THIRD-PARTY ASSESSMENT OF ASTHMA-FREE AND HYPOALLERGENIC MARKETING CLAIMS FOR ROMA USA, LLC EXTERIOR AND INTERIOR POTASSIUM SILICATE PAINT FORMULATIONS

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INTRODUCTION

ROMA Eco-Sustainable Building Technologies ("ROMA") has formulated architectural coverings with the stated intention of exceeding both the performance and sustainability of conventional and even "Low" or "Zero" volatile organic compound (VOC) paint and wall covering formulations. Ideally, ROMA would like to substantiate the following claims through experimental data:

- ROMA paint products are manufactured without chemicals that contribute to Sick Building Syndrome (SBS)[1]
- ROMA paint products do not contain asthmagens, are hypoallergenic, and have low to no levels of VOCs.

In order to substantiate the above claims, ROMA conducted emission chamber testing at Eurofins Air Toxics, Inc. ("Eurofins"). ToxServices recommended specific chemicals for analysis based on Eurofins' capabilities and the results of ToxServices' material health assessment presented in the ROMA Cradle to Cradle Certified™ Material Health Assessment Report (ToxServices 2014a).

ROMA initially conducted emission chamber testing with Eurofins Air Toxics, Inc. in July 2014 according to three different VOC test methods: CDPH SM V1.1-2010, ASTM D5116, and the French VOC testing guidelines.

For each of the three above-mentioned test methods, Total Volatile Organic Compounds (TVOCs) were less than 20 µg/m^3 and the emission rates were < 22 µg/(m^2*h). However, formaldehyde (which is not an intentionally-added ingredient or known residual in the ROMA Model EcoDomus Satin Deep Base paint formulation) was detected by all three test methods (ToxServices 2014b).

For this reason, ROMA reformulated the Model EcoDomus Satin Deep Base paint formulation by removing one specific ingredient. No other changes were made to the originally-tested formulation. The reformulated Model EcoDomus Satin Deep Base paint was then subject to a second round of emissions testing (TVOCs and individual VOCs) by Eurofins Air Toxics, Inc. with particular emphasis on formaldehyde. The methods and results of emissions testing on the reformulated product are discussed below.

ANALYTICAL CHAMBER TESTING METHODOLOGY

Selection of Test Sample for Chamber Testing

ToxServices reviewed 14 ROMA potassium silicate paint formulations (including both exterior and interior paints) that previously underwent a Cradle to Cradle Certified™ Material Health Assessment in order to determine which single ROMA paint model formulation would best represent the entire product line for VOC chamber testing. As a

[1] Sick Building Syndrome is defined as a situation in which occupants of a building experience acute health effects such as… that seem to be linked to time spent in a building, but for which no specific illness or cause can be identified (NSC 2009).

result of this review, ToxServices recommended the reformulated ROMA Model EcoDomus Satin Deep Base potassium silicate paint as the most representative formulation for chamber testing. ToxServices selected this formulation for testing because it contains the highest level of yellow and red scored ingredient components identified as potential asthmagens or respiratory sensitizers in ToxServices' Cradle to Cradle Certified™ Material Health Assessment Report (reference), and thus has the highest likelihood of emitting an asthmagen or respiratory sensitizer.

Eurofins Testing Methodologies

Eurofins performed emissions testing of the reformulated ROMA Model EcoDomus Satin Deep Base paint according to three test methods, as described below:

- Test System One: California Department of Public Health (CDPH) standard test method for assessment of indoor VOC emissions Version 1.1, also known as Specification 01350. (CDPH 2010, Eurofins 2015a).
    - This method was developed by the State of California and is designed to address key environmental performance issues related to the selection and handling of building materials. Specification 01350 provides manufactures with a consistent test for their products and is the key testing method used by several specification programs including SCS (FloorScore) and United States Green Building Council's (USGBC) LEED program.
    - Testing conducted under the CDPH method is based on measured emissions in a chamber over 14 days. Test results meeting all the requirements under this Method at no less than 168 hours (7 days), instead of the 336 hour (14 days) testing required under this method are acceptable provided that :
        - the specimen remains in the same chamber for the duration of the test;
        - samples of formaldehyde and TVOCs are collected and their corresponding chamber concentrations and emission factors are reported at a minimum of three time points between 24 and 120 hours, spaced at least 24 hours apart;
        - a full speciation of VOCs is performed at 168 hours according to the requirement described under this Method.
        - Chamber concentrations of VOCs of concern are determined to be constant or declining with time at the 168 hour time point.
    - The ROMA VOC chamber testing met all the requirements listed above and therefore was evaluated only to a seven day measurement period.

