduced on 1 April 2007 to impose VOC limits on architectural paints/coatings, printing inks and selected consumer products, as well as requiring emission reduction devices to be installed on certain printing machines. Through these measures, VOC emissions will be significantly reduced. However, to ensure that the 55% VOC reduction target will be achieved by 2010 and to tackle the smog problem, we need to take further action to reduce VOC emissions as far as possible.

¹ Air Pollution Control (Volatile Organic Compounds) Regulation.

THE PROPOSAL

Overall Framework

6. The proposed control scheme will be incorporated into the existing Air Pollution Control (Volatile Organic Compounds) Regulation¹ (the Regulation) by extending the regulated product lists to cover adhesives and sealants and following the control framework of the current regulation. The regulated adhesives and sealants shall cover adhesive primers and sealant primers (Regulated Products).

7. The proposed control scheme comprises:

- (i) Maximum limits will be imposed on the VOC content of the Regulated Products;
- (ii) Importers and local manufacturers will be banned from importing or local manufacturing Regulated Products exceeding the VOC limit after the relevant VOC limit becomes effective (the Effective Date) for local sale and use;
- (iii) Importers and local manufacturers are required to disclose the product information (including the VOC content) in the Material Safety Data Sheets, trade catalogues, packaging or containers of any Regulated Products manufactured or imported after the relevant VOC limit becomes effective;
- (iv) Importers and local manufacturers are required to report annual sales amount and other requested information of the Regulated Products for the preceding calendar year, by 31 March of each year, starting in the year immediately after the year the relevant VOC limit becomes effective; and
- (v) Importers and local manufacturers are required to keep records for at least three years of the sales amount and other information reported to the Environmental Protection Department (the Authority), and to produce them upon request for inspection by the Authority.

¹ Reference about the regulation can be found at following website:
http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/voc_reg.html

Coverage and VOC Content Limits

8. A product categorisation list with associated VOC content limits to be imposed by reference to the requirements of California can be found in Annex 1 and 2. California has a long history in regulating VOCs in their fight against smog pollution in the South Coast area. It is noted that the Californian authority has fully considered commercial as well as technological feasibilities and other relevant socio-economic factors when introducing the statutory VOC limits. It is also a set of evolving standard, taking into account social and technological advancements over time. It should be stressed that the standard is trade neutral, i.e. any products complying with the standard may be imported and sold in the market irrespective of the origin of production.

9. A total of 48 types of adhesives and sealants appeared in the list with their respective limit value ranging from 30 to 850 grams of VOCs per litre.

10. Annex 3 gives the definition of exempt compounds not counted as VOC, and Annex 4 gives the calculation method for determining VOC content in adhesives and sealants.

Determination of VOC Content

11. VOC testing would not necessarily be the only basis for determining the VOC content in the Regulated Products as manufacturers should be able to ascertain the VOC content of their products by virtue of their formulations. However, it serves as the means for ascertaining and confirming the VOC content figures. Importers or manufacturers may like to exercise due diligence and resort to laboratory testing should they find it warranted in case of doubt.

12. However, VOC testing in accordance with designated testing methods would be the Authority's basis to check compliance of the legal VOC limits.

Designated Testing Methods

13. The USEPA Test Method 24 '*Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings*' shall be used for determining VOC content of adhesives and sealants, and the SCAQMD Method 303 '*Determination of Exempt of Compounds*' shall be used for determining content of the exempt compounds.

14. The VOC content of PVC, CPVC, ABS pipe cements and adhesive primer for plastic shall be determined by the SCAQMD Method 316A "*Determination of Volatile Organic Compounds (VOC) in Materials Used for Pipes and Fittings*".

15. The designated testing methods shall be the version most recently approved by the authority.

Display of Product Information

16. To make it easier for consumers to compare and choose from the wide variety of Regulated Products, and the Authority to enforce the Regulation, product information such as the category of adhesives/sealants, date of manufacture, manufacturer's recommendations regarding thinning, reducing, or mixing of product and the recommended mixing ratios, if applicable, and maximum VOC content on ready to use condition when used in accordance with manufacturer's recommendation, shall be provided in the product's Material Safety Data Sheet, catalogue, packaging, or container.

