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Proposal on Tightening the Volatile Organic Compound (VOC) Limits of Regulated Architectural Paints and Extending the VOC Control to Cleaning Products

PURPOSE

This paper seeks Members' views on our proposals to tighten the volatile organic compound (VOC) content limits of 22 types of regulated architectural paints (RAPs) and to extend the VOC control to 7 types of cleaning products with a view to improving air quality.

BACKGROUND

2. VOCs are organic chemicals that would evaporate at room temperature. Some of them are toxic while most could contribute to the formation of ozone under photochemical reactions. The ambient concentrations of major air pollutants have dropped significantly in recent years, except that of ozone, which has exhibited an increasing trend[1]. As VOCs are one of the key precursors to the formation of ozone, reducing VOC emissions at source is a critical measure to tackle the worsening ozone pollution in Hong Kong and the region.

3. In Hong Kong, non-combustion sources (mainly VOC-containing products such as paints, consumer products, printing inks, adhesives and sealants) are the major contributor to local VOC emissions, followed by road transport and marine vessels. The Government has been adopting a multi-pronged strategy to reduce local VOC emissions from these sources. Among the control measures, the Air Pollution Control (Volatile Organic Compounds) Regulation (Cap. 311W) (the Regulation)[2] was enacted in 2007 to prohibit in phases the import and local manufacture of specified products with a VOC content exceeding the relevant statutory content limits. The Regulation currently regulates 172 types of VOC-

[1] Compared with 2013, the ambient concentration of respirable suspended particulates, fine suspended particulates, nitrogen dioxide and sulphur dioxide dropped by 51%, 55%, 43% and 62% respectively in 2022. However, ozone showed an increase in concentration by 37% in the same period.

[2] Reference about the Regulation can be found at the following website: http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/voc_reg.html

containing products, including 51 types of architectural paints and six broad categories of consumer products[3]. The VOC emissions in Hong Kong have been steadily reducing due to the continuous implementation of the air pollutant emission reduction measures. The total VOC emissions have reduced by 50% from 44 100 tonnes in 2006 to 21 910 tonnes in 2020. As regards the VOC emissions from products, they have reduced by 62% to 10 330 tonnes in 2020 since the implementation of the Regulation.

(A) TIGHTENING THE VOC Content Limits of REGULATED ARCHITECTURAL PAINTS

Feasibility Study

4. The prevailing VOC limits of 51 types of RAPs covered under the Regulation were set making reference from the relevant limits adopted by countries/region worldwide such as our country's National Standard (GB Standards), the Directives of European Union (EU), relevant limits of the California Air Resource Board[4] (CARB) and the South Coast Air Quality Management District[5] (SCAQMD) of the United States of America. Among these, the SCAQMD limits are the most stringent control on architectural paints, followed by the CARB limits. Amongst the 51 RAPs, the content limits of 23 RAPs are already on par with the latest SCAQMD limits. For the remaining 28 RAPs, we have conducted an assessment on the feasibility to tighten their VOC limits, and consulted relevant stakeholders, including paint suppliers, trade associations, Hong Kong Institute of Construction, and government works departments.

5. Having considered comments received and market data of local products, the assessment found that the VOC limits of 22 out of the concerned 28 RAPs could be tightened according to the following limits in order of preference: (i) the SCAQMD limits; (ii) the CARB limits as at 2021 and (iii) other practicable limits. The VOC limits of the remaining six RAPs will remain unchanged. The findings of the assessment are summarised below:

(a) For the first group of 15 RAPs, many paint products in compliance with the most stringent SCAQMD limits are already available on the local market. It is therefore proposed to tighten the VOC limits of these 15 RAPs to the SCAQMD limits. Provisions will be made for some of the RAPs to have a higher VOC content for specific applications to meet certain technical requirements.

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[3] These six categories of consumer products are air fresheners, hairsprays, floor wax strippers, insect repellents, insecticides and multi-purpose lubricants.