- Test System Two: ANSI/BIFMA M7.1-2011 and ANSI/BIFMA X7.1-2011, as recommended by Cradle to Cradle Certified™ Certified Standard 3.0 (ANSI/BIFMA 2011, C2C™ Products Innovation Institute 2013, Eurofins 2015b).
    - This test method is designed to determine air concentrations and specific emission rates of VOCs (TVOCs, very volatile organic compounds, and

semi-volatile organic compounds) and aldehydes emitted from specific product specimens in small-scale environmental chamber testing.
    - Testing conducted under the ANSI/BIFMA method measures emissions in a chamber over seven days; however, for this specific product, testing was conducted for 14 days.

- Test System Three: French guideline for indoor VOC emissions, DEVL1101903D (OJFR 2011, Eurofins 2015c).
    - This test method is designed to help manufacturers meet the requirements of the French Ministry of Ecology, Sustainable Development, Transport, and Housing's regulatory criteria which mandates emissions class labeling of all construction products and other related products used indoors, based on emission testing by 2012.

Eurofins used multiple analytical approaches to evaluate three air quality-related parameters (low molecular weight aldehydes, individual VOCs, and Total VOCs), as summarized in Table 1, below. The sample preparation, analytical method, instrumentation, and reporting limit were similar for each of the three test methods.

Table 1: Analytical Methods Used in Emissions Testing of Reformulated ROMA Model EcoDomus Satin Paint Formulation (Eurofins 2015a,b,c)

Parameter	Test Method	Analytical Method	Instrumentation	Reporting Limit
Low Molecular Weight Aldehydes	CDPH	ISO 16000-3, internal methods 9812 and 8400	HPLC/UV	3 µg/m^3
	ANSI/BIFMA	ISO 16000-3, internal methods 9812 and 8400	HPLC/UV	2 µg/m^3
	French VOCs	Internal methods 9812, 2808B, 8400	HPLC/UV	3 µg/m^3
Individual VOCs	CDPH	Internal methods 9812 and 2808	GC/MS	2 µg/m^3
	ANSI/BIFMA	Internal methods 9812 and 2808	GC/MS	2 µg/m^3
	French VOCs	ISO 16000-3, -6, -9, -11	GC/MS	2 µg/m^3
TVOCs	CDPH	Internal methods 9812 and 2808	GC/MS	5 µg/m^3
	ANSI/BIFMA	Internal methods 9812 and 2808	GC/MS	2 µg/m^3
	French VOCs	ISO 16000-3, -6, -9, -11	GC/MS	2 µg/m^3

VOC – volatile organic chemical; *TVOC* – total volatile organic chemicals; *HPLC/UV* – high pressure liquid chromatography with ultraviolet detection; *GC/MS* – gas chromatography/mass spectrometry.

Eurofins performed testing according to each test method in the following manner:

1. The ROMA paint sample was sent by the client to the laboratory of Eurofins Product Testing A/S (Denmark) in an airtight sealed package. The package was opened and the test specimen was transported uncovered into a stainless steel, 119 L test chamber immediately (internal method 9810).
2. The size of each test specimen was 30 cm x 40 cm, equivalent to a total area of 0.12 m^3. Each sample was homogenized, mixed with water, and applied in layers onto a glass plate using the application procedure detailed in Table 2, below (internal method 9811). The ratio of sample surface area to air volume was 1 m^2 sample: 1 m^3 air.

Table 2: Sample Preparation Procedure for ROMA Paint Samples

Layer	Application Amount (g/m^3)	Mixing Ratio (Paint : Water)	Drying Time (Hours)
1	78	5.25 : 1	1
2	78	5.25 : 1	16
3	78	5.25 : 1	-

Figure 1, below, displays the ROMA potassium silicate paint Model EcoDomus Satin Deep Base paint sample as it is prepared and placed in the stainless steel test chamber.

Figure 1: Reformulated ROMA Paint Model EcoDomus Stain Deep Base VOC Chamber Testing Sample

3. Prior to placing samples in the test chamber, a background/blank check of the chamber air was conducted. During testing, the chamber was maintained at

23°C, 50% relative humidity, and an air exchange rate of 0.5/hour.

1. Emissions (TVOCs and individual VOCs) from the prepared paint samples were tested by drawing air samples from the chamber outlet through Tenax® TA tubes[2]. The following VOC analyses were performed by thermal desorption followed by gas chromatography / mass spectroscopy (GC/MS) (internal methods 9812 and 2808); aldehydes were evaluated by drawing chamber air through DNPH-coated tubes, followed by solvent desorption and high-performance liquid chromatography with UV/diode array detection (internal methods 9812 and 8400)
    a. Test System One: Volatile aldehydes and TVOC levels were measured at 11 and 12 days. Volatile aldehydes, TVOCs, and individual VOCs were measured at 14 days.

    b. Test System Two: Aldehydes; individual VOCs, VVOCs, and SVOCs and totals thereof were measured after 14 days.

    c. Test System Three: TVOCs, aldehydes, and individual VOCs were measured after 28 days.

