

Emissions from Coatings Used in the Auto Refinishing Industry



EPA-600/R-04/127
September 2004

Emissions from Coatings Used in the Automobile Refinishing Industry

by

Pamela M. Barfield, Geddes H. Ramsey,
Tracy A. Corwin, and Carlos M. Nunez
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

EPA Project Officer: Geddes H. Ramsey
U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division
Research Triangle Park, NC 27711

Abstract

EPA Method 24 and EPA Method 311 analyses were performed on selected coatings and components from the five major auto refinishing coating manufacturers. The purpose of this report is to present the results of the EPA Methods 24 and 311 analyses and verify that the results agree with the data presented by the paint manufacturers in their Material Safety Data Sheets (MSDSs). Since the results of Method 24 agree with the VOC contents listed on the labels and on the MSDS, the autobody shops can easily and reliably estimate their volatile organic compound (VOC) emissions. The information provided by this document will be useful for anyone interested in estimating emissions from automobile refinishing operations.

EPA Method 311 analyses were performed to ensure that no unpredicted emissions were present by speciating and quantifying individual volatile paint components.

Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

Sally Gutierrez, Acting Director
National Risk Management Research
Laboratory

EPA Review Notice

This report has been peer and administratively reviewed by the U.S. Environmental Protection Agency and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

Preface

The National Rule for the regulation of emissions from automobile refinishing limits the volatile organic compound (VOC) content of automobile refinishing coatings manufactured on or after January 11, 1999. The VOC content of each component must be stated on the label, and equations are provided in this report for determining the VOC content of the ready-to-spray coatings. The Air Pollution Prevention and Control Division (APPCD) of the Environmental Protection Agency's (EPA's) National Risk Management Research Laboratory (NRMRL) is assisting in the development of a methodology for estimating auto refinishing emissions. EPA conducted tests to verify that the VOC content calculated from the coating manufacturer's information is the same as the results from EPA Method 24 analysis of the ready-to-spray coatings. EPA Method 24 analyses were performed on selected coatings from five major auto refinishing coating manufacturers. The results of Method 24 agreed with the VOC contents on the labels or on the Material Safety Data Sheets (MSDS), and the autobody shops can easily estimate their VOC emissions with the manufacturer supplied information. EPA Method 311 analyses were performed to ensure that no unpredicted toxic emissions were present by speciating and quantifying individual volatile paint components.

The purposes of this report are to present the results of the EPA Methods 24 and 311 analyses and compare them to the data presented by the paint manufacturers in their MSDS and technical data sheets. The information provided by this document will be useful for anyone interested in estimating emissions from automobile refinishing operations.

EPA-600/R-04/127 represents the bottom-up approach for estimating emissions from each auto refinishing shop. EPA analyses presented in this report show that the MSDS data sheets are a generally reliable basis for estimating VOC content of auto refinishing coatings and are useful for developing emissions estimates from individual vehicle repair shops. From the volume of paint and solvent used with the MSDS values, the auto refinishing shop operators can readily estimate emissions. EPA-600/R-03/096 describes a methodology for estimating emissions using the top down approach. This method cannot be used as readily and accurately by the body shop operators to calculate their emissions. The top down approach is more appropriate to estimation of emissions nationally.

Contents

<u>Section</u>	<u>Page</u>
Abstract	ii
Foreword	iii
Preface	iv
List of Tables	viii
1 Introduction	1
2 Experimental Methods	3
EPA Method 24	3
EPA Method 311	6
3 Results and Discussion	15
4 Quality Assurance/Quality Control	19
5 Definitions	23
6 References	29
6 Bibliography	30
Appendices	
A Method 24	31
B Method 311	39
C Method 311 Results	67

List of Tables

<u>Table</u>	<u>Page</u>
1. Volatile Organic Compound (VOC) Limits for Automobile Refinish Coatings	2
2. Paint Components and Mixing Ratios	3
3. GC/MS Conditions	7
4. Coatings Standard Curve (1 mL final volume each standard)	8
5. Coating Hardeners Analyzed with EPA Method 311	11
6. Coating Solvents (Reducers, Stabilizers, or Thinners) Analyzed with EPA Method 311	12
7. Coating Resins Analyzed with EPA Method 311	13
8. Method 24 Density Analysis Results	16
9. Method 24 VOC Analysis Results	17
10. Analytical Precision Statements	19

