

## Volatile Organic Compounds (VOC) Limits

**Editorial Note** - This version of this document amends the limits for specification 0260/2 from average of 60 to 65g/L in Table 1 and adds  $\leq$  to all Average figures.

### 1. INTRODUCTION

This document details the limits on Volatile Organic Compounds (VOC) which will apply for a range of APAS paint specifications for the interval 2007 - 2011.

VOCs contribute negatively to air pollution by participating in the chemical reactions that take place in the atmosphere and produce a variety of air pollution effects including the effect known as "smog".

The "Guide to VOC Reduction in Decorative Coatings" produced by the CEPE (European Industrial Council for Paints, Printing Inks and Artists' Colours) Technical Committee states:

*"The action of sunlight on NO<sub>x</sub> and VOCs leads to the formation of ground level ozone, a long-range pollutant, which can impact on rural areas at some distance from the original source of emission. Ozone can irritate the eyes and lungs, causing breathing difficulties, and may reduce resistance to infection. Ozone can also damage some vegetation, crops and trees.*

*Ozone levels are normally higher on still, sunny, summer days, when the air is already polluted with NO<sub>x</sub> and VOCs (eg urban areas with traffic). Because of the time required for the chemical reactions to take place, ozone formation tends to occur downwind of the pollution. The resulting smog may persist for several days and can be transported over long distances".*

VOCs also contribute negatively to indoor air quality through emissions, both during and after curing, into the daily living environment. As a result, they impact on individual health and well-being including personal allergic reactions. This aspect of VOCs is not the subject of this APAS Document.

In 1996 APAS began setting limits for VOC content of approved products. Since then, progressive reductions have been made and this version of the Document details the latest round of reductions which have been arrived at in consultation with, and agreement by, the peak paint industry body (Australian Paint Manufacturers Federation - APMF).

The limits set in this document apply only to paint products sold in Australia.

APAS Approved Products for which VOC limits are not currently specified within this document, are not required to comply with these VOC restrictions at this time.

### 2. DEFINITION OF VOC

VOCs are considered to be organic compounds in paint formulations (either as individual ingredients of the formula or as part of eg an intermediate raw material) that have;

- A) a vapour pressure  $>0.01$ mm Hg at 21°C, or
- B) an initial boiling point  $<250$ °C measured at a standard pressure of 101.3 kPa.

**Note 1** Ammonia will be classified as a VOC

**Note 2:** acetone is not considered a VOC as current evidence indicates it does not participate in smog forming reactions.

### 3. DETERMINATION OF VOC CONTENT

The VOC content of a paint or coating shall be determined by one or more of the following methods;

1. Using raw material supplier's data that corresponds with the above definition of VOC, by calculation for each of the raw materials and individual ingredients in any intermediate raw materials, the total VOC content of the formula, or

**Note 3:** Where the supplier fails to report VOC content for the ingredient in accordance with the above definition, or where the intermediate formula is not known, the VOC content must be determined by method 2 below

2. Determined experimentally in accordance with ASTM D3960 as qualified below,

By determining the weight percent non volatile content (and hence the volatile content) by ASTM D2369 (60 minutes at  $110 \pm 5^\circ\text{C}$ ) and converting to g/L (as per ASTM D3960). This method is inappropriate for constituents that decompose at elevated temperature.

**Note 4** The VOC shall be expressed to include any thinning solvent recommended as mandatory on the label or data sheet for the method of application proposed.

**Note 5** Tinter additions are excluded from VOC calculations.

### 4. REPORTING OF RESULTS

Results shall be reported on APAS document D182. The results shall be expressed in terms of the weight of VOC per litre of wet paint and is equal to:

$$\frac{[\text{mass of volatiles (g)} - \text{mass of water (g)} - \text{mass of exempt volatiles (g)}]}{[\text{volume of wet paint (L)}]}$$

### 5. ARCHITECTURAL COATINGS

In order to allow greater formulating flexibility where manufacturers of certain high volume architectural products, have a number of products eg tinting bases approved to the one APAS specification, APAS allows the use of average *and* maximum VOC calculations. This allows paint formulators greater flexibility in formulating paints that require higher VOC content to make them easier to apply. These paints (typically deep and ultra deep-style tint bases) are significantly lower in sales volume compared to whites and light tint bases so have less of an impact on the environment.

Where a manufacturer has more than one architectural product approved against an APAS specification, an average VOC shall be calculated across those approved products. The average for that product list shall not exceed the average figure quoted in this Document.

Split-fills or re-labels shall not be included in the calculation, only master or parent formulae.

In addition, within that product list, no single product shall have a VOC content greater than the Maximum limit specified in this Document.

The manufacturer's approved products shall comply to both the Average and Maximum limits set in this document.

### 6. FORMULATION CHANGES

Where minor formulation changes are made to APAS Approved Products to achieve VOC limits, full resubmission will not be required. Rather it will only be necessary to provide test results relevant to those properties which could be expected to be altered by the formulation change. For example, for reduction of a coalescent agent in an architectural latex paint, test results showing basic application properties, coalescence, mudcracking and washability tests would typically suffice.

### 7. NEW SPECIFICATIONS

APAS will progressively introduce new specifications to accommodate the development of new VOC replacement technology. (One aspect of this approach is that water based technologies may be introduced that contain higher VOC levels than traditional water based products, but are lower in VOCs than the solvent based products they are designed to replace).

## 8. POST 2011 REDUCTIONS

From 01/01/2011 APAS will move to a new method of setting VOC targets. Following agreement reached in 2005 with the Australian Paint Manufacturers' Federation Inc (APMF) it has been agreed that a mass balance-type calculation will be used.