Sales-reporting

17. In order to ascertain the effectiveness of the proposed control, it is necessary to maintain accurate emission inventories before and after its implementation. Critical piece of information that would affect significantly the accuracy of the emission inventories are the sales volumes of different adhesive and sealant products in Hong Kong. Among others, the best approach for ensuring the accuracy of the data is to require the importers and local manufacturers to provide their respective sales volume and VOC content data to the Government on a confidential basis.

Offences and Penalties

18. Offences in the Regulation will include, inter alia, manufacturing or importing Regulated Products in excess of the relevant VOC limits and failing to report the sales data. Existing laws also provide for offences in failing to provide information about the origin of suspected products without reasonable defence, providing false information and obstructing the Authority in carrying out the inspection or collection of testing samples. Penalties in the Regulation ranges from fines of up to \$200,000 and imprisonment of up to six months, depending on the severity of the offences (see Annex 5).

The Effective Date

19. Given the pressing need to improve Hong Kong's air quality, we consider it appropriate to aim to enact the amended Regulation no later than mid of 2009, with the VOC limits to be effective on 1 January 2010.

YOUR VIEWS

20. We invite your views and comments on the proposed regulatory control scheme for adhesives and sealants. Please send in your comments to us before **20 June 2008** by mail/electronic mail/facsimile to the following:

Environmental Protection Department
33/F, Revenue Tower
5 Gloucester Road
Wanchai
Hong Kong
(Attn.: VOC Consultation - Adhesives/Sealants)
E-mail address: VOCConsult@epd.gov.hk
Facsimile: 2838 2155
Telephone enquiry: 2594 6593

21. Please note that the Government would wish, either in discussion with others or in any subsequent report, whether privately or publicly, to be able to refer to and attribute views submitted in response to this consultation document. Any request to treat all or part of a response in confidence will be respected, but if no such request is made, it will be assumed that the response is not intended to be confidential.

Proposed VOC Control on Adhesives

(a) Scope of Products Regulated

The proposed control apply to all adhesives excluding products exclusively represented on the container or in accompanying literature (e.g. label, sticker, packaging, etc.) for the following types or uses:

- (i) any aerospace component;
- (ii) any aerosol adhesive and primer dispensed from aerosol spray cans;
- (iii) any cyanoacrylate adhesive;
- (iv) any light curable adhesive with a VOC content no more than 50 grams per litre, less water and less exempt compounds;
- (v) any adhesive used to fabricate orthotics and prosthetics under a practitioner's prescription;
- (vi) any shoe, luggage and handbag repair adhesive;
- (vii) any adhesive used in research and development programs and quality assurance laboratories;
- (viii) any adhesive applied during solvent welding operations used in the manufacturing of medical devices;
- (ix) any adhesive used in tyre repair;
- (x) any adhesive used exclusively for thin metal laminating operations, provided that the adhesive contains less than 780 grams of VOC per litre of adhesive, less water and less exempt compounds in ready to use condition; or
- (xi) any screen printing adhesive.

(b) Proposed Effective Date: 1 January 2010

(c) VOC Content Limit

Regulated Adhesive Type	Maximum Limit of VOC Content in Ready to Use Condition*
(1) Architectural Applications	
(a) Carpet Pad Adhesive	50
(b) Ceramic Tile Adhesive	65
(c) Cove Base Adhesive	50
(d) Dry Wall and Panel Adhesive	50
(e) Indoor Carpet Adhesive	50
(f) Multipurpose Construction Adhesive	70
(g) Outdoor Carpet Adhesive	150
(h) Rubber Flooring Adhesive	60
(i) Single-Ply Roof Membrane Adhesive	250
(j) Structural Glazing Adhesive	100
(k) Subfloor Adhesive	50
(l) VCT and Asphalt Tile Adhesive	50
(m) Wood Flooring Adhesive	100