Section 1

Introduction

The auto refinishing shops in business in the United States are classified as small, medium, large, and shops at new car dealerships. The small and medium shops do mostly jobs involving repair and refinishing of a portion of the car, such as a door or a panel. About 90% of all refinish work is this type of spot repair. Automotive body shops did about 227,000 jobs in 1998. Most of the jobs were in automotive repair shops or one of the approximately 13,500 new car dealerships that have refinishing shops; but some were for organizations that maintain their own vehicles, such as trucking companies and car rental agencies. About one automobile body repairman out of six was self-employed.¹

The procedures for refinishing a car vary from shop to shop, but the basic procedures are the same for all: clean the surface, prime the surface, apply topcoats, and clean the equipment. The shops may spray a variety of primers and topcoats (single stage or multistage) depending on the repair and the paint already on the car, but 95% of the coatings are supplied by five major manufacturers. These manufacturers are E.I. DuPont de Nemours & Company, Inc., PPG Industries, Sherwin-Williams Company, BASF Chemicals, and Akzo Coatings.²

National Volatile Organic Compound (VOC) Emission Standards for Automobile Refinish Coatings, promulgated in 1999, require the coating manufacturers to meet the VOC requirements by limiting the VOCs in the paint that they sell. This relieves the small body shop of additional environmental constraints, but they still have to be able to spray the paint from the manufacturers. The VOC limits for automobile refinishing are shown in Table 1.³

Table 1. Volatile Organic Compound (VOC) Limits for Automobile Refinish Coatings

Coating Category	Grams VOC per liter	Pounds VOC per gallon ^a
Pretreatment wash primers	780	6.5
Primers/primer surfacers	580	4.8
Primer sealers	550	4.6
One- and two-stage topcoats	600	5.0
Topcoats of more than two stages	630	5.2
Multi-COLORED topcoats	680	5.7
Specialty coatings	840	7.0

^a English units are provided for information only. Compliance will be determined based on the VOC content limit expressed in metric units.

The VOC content of each component must be stated on the label and equations are provided in this report for determining the VOC content of the ready-to-spray coatings.³ The Air Pollution Prevention and Control Division (APPCD) of EPA's National Risk Management research Laboratory (NRMRL) wanted to verify that the VOC stated content by the coating manufacturer was the same as the results from EPA Method 24 analysis of the ready-to-spray coatings and from EPA Method 311 analysis. In order to address these questions, the analyses reported herein were performed.

The amounts of VOCs stated in the Material Safety data Sheets (MSDS) needed to be quantified to ensure that the manufacturers values were accurate and to test our analytical methods. A low-VOC non-automotive paint had previously been tested, and VOC values significantly different than those stated in the manufacturers MSDS were found. Those tests suggested that a random sample of coatings from each of the five major auto coatings manufacturers should be tested. The ready-to-spray coatings should also be tested to determine if any volatile compounds were produced during mixing that would change the values stated in the MSDS.

Since the results of Method 24 and 311 agree with the VOC contents on the labels or on the MSDS, the autobody shops have reliable information at their disposal to estimate their VOC emissions.

Section 2

Experimental Methods

EPA Method 24

To check the accuracy of the VOC content of the auto refinishing coatings, the VOC content had to be determined for the ready-to-spray coating. This involved mixing the components as the manufacturers recommended and analytically determining the VOC content. To accomplish this task, the components necessary to mix typical ready to spray coatings from the five major manufacturers were purchased. The components and mixing ratios are shown in Table 2.⁴⁻⁸