[4] The VOC content limits of architectural paints set out by the CARB can be found at: https://ww2.arb.ca.gov/sites/default/files/2020-07/2020SCM_final.pdf

[5] The latest VOC content limits of architectural paints adopted in the SCAQMD can be found at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1113.pdf?sfvrsn=24

(b) For the second group of three RAPs, only a limited number of products can meet the SCAQMD limits. To ensure a stable supply of compliant products in the local market, it is proposed to tighten the VOC limits of these three RAPs to the less stringent CARB limits which were generally accepted by the trade. It is noted that CARB recently updated the VOC limits of these three RAPs in 2022, yet we propose to follow the CARB limits before the update (i.e. the limits as at 2021) which was agreed by the trade during the time of deliberation and consultation.

(c) As regards the third group of four RAPs, the trade expressed that the required performance would be impaired if only low VOC paints meeting the SCAQMD or CARB limits were allowed to be used. We have collaborated with major suppliers and conducted performance tests for these RAPs to assess the performance of low VOC products. Having regard to the findings of the test results, it is proposed to tighten the VOC limits of these four RAPs to the best practicable limits that paint suppliers considered the performance of the paints can still be maintained. Details of the performance tests are summarised in **Appendix 1**.

(d) The remaining six RAPs are widely used in severe environmental conditions to provide protection against corrosion, ultraviolet or abrasion. Lowering the VOC content of products may adversely affect the protective performance of the paints, and hence not able to comply with the technical requirements of works contracts. Meanwhile, a few products on the market could comply with the SCAQMD limits but they were not widely adopted by users. Against the above, the limits of these RAPs will remain unchanged.

Proposed Control

6. The proposed new VOC limits of the 22 RAPs are set out in **Appendix 2**. We propose that the new limits take effect from 1 January 2024. Other current provisions in the Regulation for the control of RAPs will remain unchanged.

Cost Implications

7. The proposed control has already taken into account the need to have products with higher VOC content for some specific and extreme applications to ensure that the performance of products can be maintained to meet specific technical requirements. Furthermore, according to the sales data, about 750 compliant products are available on the local market which accounts for over half of the market share generally[6]. The extensive use of a variety of low VOC paints suggested that the proposed control should not have significant cost implications.

[6] Based on the sales data of the 22 RAPs in 2016-2020, products compliant to the new, tightened limits in 19 RAPs occupied about 52% to 100% of the market share. Products compliant to the new, tightened limits in two other RAPs (namely fire-proofing exterior coatings and rust preventative coatings) took up a market share of 44% and 24% respectively. Recycled coatings are seldom used in Hong Kong.

(B) EXTENDING THE VOC CONTROL TO CLEANING PRODUCTS

Feasibility Study

8. The VOC limits of six broad categories of consumer products covered under the Regulation were set based on the most stringent control on consumer products worldwide, namely, the relevant limits set out by the CARB in the California Consumer Products Regulations (California Regulations)[7]. The Government has completed a consultancy study on consumer products to identify unregulated consumer products supplied in local chain stores and to estimate the potential VOC reduction if the unregulated consumer products are required to comply with the relevant CARB limits. The study revealed that about 80% of VOC reduction was attributable to seven types of cleaning products, namely general purpose cleaners, kitchen cleaners, glass cleaners, toilet or urinal care products, bathroom and tile cleaners, disinfectants and sanitisers.

9. To further explore the feasibility of extending the control to cleaning products, we engaged with major cleaning product suppliers for both household and institutional/commercial markets, and assessed the compliance status of local products. The assessment revealed that compliant products were commonly supplied on the household market and accepted by consumers[8]. Similar to the household market, products on institutional/commercial market showed a high compliance rate[9]. This suggested that the implementation of control would not cause substantial impacts to the product supply.