Regulated Adhesive Type	Maximum Limit of VOC Content in Ready to Use Condition*
<p>(2) Adhesive Specialty Applications</p> <p>(a) ABS Welding</p> <p>(b) Adhesive Primer for Plastic</p> <p>(c) Adhesive Primer for Traffic Marking Tape</p> <p>(d) Computer Diskette Manufacturing</p> <p>(e) Contact Adhesive</p> <p>(f) CPVC Welding</p> <p>(g) Elastomeric Adhesive with 15% or more by Weight Natural or Synthetic Rubber</p> <p>(h) Graphic Arts Adhesive</p> <p>(i) Paper, Fabric, and Film Coating Adhesive</p> <p>(j) Plastic Cement Welding</p> <p>(k) PVC Welding</p> <p>(l) Sheet-Applied Rubber Lining Operations</p> <p>(m) Special Purpose Contact Adhesive</p> <p>(n) Structural Wood Member Adhesive</p> <p>(o) Top and Trim Adhesive</p> <p>(p) Tyre Retread Adhesive</p> <p>(q) Wood Flat Stock Adhesive</p>	<p>325</p> <p>550</p> <p>150</p> <p>350</p> <p>80</p> <p>490</p> <p>730</p> <p>150</p> <p>265</p> <p>250</p> <p>510</p> <p>850</p> <p>250</p> <p>140</p> <p>250</p> <p>100</p> <p>250</p>
<p>(3) Adhesive Substrate Specific Applications[#]</p> <p>For adhesives, adhesive bonding primers, adhesive primers or any other primers not regulated by Category (1) and (2) above and applied to the following substrates, the following limits shall apply:</p> <p>(a) Fiberglass</p> <p>(b) Metal</p> <p>(c) Plastic Foams</p> <p>(d) Porous Material (except wood)</p> <p>(e) Wood</p>	<p>80</p> <p>30</p> <p>50</p> <p>50</p> <p>30</p>
<p>(4) Any adhesives, adhesive bonding primers, adhesive primers, or any other primers not falling within Category (1) to (3) above</p>	<p>250</p>

* For low-solids adhesives, the VOC limit is expressed in grams of VOC per litre of adhesive while for other adhesives, VOC limits are expressed in grams of VOC per litre of adhesive less water and less exempt compounds. For the purpose of compliance check, the VOC content in ready to use condition would be the maximum VOC content when the adhesive is in a condition ready to be applied to the surface, i.e. no more dilution or conditioning of the adhesive is required, in accordance to the manufacturer's recommendations for application. For example, when a range of ratios is recommended for dilution with organic solvent, the highest dilution ratio should be used to give the maximum VOC content.

[#] If an adhesive is used to bond dissimilar substrates together, the applicable substrate type with the highest VOC content shall apply.

(d) Most Restrictive Limit

If by any representation on the container or in accompanying literature (e.g. label, sticker, packaging, etc.) of the product states that the product is suitable for more than one regulated type in Category (1) and (2) of Section (c) above, the lowest VOC content limit shall apply.

(e) Prohibition of Toxic VOCs

The Regulated Products in Section (c) above shall not contain chloroform, ethylene dichloride, perchloroethylene, trichloroethylene, and equal to or more than 1% by weight of methylene chloride.