Table 2. Paint Components and Mixing Ratios

Sample ID	Manufacturer	Components	Mix Ratio
071333/075192	Akzo Nobel	4.0 production clear/hardener	4:1
096062(1K3)/074295	Akzo Nobel	basecoat/reducer	3:2
072086/074295/075624	Akzo Nobel	primer/reducer/hardener	2:20%:1
Diamont 84479/UR50	BASF	basecoat/reducer	2:1
DC92/DH46/UR50	BASF	clearcoat/hardener/reducer	3:1:20%
DP20/PH12/UR50	BASF	primer/hardener/reducer	4:1:1
817A/793S/8022S	DuPont	acrylic enamel/hardener/reducer	8:1:2
380S/3661S	DuPont	acrylic lacquer clear/thinner	1:2
817K/7160S	DuPont	chromabase basecoat/basemaker	1:1
99K/7175S	DuPont	chromabase basecoat/basemaker	1:1
99K/7160S	DuPont	chromabase basecoat/basemaker	1:1
131S/3661S	DuPont	lacquer primer/thinner	1:1
817L/3661S	DuPont	lacquer/thinner	1:1
1140S/1125S/1135S	DuPont	urethane primer/hardener/reducer	4:1:1
817G/7005S/7075S	DuPont	urethane topcoat/hardener/reducer	3:1:1
V7500S/V7565S (PB)	DuPont	urethane/fast activator	4:1
7500S/7575S	DuPont	urethane/mid temp. activator	4:1
V7500S/V7575S	DuPont	urethane/mid temp. activator	4:1
DBC-2185/DT-870	PPG	basecoat/thinner	1:1
DCU-2021/DT-870/DCX-61	PPG	clear coat/thinner/hardener	4:1:1
K-36/K-201	PPG	primer/catalyst	5:1
F8W2030/V6V247/R7K212	Sherwin-Williams	acrylic enamel/hardener/reducer	8:1:6
P2A43/R7K248	Sherwin-Williams	acrylic lacquer primer/thinner	1:1
E2-G980/R7-K981	Sherwin-Williams	bare metal primer/reducer	1:1
UB-2030/BCS605	Sherwin-Williams	basecoat(7000)/std. stabilizer	1:1

(continued)

Table 2. Paint Components and Mixing Ratios (concluded)

Sample ID	Manufacturer	Components	Mix Ratio
USS-2030/SSH520/US-5	Sherwin-Williams	one stage/hardener/reducer	4:1:2
P6A48/V6V79/US-3	Sherwin-Williams	primer/hardener/reducer	8:1:2
P6A48/V6V79/US-5	Sherwin-Williams	primer/hardener/reducer	8:1:2
P6A48/V6V79/US-1	Sherwin-Williams	primer/hardener/reducer	8:1:2
E6H59/V6V79/US-1/ES15	Sherwin-Williams	sealer/hardener/reducer/solvent	4:1:2:2
E6H59/V6V79/US-3/ES15	Sherwin-Williams	sealer/hardener/reducer/solvent	4:1:2:2
CC645HS/CCH690/US3	Sherwin-Williams	urethane/activator/reducer	4:1:2

Sample Preparation

A 210–220 mL of sample was prepared by mixing the components in a 250 mL glass jar. The components were combined by volume in the ratio recommended by the manufacturer as follows:

1. The correct volume of coating component A containing solvent, thinner, and/or reducer were poured into a 150 mL pharmaceutical graduate. The correct volume of coating component B containing hardener, activator, and/or catalyst, if applicable, were added to coating component A in the same pharmaceutical graduate and stirred with a spatula (5–10 s).

SPECIAL INSTRUCTIONS FOR HARDENER:

- a. Remove the safety cap from the hardener container.
 - b. Turn on the nitrogen purge.
 - c. Add the hardener to the pharmaceutical graduate.
 - d. Clean the grooved top of the hardener container with a paper towel.
 - e. Purge the hardener with nitrogen before closing its container.
2. The correct volume of the coating component C containing the resin for any one of the coating types chosen for formulation (i.e., primer, sealer, clear coat, basecoat, enamel, lacquer or urethane) was then poured into a 250 mL pharmaceutical graduate. Combined coating components A and B were added to component C and stirred with a spatula for 20–30 s. The sample was then poured into a 250 mL glass jar, and the jar was shaken by hand for 20–30 s to ensure the combined components A, B, and C were thoroughly mixed.

Total Volatile Content

Appendix A is a copy of Method 24, which references ASTM Standards D 2369-95⁹. An

aluminum weighing dish was preconditioned by heating for 30 min in a forced draft, type IIA oven at 110 ± 5 °C. The dish was then stored in a desiccator until cool. To the preconditioned and weighed aluminum weighing dish, 3 ± 1 mL of Certified ACS toluene was added. Using a 3 mL disposable syringe, the correct amount of sample was added to the toluene in the dish according to the following:

<u>Expected VOC</u>	<u>Sample Weight</u>
40% or less	0.3 ± 0.1 g
more than 40%	0.5 ± 0.1 g

While adding the sample dropwise to the dish, the dish was swirled to disperse the sample in the solvent. A duplicate was then prepared in the same manner. The samples were required to stand from 1 to 24 hours before being placed in the forced draft oven for one hour at 110 ± 5 °C.

