

Guideline for VOC (Volatile Organic Compound) determination for the Protective Coatings Industry

1. Introduction.

This document is intended as a guideline for common approaches to be applied by the Protective Coatings industry concerned with the European directives on the limitation of VOC emissions. Protective Coatings can fall under two current European directives concerned with the limitation of VOC emissions. These directives are 1999/13/EC often referred to as the Solvent Emissions Directive (SED) and 2004/42/CE which is commonly described as the Product Directive (PD).

Depending upon the point of application a Protective Coating can fall within the scope of the SED (if applied within an installation) or within the scope of the PD (if applied on-site to a building). Within Directive 2004/42/CE there are product categories under the scope of which Protective Coatings can fall. These categories have defined VOC limits. However there are no VOC limits defined for Protective Coatings in Directive 1999/13/EC.

Definitions of VOC and analytical methods to be applied to determine VOC have been specified below. In practice routine analytical determination of VOC would be problematic and this guideline proposes a practical way to determine compliance with the Product Directive 2004/42/CE and to provide VOC data to users having to comply with the Solvent Emissions Directive 1999/13/EC. The purpose is to establish a uniform and accepted way of working which can be applied throughout the European Protective Coatings industry.

2. Definition and methods.

VOC definition as used in Directive 1999/13/EC (SED)

The directive specifies the following definition for VOC's:

" Volatile Organic Compound" (VOC) means any organic compound having at 293,15K a vapour pressure of 0,01kPa or more, or having a corresponding volatility under the particular conditions of use

There is no VOC content definition specified in Directive 1999/13/EC (SED), however it typically means the mass of VOC, expressed as grams per kilogram (g/kg) in the formulation of the product.

There is no VOC determination method specified in Directive 1999/13/EC (SED)

VOC definition as used in Directive 2004/42/CE (PD)

The directive specifies the following definition for VOC's:

" Volatile Organic Compound" (VOC) means any organic compound having an initial boiling point less than or equal to 250 C measured at a standard pressure of 101,3 kPa.

VOC content as specified in Directive 2004/42/CE

VOC content means the mass of VOC, expressed in grams per litre (g/l) in the formulation of the product in its ready to use condition. The mass of volatile organic compounds in a given product which react chemically during drying to form part of the coating shall not be considered part of the VOC

VOC determination as specified in Directive 2004/42/CE (PD)

Standard VOC content: ISO 11890-2

VOC content where reactive diluents are present: ASTM D 2369.

3. **General approach.**

For practical reasons the (maximum) VOC content of a product can be determined by the paint supplier based on calculation and relates to the ready for use product. Therefore the maximum VOC should be calculated based on any recommended additions of for example colourants and thinners. For this calculation data supplied by the raw material suppliers regarding solids content, VOC content and density etc. will be used. See paragraph 5 for more details.

4. **Vapour Pressure**

For calculations in accordance with the SED, VOC is to be determined based on the official stated vapour pressure specification as provided by the producers/suppliers of these materials within their product and material safety datasheet. Paint industry will apply those data which are assumed to be based on latest methods for vapour pressure determination

5. **Boiling point.**

For calculations in accordance with the Product Directive, VOC is to be determined based on the official stated boiling point specification as provided by the producers/suppliers of these materials within their product and material safety datasheet. Paint industry will apply those data which are assumed to be based on latest

methods for boiling point determination.

6. VOC calculation of ready to use product formulations.

The VOC calculation of a product has to be based on the VOC content in its ready to use state. This includes the highest amount of VOC's that may be introduced from i) recommended tinting processes outside the primary production process, ii) from VOC additions that are specified to be added to thin the product for application with the intended tools and iii) any other recommended additions - as specified on the label or technical datasheet.

Composition data of the ready for use material can be derived by calculation from the formulations (as specified for manufacturing) of the relevant products. The formulations will provide an overview of the intended volatile materials to be present in the product. VOC calculation can now be made by summation of that part of volatile organic materials originating from the formulation. Subsequently, any VOC amount from recommended tinting or thinning procedures outside the primary production process have to be included in the VOC calculation.

In case of theoretical calculation, one can use the calculated density, again derived from the density specification of the intended materials specified in the ready to use state. Alternatively the statistical upper limit of practical density determinations (in the ready for use state) can be used.

7. Practical VOC determination of products ready to use.

To assess compliance (with the relevant VOC limit) of a ready for use product by analytical measurement of VOC, the following procedure should be followed:

- Analyse the product in its ready to use state. That is the composition that gives the highest VOC that could result from any composition recommended for the product e.g. on the label or datasheet.
- Analyse the product according to the analytic methods specified in the directive being either ISO 11890-2 or ASTM D 2369 when the product contains volatile reactive diluents.
- Calculate from the analytical measurement data the VOC content in grams/liter, whereby the density of the product is measured with the appropriate density determination method (ISO 2811).

8. Published VOCs

To eliminate any confusion as regards published VOC data, the default VOC on manufacturers technical data sheets or other product literature should be a value

calculated from the formulation in accordance with SED 1999/13/EC. Any additional published VOC values that have been practically determined should indicate the method used.

9. Disputes with authorities on VOC content.

As it is to be expected that products placed on the market will frequently be based on calculated VOC content, it may arise that monitoring authorities determine by practical measurement VOC data that deviate from the ones made from theoretical calculations. In case of “borderline exceed” VOC limits, as specified in Annex II of the directive, it is recommended that any dispute is resolved by open book discussion whereby the paint company can provide background about the intended VOC content of the product.