(f) Major Definitions Relevant to the Regulated Adhesives

- (1) “acrylonitrile-butadiene-styrene (ABS)” plastic is made by reacting monomers of acrylonitrile, butadiene, and styrene and is normally identified with an ABS marking.
- (2) “adhesive” is any substance that is used to bond one surface to another surface by attachment. Adhesive includes adhesive bonding primer, adhesive primer, adhesive primer for plastic, and any other primer, but does not include aerosol adhesive, products used on humans and animals, adhesive tape, contact paper, wallpaper, shelf liners, or any other product with an adhesive incorporated onto or in an inert substrate.
- (3) “adhesive bonding primer” is an adhesive applied to a surface to improve the bond of subsequent adhesives and sometimes to inhibit corrosion.
- (4) “adhesive primer” is a coating applied to a substrate, prior to the application of an adhesive, to provide a bonding surface.
- (5) “adhesive primer for plastic” is a material applied to a plastic substrate before applying an Adhesive in order to obtain better adhesion.
- (6) “adhesive primer for traffic marking tape” is any adhesive primer to be applied to surfaces prior to installation of traffic marking tape.
- (7) “aerosol adhesive” means any adhesive packaged as an aerosol product in which the spray mechanism is permanently housed in a non-refillable can designed for hand-held application without the need for ancillary hoses or spray equipment.
- (8) “architectural application” is the use of a material on stationary structures, including mobile homes, and their appurtenances. Appurtenances to an architectural structure include, but are not limited to: hand railings, cabinets, bathroom and kitchen fixtures, fences, rain gutters and downspouts, and windows.
- (9) “carpet pad adhesive” is an adhesive used for the installation of a carpet pad (or cushion) beneath a carpet.
- (10) “ceramic tile adhesive” is an adhesive used for the installation of ceramic tile products.
- (11) “chlorinated polyvinyl chloride (CPVC)” plastic is a polymer of the chlorinated polyvinyl monomer that contains 67% chlorine and is normally identified with a CPVC marking.

- (12) “computer diskette manufacturing” is the process where the fold-over flaps are glued to the body of a vinyl jacket.
- (13) “contact adhesive” is an adhesive applied to two separate surfaces, allowed to dry, and brought together for adhesion and bonding with subsequent pressure.
- (14) “cove base adhesive” is an adhesive used during the installation of cove base (or wall base), which is generally made of vinyl or rubber, on a wall or vertical surface at floor level.
- (15) “cyanoacrylate adhesive” is a single-component reactive diluent adhesive that contains at least 85 percent by weight ethyl, methyl, methoxymethyl or other functional groupings of cyanoacrylate.
- (16) “dry wall adhesive” is an adhesive used during the installation of gypsum dry wall to studs or solid surfaces.
- (17) “elastomeric adhesive” means an adhesive containing natural or synthetic rubber applied by any means to ships, boats, and their appurtenances, and to buoys and drilling rigs intended for the marine environment.
- (18) “graphic arts adhesive” means an adhesive used in gravure, letterpress, flexographic, and lithographic printing operation, or related coating or laminating operation such as in the binding or laminating of magazines, books, or other printed materials.
- (19) “indoor carpet adhesive” is an adhesive used during the installation of a carpet that is in an enclosure and is not exposed to ambient weather conditions during normal use.
- (20) “laminating operation” is a process where two or more layers of material is composed to form a single, multiple-layer sheet by using an adhesive.
- (21) “light curable adhesives” are single-component reactive adhesives that cure upon exposure to visible-light, ultra-violet light or to an electron beam.
- (22) “low-solids adhesive” is an adhesive which has less than 120 grams of solids per litre of material.
- (23) “low-solids adhesive primer” is an adhesive primer which has less than 120 grams of solids per litre of material.
- (24) “multipurpose construction adhesive” is any adhesive to be used for the installation or repair of various construction materials, including but not limited to: dry wall, subfloor, panel, fiberglass reinforced plastic (FRP), ceiling tile, and acoustical tile.
- (25) “outdoor carpet adhesive” is an adhesive used during the installation of carpet that is not in an enclosure and is exposed to ambient weather conditions during normal use.
- (26) “panel adhesive” is an adhesive used for the installation of plywood, pre-decorated hardboard (or tileboard), fiberglass reinforced plastic, and similar pre-decorated or non-decorated panels to studs or solid surfaces.
- (27) “paper, fabric, and film coating adhesive” means an adhesive used in paper coating, fabric coating, or film coating application process where a layer of adhesive is applied

and/or cured to paper, fabric, and/or film substrate that forms a film on a coating line. Such coating line shall include coating applicators, heating or drying ovens, any dryers, and any other equipment where VOC emissions occur.