Proposed Control

10. We propose to control the VOC content of seven types of cleaning products as set out in **Appendix 3**. The proposed VOC limits are set with reference to the CARB limits of the respective products[10]. The seven types of cleaning products are proposed to be defined as shown in **Appendix 4**. The current provisions in the Regulation for the control of consumer products would be applicable to the newly controlled cleaning products, including the requirement of reporting and keeping records of manufactured or imported products, and the provisions of exemption for products that are goods in transit, in the course of transhipment, or are solely for export or re-export. To allow time for the trade to

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[7] The California Consumer Products Regulations have the most comprehensive control on consumer products which have been implemented in all districts in the state of California. See Article 1 and 2 of the California Regulations at: https://ww2.arb.ca.gov/our-work/programs/consumer-products-program/current-regulations

[8] At least 76 compliant products were identified on the household market, accounting for over 70% market share.

[9] Based on the product information provided by suppliers, nearly all high-end products were in compliance with the CARB limits. The test results of mid-end and low-end products also revealed that about 90% of the assessed products comply with the CARB limits.

[10] For kitchen cleaners, the proposed limit is set with reference to the limit for "oven or grill cleaners" so as to allow a higher degreasing capability to cope with the grease generated from the stir-frying and deep-frying in Chinese-style cooking.

prepare for necessary product reformulation, we propose that the control on cleaning products takes effect from 1 January 2025.

Efficacy of Cleaning Products

11. VOCs are typically used as propellants and solvents in cleaning products. VOCs used as propellants can be replaced by other alternatives without affecting the cleaning performance. As for VOCs used as solvents, the suppliers confirmed that the overall performance of cleaning products could maintain a satisfactory level after reformulation of the products to the proposed limits.

12. The efficacy of disinfectants and sanitisers has also been duly considered to ensure that public health would not be jeopardised by limiting the VOC content of these products. CARB conducted a review[11] to assess the potential impacts of the CARB limits on the disinfecting function of disinfecting products. The review determined that products complying with the CARB limits could still achieve a satisfactory level of disinfecting or sanitising function. We have approached the Centre of Health Protection and Hospital Authority for their comments on the proposed VOC limits of disinfecting products. They did not have any adverse comments on the proposed VOC limits from the public health perspective.

13. Major active ingredients of disinfecting products on the local market include sodium hypochlorite, benzalkonium chloride and chloroxylenol. Sodium hypochlorite is not a VOC, while benzalkonium chloride has relatively low volatility and is exempted from the control under the Regulation. For products containing chloroxylenol, VOC solvent is added because chloroxylenol is not easily soluble in water. The VOC content of these products is comparatively low and able to comply with the proposed limits. In addition, alcohol-based disinfecting products (usually contains 60-80% isopropyl alcohol) are also commonly used as anti-epidemic products against the COVID-19 epidemic. Making reference to the California Regulations, the proposed definitions for disinfectants and sanitisers have excluded these products such that they would not be subject to the proposed control. Moreover, with reference to the provisions in the California Regulations, products labelled solely for use on medical equipment or in medical establishments would be exempted from the proposed control.

Cost Implications

14. The extensive use of low VOC cleaning products indicated that the proposed control should have little impacts on the product price. For those products requiring reformulation, no substantial impact on the product cost is expected given that the VOC component only accounts for a very small portion of the products. For end-users on institutional/commercial market such as cleaning contractors and property management agents, the relevant trade association

[11] Technical Support Document for the 2006 proposed amendments to the California Regulation published by CARB. (https://ww3.arb.ca.gov/regact/cpwg2006/appena.pdf).

indicated that the proposed control would not pose any significant cost implications to the trade.

VOC REDUCTION

15. The limits of VOC contents proposed for RAPs and the seven types of cleaning products are generally on par with the most stringent control for the relevant products worldwide. It is estimated that the implementation of the two control proposals could reduce about 700 tonnes of VOC emissions annually.