After the dishes were removed from the oven, they were immediately placed in a desiccator and allowed to cool to ambient temperature before weighing to within 0.1 mg.

The percent volatile matter was calculated using the equation

$$\%VM = 100 - [(W_2 - W_1)/S] \times 100]$$

where

%VM = percent volatile matter

W_1 = weight of dish, g

W_2 = weight of dish plus sample after heating, g

S = sample weight, g

The analyses were run in pairs until the precision requirement—the relative percent difference between the volatile content values for a pair of coating samples cannot exceed 1.5%—was met. Relative percent difference is the absolute value of the difference between the two values divided by the mean of the two values, expressed as a percentage.

Density

Six U.S. standard weight-per-gallon cups were calibrated according to ASTM Standard D1475-90 10 with freshly boiled distilled water that was cooled to below 25 °C. The cups were placed in a constant temperature water bath maintained at 25 °C for 30 minutes, dried, and weighed to within 1 mg. The volume of each cup was calculated using the equation

$$V = (N - M)/\Delta$$

where

V = volume of cup, mL

N = weight of cup and water, g

M = weight of empty cup, g

Δ = absolute density of water at 25 °C, (0.997072 g/mL)

To determine the density of the coating, one of the cups was weighed and filled with sample. The cover was placed on the cup and sealed with a rotary motion. A small amount of the sample must flow from the small hole in the center of the cover to ensure that the cup is completely filled. A duplicate was prepared in the same manner, and both cups were placed in a constant temperature water bath maintained at 25 °C. The samples remained in the water bath for 30 minutes. After wiping off the overflow from the hole in the cover, each cup was dried and weighed to the nearest milligram. The density was calculated using the equations

$$D(\text{g/mL}) = (W - w)/V$$

$$D(\text{lb/gal}) = (W - w) \times K/V$$

where

D = density, g/mL or lb/gal

W = weight of cup and sample, g

w = weight of empty cup, g

V = volume of cup, mL

K = 8.3454, conversion factor

The analyses were run in pairs until the precision requirement—the absolute difference between each density value of the pair and the mean of the two density values could not deviate by more than 0.001 kg/L—was met.

EPA Method 311

A copy of EPA Method 311 is attached as Appendix B. A Hewlett Packard 6890 Gas Chromatograph (GC) and a 5973 Mass Selective Detector (MSD) were used for this analysis. The GC column used for the analysis was a 30-meter by 0.25 mm id. DB Wax. This was chosen because it separated all the xylene isomers and also lacked co-elution problems with the late eluting dimethylformamide (DMF) solvent. The GC system was

equipped with electronic programmable control that allowed exactly 1 mL/min to flow through the column allowing for very stable retention times. A split injection of 20:1 was performed due of the need to increase the calibration range.

The MSD was the detector of choice for this particular application. There was need for positive confirmation of all compounds found in these low VOC coatings. In addition, co-elution of target analytes did not affect quantification. Target analyte integrations were performed based upon singular ions found in each target analyte. The software allows for specific ions to be used solely for quantification while each compound has qualifier ions that ensure qualitative assignment by ion ratio comparison with the NIST 98 library.

The MSD was run in “full-scan” mode to allow for unknowns to be determined by comparison with the NIST 98 spectral library. The MSD was tuned using perfluorotributylamine (PFTBA). The standard spectra autotune software was used as a means to tune the MSD. Using standard spectra autotune tuning program, the isotopic abundance ratios for the fragmentation of PFTBA were such that 69 m/z was the highest fragment with 219 m/z having a relative abundance of 55% and 502 m/z having a relative abundance of 2.5%. The sampling scan rate was adjusted to obtain close to 2 full scans per second, which equated to nearly 10 sampling periods across each peak. The electro multiplier voltage was determined using standard spectra autotune. The GC/MS (Mass Spectroscopy) conditions are shown in Table 3.