- (28) “plastic cement welding” is the use of adhesives made of resins and solvents which are used to dissolve the surfaces of plastic, except ABS, CPVC, and PVC plastic, to form a bond between mating surfaces.
- (29) “polyvinyl chloride (PVC)” plastic is a polymer of the chlorinated vinyl monomer that contains 57 percent chlorine.
- (30) “porous material” is a substance which has tiny openings, often microscopic, in which fluids may be absorbed or discharged. Such materials include, but are not limited to, wood, fabric, paper and corrugated paperboard.
- (31) “reactive diluent” is a liquid which is a VOC during application and one in which, through chemical and/or physical reactions, such as polymerization, 20 percent or more of the VOC becomes an integral part of a finished material.
- (32) “rubber flooring adhesive” is an adhesive that is used for the installation of flooring material in which both the back and the top surface are made of synthetic rubber, and which may be in sheet or tile form.
- (33) “screen printing adhesive” means an adhesive used in screen printing, which is a printing process in which the adhesive is passed through a taut web or fabric to which a refined form of stencil has been applied.
- (34) “sheet-applied rubber lining operation” is the hand application of sheet rubber lining to metal or plastic substrates in order to protect the underlying substrate from corrosion or abrasion. These operations also include laminating sheet rubber to fabric.
- (35) “shoe, luggage and handbag repair adhesive” is an adhesive used to repair worn, torn or otherwise damaged uppers, soles, and heels of shoes, or for making repairs to luggage and handbags.
- (36) “single-ply roof membrane adhesive” is any adhesive to be used for the installation or repair of single-ply roof membrane. Installation includes, but is not limited to attaching the edge of the membrane to the edge of the roof and applying flashings to vents, pipes, or ducts that protrude through the membrane.
- (37) “special purpose contact adhesive” is a contact adhesive that is used to bond all of the following substrates to any surface: melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber and wood veneer 0.16 cm or less in thickness.
- (38) “structural glazing adhesive” is any adhesive to be used to adhere glass, ceramic, metal, stone, or composite panels to exterior building frames.
- (39) “structural wood member adhesive” is an adhesive used for the construction of any load bearing joints in wooden joists, trusses, or beams.
- (40) “subfloor adhesive” is an adhesive used for the installation of subflooring material over floor joists.

- (41) “top and trim adhesive” is an adhesive used during the installation of vehicle and marine trim, including, but not limited to, headliners, vinyl tops, vinyl trim, sunroofs, dash covering, door covering, floor covering, panel covering and upholstery.
- (42) “tyre retread adhesive” is any adhesive to be applied to the back of precured tread rubber and to the casing and cushion rubber, or to be used to seal buffed tyre casings to prevent oxidation while the tyre is being prepared for a new tread.
- (43) “VCT” means vinyl composition tile and is a material made from thermoplastic resins, fillers and pigments.
- (44) “wood flat stock adhesive” means an adhesive used for manufacturing interior wood panels and exterior wood siding, which include but are not limited to, redwood, cedar or plywood stocks, plywood panels, chipboards, composition hard boards, and any other panels or siding constructed of solid wood or a wood-containing product. Wood flat stock adhesive does not include any adhesive used in laminating of fiberglass, metal, or plastic sheets to wood panels.
- (45) “wood flooring adhesive” is an adhesive used to install a wood floor surface, which may be in the form of parquet tiles, wood planks, or strip-wood.