PUBLIC CONSULTATION

16. We had been engaging the paint industry and stakeholders as early as 2017 and engaging the cleaning product industry and stakeholders since 2019 during the course of drafting of the two control proposals. In addition to that, we issued consultation papers on the two control proposals in December 2021 and December 2022 respectively to solicit comments from over 750 stakeholders, including importers, suppliers, trade associations, green groups, government departments, professional and academic institutions. Two briefing sessions for the two proposals were held in January 2022 and February 2023 respectively to explain the details of the proposals to the trade and stakeholders.

17. The control proposals in paragraphs 6 and 10 are generally supported by the stakeholders. The proposed VOC limits, definition of the regulated products and implementation dates have taken into account the comments received in the public consultation.

LEGISLATIVE TIMETABLE

18. We aim at introducing the amendment of the Regulation to the Legislative Council in the fourth quarter of 2023.

ADVICE SOUGHT

19. Members are invited to comment on the proposals set out in paragraphs 6 and 10 of this paper.

Environment and Ecology Bureau
July 2023

Appendix 1

Summary of assessments on performance of four types of regulated architectural paints

In 2017-2019, the Environmental Protection Department (EPD) in collaboration with the paint suppliers, professional institution, trade association and government works departments conducted an assessment on the feasibility and extent to tighten the VOC limits of 28 regulated architectural paints (RAPs) which are not on par with the latest SCAQMD limits.

2. Amongst the concerned 28 RAPs, paint suppliers expressed that the required performance of four RAPs (set out in the table below) would be impaired if only low VOC paints meeting the SCAQMD/ CARB limits are allowed to be used. To explore the feasibility of tightening the VOC limits of these four RAPs, we collaborated with paint suppliers to conduct performance tests on these RAPs.

RAP	Prevailing limit (g/L)	SCAQMD limit / CARB limit (g/L)	Test on functional performance
Roof coatings (non-exposed) (P08-17)	250	50 / 50	Waterproofing function
Clear lacquers[#] i) Clear brushing lacquers (P08-04) ii) Clear wood finishes (lacquers) (P10-01)	 650 550	 275 / 275 275 / 275	Gloss level and protection from scratches
Rust preventative coatings (P10-14)	400	100 / 250	Resistance to rusting

"Clear brushing lacquers (P08-04)" and "clear wood finishes (lacquers) (P10-01)" are very similar in nature and have similar applications. They are collectively categorised as "lacquers" in the SCAQMD. Hence, they were collectively considered as "clear lacquers" in the assessments.

3. For each RAP, a readily available product that can comply with the SCAQMD limit (i.e. low VOC paint) and another product with a less stringent limit

which has similar primary ingredients and application characteristics (i.e. high VOC paint) were selected to assess their performance with details as follows:

(I) Assessment on decorative performance

- The Hong Kong Institute of Construction was commissioned to conduct assessments on finished coatings with low and high VOC paints respectively and provide expert views on the craftsmanship of paint application and aesthetic appearance of finished coatings.

(II) Assessment on protective performance

- Having considered the specific property of each paint type, suitable performance tests were identified to assess the technical performance of low and high VOC coatings. The performance test methods were commonly adopted in the paint industry and agreed by paint suppliers beforehand.

- As humidity is a crucial factor of coating formation during the curing process, the performance tests were carried out with duplicate samples prepared under two different humidity conditions (i.e. 65% and 90% relative humidity), having regard to the weather conditions in Hong Kong.

4. EPD also commissioned the Hong Kong Productivity Council to conduct a review on the findings and provide recommendations on the assessments. The findings and recommendations were given as follows:

(i) Roof coatings (non-exposed) (P08-17)

The test revealed that there was no water penetration through the concrete substrates coated with either the low or high VOC paints. There was not any deviation in performance in the samples prepared under different curing conditions. Considering that non-exposed roof coatings will need to withstand additional loading of building materials, landscaping facilities, and motor vehicles, etc. in real applications (e.g. for application on podium) and the water permeability test could not take into account these factors, it is proposed to tighten the VOC content limit of non-exposed roof coatings to a less stringent limit of 150 g/L, which is the best practicable limit that paint suppliers considered the performance of the paint can still be maintained.