Table 3. GC/MS Conditions

GC Component	Hewlett Packard 6890 GC
GC column	30 m DB Wax by 0.25 mm id by 0.25 μ m film thickness
Carrier gas	Helium at 1 mL/min using electronic pressure control
Oven temp. ramp rate	45 °C hold 4 min; ramp at 2 °/min to 65 °C; hold 6 min; ramp at 35 °/min to 220 °C; hold 10 min
Injection port	250 °C
Detector	Low resolution mass-selective detector
Detector characteristics	AMU rang 29 m/z to 450 m/z; scan rate = 3 (2 scans/s); threshold value = 100; EMV-1518

Pure standards were purchased from Sigma-Aldrich and Chem Services. A stock solution was prepared at a concentration of 10,000 μ g/mL. This stock solution was traceable to the gravimetric weighing of each of the standards. The dilution reagent DMF was only 99.8% free from foreign substances, but blanks demonstrated that no target analytes were

detected. All target analytes were pure and required no compensatory multiplier to adjust for actual purity. The calibration ranged between 200 and 3000 µg/mL and was established prior to sample analysis. Standards were prepared sequentially by adding 20, 75, 150, 225, and 300 µL of a 10,000 µg/ml stock solution to each of 5 vials and diluted to 1 mL with DMF. All calibration levels were performed in triplicate. Relative standard deviations (RSD) for all target analytes were less than 15% as the method specified for the initial calibration. A mid-level check standard (calibration standard #3) was analyzed every 10 samples and before each daily sample analysis. Relative differences for all target analytes were less than 10% compared to the initial calibration. A deuterated internal standard, d8-toluene, was used in the analysis. The internal standard was added to each 1 mL sample just prior to analysis (3.3 µL). Table 4 identifies the calibration.

Table 4. Coatings Standard Curve (1 mL final volume each standard)

Substance	0505BTP1	0505BTP2	0505BTP3	0505BTP4	0505BTP5
	ng ^a	ng ^a	ng ^a	ng ^a	ng ^a
d8 toluene (internal standard)	3026.1	3026.1	3026.1	3026.1	3026.1
ethyl acetate	180.2	675.9	1351.4	2027.2	2703.0
p-chlorobenzotrifluoride	192.7	722.7	1445.0	2167.6	2890.1
2-heptanone	229.6	861.2	1721.9	2583.1	3444.1
2-pentanone	249.1	934.4	1868.2	2802.5	3736.7
acetone	216.1	810.7	1562.0	2431.6	3242.1
1-methoxy-2-propanol acetate	260.4	976.7	1952.9	2929.5	3906.0
dichloromethane	258.2	968.6	1936.5	2905.0	3873.3
butyl propionate	296.1	1110.8	2220.9	3331.6	4442.1
MEK	185.8	697.1	1393.7	2090.7	2787.7
MIAK	190.4	714.2	1427.9	2142.0	2856.0
MIBK	197.4	740.5	1480.6	2221.1	2961.4
toluene	262.1	983.0	1965.5	2948.4	3931.2
ethyl benzene	237.5	890.9	1781.3	2672.2	3562.9
p-xylene	243.8	914.3	1828.1	2742.4	3656.5
o-xylene	247.5	928.4	1856.3	2784.7	3712.9
m-xylene	234.3	878.7	1756.8	2635.4	3513.9
n-butyl acetate	228.7	857.9	1715.3	2573.0	3430.7
2-butoxyethanol	231.0	866.4	1732.3	2598.7	3464.9
isopropanol	192.9	723.4	1446.5	2169.8	2893.1
2-butoxyethyl acetate	282.4	1059.2	2117.7	3176.8	4235.7
isopropyl acetate	205.7	771.7	1543.0	2314.6	3086.2
dibutyl phthalate	281.4	1055.5	2110.3	3165.6	4220.8
ethanol	203.6	763.6	1526.7	2290.1	3053.5

(continued)

Table 4. Coatings Standard Curve (1 mL final volume each standard) (concluded)

Substance	0505BTP1	0505BTP2	0505BTP3	0505BTP4	0505BTP5
	ng ^a	ng ^a	ng ^a	ng ^a	ng ^a
methanol	238.9	896.1	1791.7	2687.8	3583.7
1,2,3-trimethylbenzene	256.6	962.6	1924.7	2887.2	3849.5
1,2,4-trimethylbenzene	249.4	935.5	1870.5	2805.8	3741.1
1,3,5-trimethylbenzene	249.4	935.5	1870.5	2805.8	3741.1
d10- <i>p</i> -xylene (surrogate)	246.6	925.1	1849.7	2774.7	3699.5

^a A 20× inlet split reduced the actual dynamic range to between 10 and 150 ng to the GC/MS system.