Proposed VOC Control on Sealants

(a) Scope of Products Regulated

The proposed control apply to all sealants excluding products exclusively represented on the container or in accompanying literature (e.g. label, sticker, packaging, etc.) for the following types or uses:

- (i) any aerospace components;
- (ii) any light curable sealant with a VOC content no more than 50 grams per litre, less water and less exempt compounds;
- (iii) any sealant used in research and development programs and quality assurance laboratories;
- (iv) any sealant applied during solvent welding operations used in the manufacturing of medical devices;

(b) Proposed Effective Date: 1 January 2010

(c) VOC Content Limit

Regulated Sealant Type	Maximum Limit of VOC Content in Ready to Use Condition *
(1) Sealants (excluding sealant primers)	
(a) Portable Sealant or Caulking Compounds # (except roof cements and roof sealants; insulating foams; removable caulking compounds; clear/ paintable/water resistant caulking compounds; floor seam sealers; products represented exclusively for vehicle uses; or sealers that are applied as continuous coatings)	50
(b) Architectural	250
(c) Marine Deck	760
(d) Nonmembrane Roof	300
(e) Roadway	250
(f) Single-Ply Roof Membrane	450
(g) Others	420

Regulated Sealant Type	Maximum Limit of VOC Content in Ready to Use Condition *
(2) Sealant Primers	
(a) Architectural (Non-Porous)	250
(b) Architectural (Porous)	775
(c) Marine Deck	760
(d) Modified Bituminous	500
(e) Others	750

* For low-solids sealants, the VOC limit is expressed in grams of VOC per litre of sealant; while for other sealants, VOC limits are expressed in grams of VOC per litre of sealants less water and less exempt compounds. For the purpose of compliance check, the VOC content in ready to use condition would be the maximum VOC content when the sealant is in a condition ready to be applied to the surface, i.e. no more dilution or conditioning of the sealant is required, in accordance to the manufacturer's recommendations for application. For example, when a range of ratios is recommended for dilution with organic solvent, the highest dilution ratio should be used to give the maximum VOC content.

#Other sealants not regulated as "Portable Sealant or Caulking Compounds" shall comply with the limits for Type (b) to (g) of Category (1) or Category (2) except sealers that are applied as continuous coatings.

(d) Most Restrictive Limit

If by any representation on the container or in accompanying literature (e.g. label, sticker, packaging, etc.) of the product states that the product is suitable for more than one regulated type in Section (c) above, the lowest VOC content limit shall apply.

(e) Prohibition of Toxic VOCs

The Regulated Products in Section (c) above shall not contain chloroform, ethylene dichloride, perchloroethylene, trichloroethylene, and equal to or more than 1% by weight of methylene chloride.

(f) Major Definitions Relevant to the Regulated Sealants

- (1) "architectural sealant or sealant primer" is any sealant or sealant primer applied to stationary structures, including mobile homes, and their appurtenances. Appurtenances to an architectural structure include, but are not limited to: hand railings, cabinets, bathroom and kitchen fixtures, fences, rain gutters and downspouts, and windows.
- (2) "clear/paintable/water resistant caulking compounds" means a compound which contains no appreciable level of opaque fillers or pigments; transmits most or all visible light through the caulk when cured; is paintable; and is immediately resistant to precipitation upon application.
- (3) "floor seam sealer" means any product designed and labelled exclusively for bonding, fusing, or sealing (coating) seams between adjoining rolls of installed flexible sheet flooring.