(ii) Clear lacquers (P08-04 and P10-01)

The results of the tests revealed that samples using either low or high VOC paints and prepared under different curing conditions had similar performance. Low VOC paints could not achieve similar gloss level as the conventional high VOC paints. In addition, the low VOC paint samples had more obvious imprint after curing. The aesthetic appearance may not be acceptable to clients requiring a smooth and glossy finish. The low VOC paints were inferior from a decorative perspective. Given the unsatisfactory decorative performance of low VOC paints as revealed from the assessments, it is proposed to tighten the VOC content limit of clear lacquers to a less stringent limit of 400 g/L, which is the best practicable limit that paints suppliers considered the performance of the paint can still be maintained.

(iii) Rust preventative coatings (P10-14)

The samples coated with low VOC paint rusted earlier and the extent of rusting was more severe than that of the samples with high VOC paint. Samples prepared under different curing conditions had similar results. The test results indicated that the rust preventative performance of the low VOC paint was inferior to that of the high VOC paint. Given the unsatisfactory rust preventative performance of low VOC paints as revealed from the assessments, it is proposed to tighten the VOC content limit of rust preventative coatings to a less stringent limit of 350 g/L, which is the best practicable limit that paint suppliers considered the performance of the paint can still be maintained.

Appendix 2

Proposed new VOC limits of 22 types of regulated architectural paints

Item	Regulated Architectural Paint (Regulated Product Code)	Prevailing VOC Limit (g/L)	Proposed New VOC Limit^ (g/L)
I) VOC limits to be tightened to the SCAQMD limits			
1	Aluminium roof coatings (P08-01)	250	100
2	Concrete-curing compounds (P08-06)	350	100 (350 for road and bridge works/in severe conditions)
3	Dry-fog coatings (P08-07)	400	50
4	Fire-proofing exterior coatings (P08-08)	350	150
5	Mastic coatings (P08-12)	300	100
6	Other architectural coatings (P08-13)	250	50
7	Recycled coatings (P08-15)	250	150
8	Specialty primers (P08-20)	350	100
9	Waterproofing concrete or masonry sealers (P08-24)	400	100 (400 for road and bridge works/in severe conditions)
10	Fire-retardant coatings (clear) (P09-01)	650	150
11	Fire-retardant coatings (pigmented) (P10-04)	350	150
12	Primers, sealers and undercoaters (P10-11)	200	100 (200 for outdoor applications)
13	Quick-dry primers, sealers and undercoaters (P10-13)	200	100 (200 for outdoor applications)

Item	Regulated Architectural Paint (Regulated Product Code)	Prevailing VOC Limit (g/L)	Proposed New VOC Limit^ (g/L)
14	Traffic coatings (P10-16)	150	100
15	Waterproofing sealers (P10-17)	250	100
II)	VOC limits to be tightened to the CARB limits as at 2021		
16	Non-flat coatings (P09-06)	150	100
17	Floor coatings (P10-05)	250	100
18	Quick-dry enamels (P10-12)	250	100
III)	VOC limits to be tightened to best practicable limits		
19	Clear brushing lacquers (P08-04)	650	400
20	Roof coatings (non-exposed) (P08-17)	250	150
21	Clear wood finishes (lacquers) (P10-01)	550	400
22	Rust preventative coatings (P10-14)	400	350

Notes:

^ The VOC content in a ready-to-use condition shall be determined by USEPA Method 24 and SCAQMD Method 303 and using the equations set out in Schedule 1 – Part 5 of the Regulation.