A method detection limit (MDL) study was performed prior to sample analysis. A practical quantification limit (PQL-lowest calibration level) of 200 ng was chosen to be the level replicated 7 times (in accordance to 40 CFR Appendix B to Part 136). The standard deviation of these 7 replicates multiplied by the factor 3.14 gave the calculated detection limits. These values would have been lowered if a lower PQL was chosen but were acceptable for the scope of this study. Because the final target analyte list was not complete when the initial MDL study was performed, a few compounds (acetone, ethyl acetate, 2-pentanone, *p*-chlorobenzotrifluoride, 2-heptanone, and 1-methoxy-2-propanol acetate) were estimated because they were late additions to the calibration database. These estimated detection limits were prepared by assigning a value of 1 ng to each and multiplying by the split ratio of 20. These estimated values are considered conservative for the MSD 5973 detector.

An independent quality control (QC) test was also performed. Four components: methyl ethyl ketone (MEK), methyl isoamyl ketone (MIAK), methyl isobutyl ketone (MIBK), and *n*-butyl acetate were spiked in similar fashion to the weighing of a sample. Because these four compounds were of vital importance to most samples tested and were considered a microcosm of most target analytes in this study, only these were chosen to determine the validity of the QC test mandated in method 311. Specifically, a 10,000 µg/mL stock solution of each of the four components was prepared gravimetrically in DMF. From this stock solution, a low and high spike was prepared. The low spike was prepared close to 200 µg/mL, and the high spike was prepared close to 900 µg/mL. A 20 µL aliquot was taken from the stock and added to 980 µL of DMF for the low spike. A 90 µL aliquot was taken from the stock and added to 910 µL of DMF for the high spike. Each sample had 3.3 µL of d8-toluene added just prior to injection, and the samples were shaken for 2 minutes (ref: personal lab book #.1802, page 20). All recoveries were between 94% and 102%.

Automotive refinish coating samples were prepared by weighing 0.05 gram into a tared 7 mL amber vial filled with 5 mL of DMF solvent. Each sample was shaken for two minutes to extract the VOC contents in each coating into the DMF. If the sample was cloudy, it was centrifuged for 10 minutes to shake out the solid material. A surrogate compound, d-10-p-xylene, was added to most samples to help determine extraction efficiency. Six μL of d10-p-xylene was added as a surrogate compound. A few samples were not spiked with this surrogate compound but are still valid samples (surrogate's function was to assess extraction efficiency and wasn't mandatory). A 1 mL portion was transferred to a 2 mL graduated amber vial, 3.3 μL of d8-toluene was added and shaken again for 20 seconds. A 1 μL aliquot was then injected onto the GC/MS system. The operating procedure was:

1. Mix sample thoroughly.
2. Weigh 0.05 g into a tared amber 7 mL vial.
3. Spike 6 μL of d10-p-xylene (surrogate) onto the coating.
4. Immediately add 5 mL of N,N-dimethylformamide.
5. Shake the vial for 2 minutes.
6. If the solution is clear, transfer a 1 mL portion to an amber 2 mL vial.
7. If the solution is cloudy, centrifuge the sample for 30 minutes then transfer.
8. Add 3.3 μL of d8-toluene as the internal standard.
9. Inject a 1 μL portion into the GC/MS system.

A total of 65 samples were analyzed in this study (Appendix C). Two duplicate samples and four blanks (three reagent and one method) were also analyzed. All blanks were less than the MDL. Because the goal of the project was to verify project data sheet concentrations that only comprised significant target hits (and all blanks that were analyzed demonstrated cleanliness), blanks were not analyzed as frequently as method 311 specified. Moreover, once it was determined that nearly all of the sample concentrations matched product literature values, complete sample replication was deemed unnecessary. Each duplicate was treated as an independent sample and was extracted/analyzed. The two duplicated samples had an average difference of less than 5% for the major components determined by the analysis. Specific component sample concentrations marked with a "J" denote that the value is between the PQL and the MDL. Specific component sample concentrations marked with an "E" denote that the original analysis exceeded calibration, and the value was obtained by diluting the sample by an appropriate amount. Although such dilution was ideal for compounds that were above calibration, it put other components below optimal levels. Therefore, only the previously "above calibration" value was used from the diluted run. This ensured that all reported targets were analyzed

within the calibration curve limits.