- (4) “light curable sealant” is a single-component reactive sealant that cure upon exposure to visible-light, ultra-violet light or to an electron beam.
- (5) “low-solids sealant” is a sealant which has less than 120 grams of solids per litre of material.
- (6) “low-solids sealant primer” is a sealant primer which has less than 120 grams of solids per litre of material.
- (7) “marine deck sealant” is any sealant to be applied to wooden marine decks.
- (8) “marine deck sealant primer” is any sealant primer to be applied to wooden marine decks.
- (9) “modified bituminous primer” consists of bituminous materials, and a high flash solvent used to prepare a surface by (a) improving the adhesion and (b) absorbing dust from the surface for adhesive, or flashing cement bitumen membrane.
- (10) “non-membrane roof sealant” is any sealant to be used for installation or repair of non-membrane roofs. This type includes plastic or asphalt roof cement, asphalt roof coatings, and cold application cement.
- (11) “porous material” is a substance which has tiny openings, often microscopic, in which fluids may be absorbed or discharged. Such materials include, but are not limited to, wood, fabric, paper, corrugated paperboard, and plastic foam.
- (12) “portable sealant or caulking compounds” means any product with adhesive properties that is designed to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces but does not include:
 - (a) products that are incorporated into or used exclusively in the manufacture or construction of the goods or commodities at the site of the establishment;
 - (b) units of product, less packaging, which weigh more than 453 grams or consist of more than 473 millilitres;
 - (c) roof cements and roof sealants;
 - (d) insulating foams;
 - (e) removable caulking compounds;
 - (f) clear/paintable/water resistant caulking compounds;
 - (g) floor seam sealers;
 - (h) products designed exclusively for vehicle uses; or
 - (i) sealers that are applied as continuous coatings.
- (13) “reactive diluent” is a liquid which is a VOC during application and one in which, through chemical and/or physical reactions, such as polymerization, 20 percent or more of the VOC becomes an integral part of a finished material.
- (14) “removable caulking compounds” means a compound which temporarily seals windows or doors for three to six month time intervals.
- (15) “roadway sealant” is any sealant to be applied to public streets, highways, and other surfaces, including but not limited to curbs, berms, driveways, and parking lots.

- (16) “sealant” is any material with adhesive properties that is formulated primarily to fill, seal, or waterproof gaps or joints between two surfaces. Sealants include sealant primers and caulks.
- (17) “sealant primer” is any product applied to a substrate, prior to the application of a sealant, to enhance the bonding surface.
- (18) “single-ply roof membrane sealant” is any sealant to be used for the installation or repair of single-ply roof membrane to the edge of the roof and applying flashings to vents, pipes, or ducts that protrude through the membrane.

List of Exempt Compounds for Adhesives and Sealants

1. acetone
2. ethane
3. methyl acetate
4. parachlorobenzotrifluoride (PCBTF)
5. perchloroethylene (tetrachloroethylene)
6. 1,1,1-trichloroethane (methyl chloroform)
7. trichlorofluoromethane (CFC-11)
8. dichlorodifluoromethane (CFC-12)
9. 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113)
10. 1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114)
11. chloropentafluoroethane (CFC-115)
12. chlorodifluoromethane (HCFC-22)
13. chlorofluoromethane (HCFC-31)
14. 2,2-dichloro-1,1,1-trifluoroethane (HCFC-123)
15. 1,2-dichloro-1,1,2-trifluoroethane (HCFC-123a)
16. 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124)
17. 1,1-dichloro-1-fluoroethane (HCFC-141b)
18. 1-chloro-1,1-difluoroethane (HCFC-142b)
19. 1-chloro-1-fluoroethane (HCFC-151a)
20. 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC 225ca)
21. 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC 225cb)
22. methylene chloride (dichloromethane)
23. trifluoromethane (HFC-23)
24. difluoromethane (HFC-32)
25. 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC-43-10mee)
26. pentafluoroethane (HFC-125)
27. 1,1,2,2-tetrafluoroethane (HFC-134)
28. 1,1,1,2-tetrafluoroethane (HFC-134a)
29. 1,1,1-trifluoroethane (HFC-143a)
30. 1,1-difluoroethane (HFC-152a)
31. ethylfluoride (HFC-161)
32. 1,1,1,2,3,3-hexafluoropropane (HFC-236ea)
33. 1,1,1,3,3,3-hexafluoropropane (HFC-236fa)
34. 1,1,2,2,3-pentafluoropropane (HFC-245ca)
35. 1,1,2,3,3-pentafluoropropane (HFC-245ea)
36. 1,1,1,3,3-pentafluoropropane (HFC-245fa)
37. 1,1,1,2,3-pentafluoropropane (HFC-245eb)
38. 1,1,1,3,3-pentafluorobutane (HFC-365mfc)
39. cyclic, branched, or linear, completely methylated siloxanes (VMS)
40. cyclic, branched, or linear, completely fluorinated alkanes
41. cyclic, branched, or linear, completely fluorinated ethers with no unsaturations
42. cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations
43. sulphur-containing perfluorocarbons with no unsaturations and with sulphur bonds only to carbon and fluorine
44. 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane (C₄F₉OCH₃ or HFE-7100)
45. 1-ethoxy-1,1,2,2,3,3,4,4-nonafluorobutane (C₄F₉OC₂H₅ or HFE-7200)
46. 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane [(CF₃)₂CF₂OC₂H₅]
47. 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane [(CF₃)₂CF₂OC₂H₅]