2. All single VOCs were identified if the concentration exceeded 2 µg/m^3; single aldehydes were identified if present at greater than 2 or 3 µg/m^3. Quantification was done with the respective instrument response factors and either characteristic mass ion fragment(s) (VOCs) or standard UV spectra (aldehydes). All non-identified substances were quantified as toluene equivalents if present at greater than 2 µg/m^3.

Eurofins calculated the concentration of each quantified substance ($C_{Calculated}$) in the air of a typical office building or classroom using the following equation:

$$C_{Calculated} = \frac{SER_A \times A}{n \times V}$$

Where:
SER_A = area-specific emission rate (µg/(m^2 x h))
A = wall area (m^2)
n = air exchange (h^{-1})
V = volume of room (m^3)

EUROFINS VOC CHAMBER TESTING RESULTS

The results of the Eurofins VOC emission testing conducted after 14 or 28 days are presented in Table 3, below.

[2] Tenax® TA tubes are made from a porous polymer resin based tube which has been specifically designed for the trapping of volatiles and semi-volatiles from air or which have been purged from liquid or solid matrices (SIS 2014).

Table 3: Results of Eurofins VOC Emissions Testing of Reformulated ROMA Paint Model EcoDomus Satin Deep Base							
Chemical	**CAS Number**	**CDPH**		**ANSI/BIFMA**		**French VOC Method**	
		Classroom Air Concentration ($\mu g/m^3$)	**Emission Rate ($\mu g/(m^2 \times h)$)**	**Classroom Air Concentration ($\mu g/m^3$)**	**Emission Rate ($\mu g/(m^2 \times h)$)**	**Classroom Air Concentration ($\mu g/m^3$)**	**Emission Rate ($\mu g/(m^2 \times h)$)**
TVOCs	-	0.6	1.3	0.6	1.3	0.6	1.3
Formaldehyde‡	50-00-0	< 1	< 2	< 1	< 2	< 1	< 3
Acetaldehyde‡	75-07-0	< 1	< 2	< 1	< 2	< 1	< 3

ND – not detected

‡ - asthmagen/respiratory sensitizer not identified as an ingredient in ROMA paint formulation.

* - asthmagen/respiratory sensitizer identified as an ingredient in ROMA paint formulation.

Listed below are the individual results of the Eurofins testing on the reformulated ROMA Model EcoDomus Satin Deep Base (Eurofins 2015a,b,c):

California Department of Public Health

Under the California Department of Public Health (CDPH) test method, formaldehyde and acetaldehyde were below the 3 µg/m^3 quantitation limit after a 14-day test period and are therefore considered non-detectable. TVOCs and two individual VOCs (1-butanol and 2-methyl-4-isothiazolin-3-one) were present at quantifiable levels.

ANSI/BIFMA Cradle to Cradle Certified™ Certified Section 5.8

Under the ANSI/BIFMA test method, the following results were determined:

- The TVOC concentration was below the classification threshold of 0.5 mg/m^3 after a 14-day test period.
- Formaldehyde and acetaldehyde were below the 2 µg/m^3 quantitation limit after a 14-day test period and are therefore considered non-detectable.
- The formaldehyde specific emission rate was below the classification threshold of of 9 µg/m^3.
- All individual VOCs were below 0.01 TLV or MAK value (whichever is lower).
- TVOCs and two individual VOCs (1-butanol and 2-methyl-4-isothiazolin-3-one) were present at quantifiable levels.

French VOC Method

Under the French VOC Label Small Chamber test method, formaldehyde and acetaldehyde were below the 3 µg/m^3 quantitation limit after a 28-day test period and are therefore considered non-detectable. Similarly, there were no quantifiable individual VOCs; TVOCs were also below the limit of quantitation (2 µg/m^3).

CONCLUSION

This report assesses the results of Eurofin's emission chamber testing performed on the reformulated ROMA Model EcoDomus Satin Deep Base paint formulation. Eurofins performed emissions testing according to three separate, albeit methodologically similar, test methods. Formaldehyde was not detectable under any of the three test methods. As per the results of the three test procedures, ToxServices has determined that total VOC concentration levels (TVOC) and formaldehyde levels were both below their classification levels of 0.5 mg/m^3 and 9 µg/m^3, respectively. Two test methods (CDPH and ANSI/BIFMA) identified low TVOC emission rates and low emission rates for two single VOCs: 1-butanol and 2-methyl-4-isothiazolin-3-one. Although 1-butanol and 2-methyl-4-isothiazolin-3-one were detected in the EcoDomus Satin Deep Base paint formulation, their emission rates were below 1% of their respective TLV or MAK values (whichever is lower) and therefore are compliant with both CDPH (CDPH 2015) and ANSI/BIFMA (ANSI/BIFMA 2011) standards.

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