Tentatively identified compounds (TIC) were also found and reported using the Library Search Compound (LSC) program. This is not to be confused with the term “tentatively identified compound” found in section 12.1 of the method. TIC in this case is geared specifically toward GC/MS applications and refers only to non-target components that are positively identified. The LSC program searches and finds spectral matches for non-target hits that are not part of the calibration database. The reported TIC’s used only the response factor of the nearest internal standard as a basis for quantification. Because it is an unknown without a relative response factor like the target components, these values are only estimated.

The specific coating hardeners analyzed with EPA Method 311 are identified in Table 5, the solvents in Table 6, and the resins in Table 7.

Table 5. Coating Hardeners Analyzed with EPA Method 311

Manufacturer	Hardener
Akzo-Nobel	075192 Multi Panel Clear 075624 4.6 Fast Epoxy
BASF	RM-DH46 Low VOC Diamont RM-PH12 Undercoat
DuPont	1125S Urethane Primer 7005S Urethane V-7565S Aliphatic polymeric isocyanate V-7575S Aliphatic polymeric isocyanate 193S Activator for Imron syatems
PPG	DCX61 K201 Primer-Surfacer Catalyst
Sherwin-Williams	CCH690 ULTRA 7000 HS E6C61 ULTRA-FIL II SSH520 ULTRA ONE STAGE Urethane UH80 ULTRA 7000 Low VOC V6V247 ACRYLYD Acrylic Enamel

Table 6. Coating Solvents (Reducers, Stabilizers, or Thinners) Analyzed with EPA Method 311

Manufacturer	Solvent
Akzo-Nobel	074295 4.6 Medium Reducer
BASF	RM-UR50 Universal Mid Temp Reducer
DuPont	8022S Enamel Reducer 7075S Urethane Reducer 1135S Urethane Primer Reducer 7175S Reducer for Chromabase systems 7160S Reducer for Chromabase systems 3661S Laquer thinner N0006HNNH White Single-application Coating L0006HNNH White basecoat
PPG	DT870 Reducer
Sherwin-Williams	ES15 Transducer Compliant Solvent #2 ES20 Compliant Solvent R7K212 ACRYLYD Acrylic Enamel Reducer R7K248 Sher-Lac Acrylic Lacquer Thinner R7K981 G.B.P. Etching Filler Reducer R7K982 G.B.P. Etching Filler Reducer US1 ULTRASOLV US2 ULTRASOLV US3 ULTRASOLV US5 ULTRASOLV BCS600V Ultra 7000 Basecoat Fast Stabilizer BCS605V Ultra 7000 Basecoat Standard Stabilizer

Table 7. Coating Resins Analyzed with EPA Method 311

Manufacturer	Resin
Akzo-Nobel	071333 4.0 Production Clear 072086 2.8-4.6 Gray Epoxy Primer Sealer 1k Basecoat
BASF	RM-84479 Polyester Basecoat RM-DC92 Low VOC Diamont Clear RM-DP20 Undercoat Urethane Primer
DuPont	817A Acrylic Enamel 817G 131S Fill 'N' Sand Acrylic Primer Surfacer 817L Lacquer 1440S Urethane Primer 817K Chromabase Basecoat 899K Chromabase Black Basecoat 3440S High Solids Clear for Imron systems 380S Imron 6000 Clear
PPG	DCU2021 Urethane Clear DBC2185 Acrylic Urethane Basecoat
Sherwin-Williams	CC637 ULTRA 7000 HS P2A43 ULTRA-FIL Acrylic Primer-Surfacer P6A48 ULTRA-FIL Acrylic Urethane Primer-Surfacer E6H59 ULTRA-FIL II Acrylic Urethane E2G980 G.B.P. Etching Filler U7F2030 USS2030 WB2030 WU6590

Section 3

Results and Discussion

The results of the EPA Method 24 analyses are shown in Tables 8 and 9. The manufacturers reported VOC and density values for individual coating components in the MSDS. Method 24 was used to analyze multi-component coatings after two or more individual parts were combined. Therefore, to compare these results to those in the MSDS, the data for individual components was used to calculate values for the multi-component mixtures. These values are listed in the tables under the Report/Calc columns because calculations were performed using reported data. Examples of these calculations are listed in the Definitions section.

Akzo Nobel, BASF, and Dupont reported weight percent volatiles as well as VOC less exempts (LE) as pounds per gallon. The only exception was the BASF Diamont 84479. PPG reported weight percent volatiles, and Sherwin Williams reported VOC LE as pounds per gallon, so dashed lines appear under the Report/Calc columns due to the lack of reported data. Density results for Dupont sample 1140S /1125S /1135S do not appear because the precision requirement was not met. The Method 24 results generally agreed with the values reported by the manufacturers. The largest discrepancies occurred with the low temperature transducers, which tend to evaporate fast. The Method 24 analyses included the volatiles and density run on the same sample. The density was done first, and this may have allowed a portion of the solvents to evaporate before the volatiles analysis was done.