Method of Calculating the VOC Content of Adhesives and Sealants

(1) For adhesives or sealants that do not contain reactive diluents¹, the VOC content in ready to use condition in grams of VOC per litre of adhesive or sealant, less water and less exempt compounds, except a low-solids adhesive or sealant² shall be calculated according to the following equation:

$$\frac{\text{Grams of VOC per Litre of Adhesive or Sealant,}}{\text{Less Water and Less Exempt Compounds}} = \frac{W_a - W_b - W_c}{V_d - V_e - V_f}$$

where W_a = weight of volatile compounds in grams
 W_b = weight of water in grams
 W_c = weight of exempt compounds in grams
 V_d = volume of material in litres
 V_e = volume of water in litres
 V_f = volume of exempt compounds in litres

(2) For adhesives and sealants that contain reactive diluents, the VOC content of the adhesive or sealant is determined after curing according to procedure recommended by the manufacturer. The VOC content in grams of VOC per litre of adhesive or sealant, less water and less exempt compounds, except a low-solids adhesive or sealant shall be calculated according to the following equation:

$$\frac{\text{Grams of VOC per Litre of Adhesive or Sealant,}}{\text{Less Water and Less Exempt Compounds}} = \frac{W_g - W_h - W_i}{V_j - V_k - V_l}$$

¹ Reactive diluent is a liquid which is a VOC during application and one in which, through chemical and/or physical reactions, such as polymerization, 20 percent or more of the VOC becomes an integral part of a finished material. For the purpose of compliance check, only product represented on the container or in accompanying literature (e.g. label, sticker, packaging, etc.) to contain reactive diluents and indicate curing procedures will follow the relevant equation (i.e. the 2nd equation in this Annex), if applicable, for calculating the VOC content.

² Low-solids adhesive or sealant is an adhesive or a sealant which has less than 120 grams of solids per litre of material.

where W_g = weight of volatile compounds not consumed during curing in grams
 W_h = weight of water not consumed during curing in grams
 W_i = weight of exempt compounds not consumed during curing in grams
 V_j = volume of material prior to curing in litres
 V_k = volume of water not consumed during curing in litres
 V_l = volume of exempt compounds not consumed during curing in litres

(3) For low-solids adhesives or sealants, the VOC content in ready to use condition in grams of VOC per litre of adhesive or sealant shall be calculated according to the following equation:

$$\text{Grams of VOC per Litre of Adhesive or Sealant} = \frac{W_a - W_b - W_c}{V_d}$$

where W_a = weight of volatile compounds in grams
 W_b = weight of water in grams
 W_c = weight of exempt compounds in grams
 V_d = volume of material in litres

Maximum Penalties for Various Offences

Offence	Maximum Penalty
Importing into Hong Kong or manufacturing in Hong Kong Regulated Products in excess of the statutory VOC limits	\$200,000 and 6 months' imprisonment
Failure to display product information, or to submit an annual report with specific information for Regulated Products	\$50,000 and 3 months' imprisonment
Failure to keep records or failure to retain such records for at least three years of Regulated Products imported or manufactured for local sale or use	\$50,000 and 3 months' imprisonment
Failure to produce upon request any record of Regulated Products for inspection by the Authority	\$50,000 and 3 months' imprisonment
Knowingly or recklessly displaying, giving, reporting or recording any information concerning the Regulated Products that is misleading, false or incomplete in a material particular	\$50,000 and 3 months' imprisonment