The logic behind this significant change to the philosophy behind VOC content determination, is that all VOCs incorporated into paint products will (eventually) finish up in the atmosphere where they will contribute negatively towards outdoor air pollution (smog development). It does not matter what the source of the VOC is. If each manufacturer can reduce their total emissions of VOC to atmosphere, the benefit to the atmosphere will be positive.

Each manufacturer shall determine total VOC content of sales of all APAS products for the previous 12 months as at 31/12/2007 with an annual sales volume > 1000L and set this as the base line (eg 14K tonnes). Via a consensus negotiation process with the APMF, an industry-wide percentage reduction target will be set (eg 7%) for all manufacturers (eg 14K tonnes will need to be reduced by 7% to 13K tonnes by the end of the next 5 year period).

This reduction may be achieved via either formulating for lower VOC, withdrawing higher VOC ranges from the market.

## EXAMPLE 1

Manufacturer A determines on 31/12/2007 that they have at that time 17 products listed on the APAS List of Approved Products. This includes tint bases and factory mixed colours.

*Note 1: Whether APAS approval was achieved early or late in 2007 is immaterial. If the product has been available for purchase prior to 01/01/2007 but APAS approval was achieved in Nov 2007, the full year's sales of that product are taken into account. Part-year sales need to be extrapolated to full year*

The annual volume of sales of each product since 01/01/2007 will be determined and, knowing the VOC content of each, the total VOC for the year 2007 (Base Year 1) will be able to be determined (say 15.6K tonnes pa).

If the agreed VOC reduction target has been set at 10%, Manufacturer A will need to have total VOC content for calendar year 2012 of  $15.6 - 1.56 = 14.04K$  tonnes pa for that volume of product sales.

## EXAMPLE 2

If the annual sales volume of Manufacturer A's APAS approved product list has increased by 3% over Base Year 1, the required VOC reductions will need to accommodate that increase ie higher reductions per formula will be necessary to achieve the 14.04K tonne target.

## 9. REPORTING REQUIREMENTS

The manufacturer shall be responsible for gathering the necessary data and calculating the annual total VOC loading. Results shall be recorded on the form in Appendix A below (or equivalent in-house form providing same data) and shall be submitted to APAS prior to the end of March each calendar year. Original data and calculations will be inspected as part of each 2-yearly APAS audit.

## 10. FAILURE TO ACHIEVE TARGETS

Failure to achieve agreed reductions will result in removal of all APAS approvals for a minimum period of 12 months.

**TABLE 1**  
High Volume Architectural Products

VOC limits, expressed in g/litre of wet paint, applicable to selected APAS specifications are as follows:

APAS Specification	Product type	1 Jan 2007 to 31 Dec 2011	
		Average	Max
0134	Latex primer for galvanised iron & Zinalume®	≤45	50
0163/1	Exterior latex undercoat	≤55	65
0163/2	Interior latex undercoat	≤60	65
0172	Interior sealer	≤50	60
0183	Exterior timber primer	≤50	60
0260/1	Interior gloss	≤75	90
0260/2	Interior semi gloss	≤65	80
0260/3	Interior low sheen	≤50	75
0260/4	Interior flat - washable	≤60	70
0260/5	Interior flat - ceilings	≤50	60
0280/1	Exterior gloss	≤60	85
0280/2	Exterior semi gloss	≤60	80
0280/3	Exterior flat & low sheen	≤45	70
0280/4	Exterior gloss	≤65	80
0280/5	Exterior low sheen	≤50	80

**TABLE 2**  
Other Architectural Products

APAS Specification	Product type	1 Jan 2007 to 31 Dec 2011 maximum
0011	Solvent borne roof paint for galvanised steel	450
0012	Latex roof paint	100
0015	Exterior/interior alkyd, gloss & semi gloss	450
0016	Interior & exterior undercoat	450
0024	Exterior oil & petrol resistant enamel	450
0029	Undercoat (oil & petrol resistant)	450
0032	Metal primer (buildings - excl. lead & chromates)	550
0055	One pack exterior varnish (general purpose)	550
0070/1	Chalkboard paint – solvent based	450
0070/3	Chalkboard paint – water based	100
0114	One pack Interior varnish (general purpose)	500
0115	Lightly pigmented ranch finish - exterior timber	450
0162	Zinc phosphate metal primer	550
0171	Interior solvent based sealer	450
0181	Primer	450
0200	One pack pigmented solvent borne paving paint	550
0202	One pack pigmented latex paving paint	80
0215	Low odour/low environmental impact	5

**TABLE 3**

**Industrial & Protective Coatings Products**

VOC limits, expressed in g/litre of wet paint, applicable to selected APAS specifications are as follows:

<b>APAS Specification</b>	<b>Product type</b>	<b>1 Jan 2007 to 31 Dec 2011 maximum</b>
0006	Army Olive Drab enamel	550
0009	Undercoat for Army Olive Drab flat enamel	550
0041/2	Roadmarking paint - solvent borne	450
0041/5	Roadmarking paint – White water borne	60
2901	Protective coatings for steel - latex	100
2920	Polysiloxane coating	400
2921	Protective coatings for steel - primers	450
2922	Protective coatings for steel – modified alkyd finish	450
2930	Single pack moisture cure urethane for steel	400
2940	MIO or aluminium coating subject to continuous condensation	350
2971	Epoxy primers, 2 pack	400
2972	Low build epoxy GP enamel, 2 pack	350
2973	Solvent borne epoxy to 400 µm, 2 pack	350
2974	Solventless epoxy to 400 µm, 2 pack	120
2975	Ultra high build epoxy, immersion, 2 pack	350
2976	Solvent borne epoxy mastic	180
2977	Solvent borne epoxy mastic, slow drying; high volume solids; >400 µm	180