Appendix 3

Proposed VOC limits of seven types of cleaning products

Item	Cleaning Product	Proposed VOC Content Limit (% VOC by weight**)	
		Aerosol	Non-aerosol
1	Bathroom and tile cleaners	7	1
2	Disinfectants	70	1
3	General purpose cleaners	8	0.5
4	Glass cleaners	10	3
5	Kitchen cleaners	8	4
6	Sanitisers	70	1
7	Toilet or urinal care products	10	3

Notes:

** The VOC content in a ready-to-use condition shall be determined by Method 310 using the calculation methods as set out in Schedule 3 – Part 7 of the Regulation.

Appendix 4

Proposed definitions of seven types of cleaning products

(1) BATHROOM AND TILE CLEANER

means any product designed or labelled to clean tile or surfaces in bathroom.

(2) DISINFECTANT

means any product that is labelled as a "disinfectant", or is designed or labelled primarily to destroy or irreversibly inactivate infectious or other undesirable bacteria, pathogenic fungi, or viruses on surfaces or inanimate objects. Products that are labelled as both a "sanitiser" and a "disinfectant" are considered disinfectants.

"Disinfectant" does not include any of the following:

(i) products labelled solely for use on humans or animals;
(ii) products labelled solely for agricultural use;
(iii) products labelled solely for use in swimming pools, therapeutic tubs, or hot tubs;
(iv) products labelled solely for use on medical devices or medical equipment surfaces;
(v) products labelled solely for use in medical, convalescent, or veterinary establishments;
(vi) products labelled solely for use on food-contact surfaces;
(vii) products labelled solely for use on fabrics;
(viii) products labelled as containing not less than 60% (by volume) ethanol, isopropanol or n-propanol, or a combination of these substances; or
(ix) products which are designed or labelled with other primary functions that make disinfecting or sanitising claims on the label.

(3) GENERAL PURPOSE CLEANER

means any product that is designed or labelled to clean hard surfaces in homes, garages, patios, commercial, or institutional environments. “General Purpose Cleaner” includes products that clean appliances, counters, walls, cabinets or floors and products that claim to clean a variety of similar surfaces such as plastics, stone or metal.

“General Purpose Cleaner” does not include “Kitchen Cleaner”, dishwashing detergents and “Single Purpose Cleaner”.

"Single Purpose Cleaner" means any product that is designed or labelled exclusively to clean one specific object or its parts that is not subject to any other regulated category, except that a cleaning product that claims to clean a single appliance, counter, wall, cabinet or floor is a general purpose cleaner.

(4) GLASS CLEANER

means any product designed or labelled primarily for cleaning surfaces made of glass.

"Glass Cleaner" does not include products designed or labelled solely for the purpose of cleaning optical materials used in eyeglasses, photographic equipment, scientific equipment and photocopying machines.

(5) KITCHEN CLEANER

means any product that is designed or labelled exclusively to:

(i) clean hard surfaces in kitchens; and/or

(ii) remove greases or deposits from food preparation or food cooking appliances including but not limited to range hoods, stoves, microwave ovens and ovens.

"Kitchen cleaner" does not include dishwashing detergents.

(6) SANITISER

means any product that is labelled as a "sanitiser," or is designed or labelled primarily to reduce, but not necessarily eliminate, microorganisms in the air, on surfaces, or on inanimate objects.

"Sanitiser" does not include any of the following:

(i) "Disinfectant";

(ii) products labelled solely for use on humans or animals;

(iii) products labelled solely for agricultural use;

(iv) products labelled solely for use in swimming pools, therapeutic tubs, or hot tubs;

(v) products labelled solely for use on medical devices or medical equipment surfaces;

(vi) products labelled solely for use in medical, convalescent or veterinary establishments;

(vii) products labelled solely for use on food-contact surfaces;

(viii) products labelled solely for use on fabrics;

(ix) products labelled as containing not less than 60% (by volume) ethanol, isopropanol or n-propanol, or a combination of these substances; or

(x) products which are designed or labelled with other primary functions that make disinfecting or sanitising claims on the label.

(7) <u>TOILET OR URINAL CARE PRODUCT</u>

means any product that is designed or labelled to clean or to deodorise toilet bowl, toilet tank, or urinal.