The EPA Method 311 data sheets shown in Appendix C contain all of the coatings that were analyzed. Reagent blanks and a method blank were also analyzed and reported. The reporting format consists of a listing of the target analytes, the GC/MS Method 311 values, a column for aggregate xylenes, and the MSDS listing for each compound. The GC/MS values agreed well with the MSDS values with only a few exceptions. Because of the generic nature of the literature data and the likelihood of compositional components being changed before the literature is updated, discrepancies can and did occur. When these discrepancies occurred, most, if not all, of the other components in the same sample agreed well with the MSDS listed values. Fortunately, mass selection detection greatly

Table 8. Method 24 Density Analysis Results

Sample ID	Manufacturer	Components	Mix Ratio	M24 Density (kg/L)	M24 Density (lb/gal)	Report/Calc. Density (lb/gal)
071333/075192	Akzo Nobel	4.0 production clear/hardener	4:1	0.948	7.908	7.84
096062(1K3)/074295	Akzo Nobel	basecoat/reducer	3:2	1.038	8.659	7.78
072086/074295/075624	Akzo Nobel	primer/reducer/hardener	2:20%:1	1.227	10.236	10.43
Diamont 84479/UR50	BASF	basecoat/reducer	2:1	0.995	8.306	7.41–8.78
DC92/DH46/UR50	BASF	clearcoat/hardener/reducer	3:1:20%	0.962	8.031	8.01
DP20/PH12/UR50	BASF	primer/hardener/reducer	4:1:1	1.327	11.072	10.92
817A/793S/8022S	DuPont	acrylic enamel/hardener/reducer	8:1:2	0.985	8.220	8.41
380S/3661S	DuPont	acrylic lacquer clear/thinner	1:2	0.847	7.072	7.04
817K/7160S	DuPont	chromabase basecoat/basemaker	1:1	0.920	7.681	7.65
99K/7175S	DuPont	chromabase basecoat/basemaker	1:1	0.853	7.117	7.20
99K/7160S	DuPont	chromabase basecoat/basemaker	1:1	0.846	7.061	7.18
131S/3661S	DuPont	lacquer primer/thinner	1:1	1.120	9.347	8.88
817L/3661S	DuPont	lacquer/thinner	1:1	0.901	7.516	7.61
1140S/1125S/1135S	DuPont	urethane primer/hardener/reducer	4:1:1	—	—	11.12
817G/7005S/7075S	DuPont	urethane topcoat/hardener/reducer	3:1:1	1.113	9.285	9.25
V7500S/V7565S (PB)	DuPont	urethane/fast activator	4:1	0.953	7.955	7.93
V7500S/V7565S (TC)	DuPont	urethane/fast activator	4:1	0.960	8.005	7.93
V7500S/V7565S (GR)	DuPont	urethane/fast activator	4:1	0.954	7.959	7.93
V7500S/V7565S (LH)	DuPont	urethane/fast activator	4:1	0.960	8.008	7.93
7500S/7575S	Dupont	urethane/mid temp. activator	4:1	0.966	8.062	8.07
V7500S/V7575S	Dupont	urethane/mid temp. activator	4:1	0.959	8.000	7.95
DBC-2185/DT-870	PPG	basecoat/thinner	1:1	1.046	8.731	7.96
DCU-2021/DT-870/DCX-61	PPG	clear coat/thinner/hardener	4:1:1	0.953	7.953	7.93
K-36/K-201	PPG	primer/catalyst	5:1	1.420	11.848	11.76
F8W2030/V6V247/R7K212	Sherwin-Williams	acrylic enamel/hardener/reducer	8:1:6	1.024	8.543	7.3–8.3
P2A43/R7K248	Sherwin-Williams	acrylic lacquer primer/thinner	1:1	1.028	8.576	8.49
E2-G980/R7-K981	Sherwin-Williams	bare metal primer/reducer	1:1	0.930	7.759	7.80
UB-2030/BCS605	Sherwin-Williams	basecoat(7000)/std. stabilizer	1:1	0.949	7.924	7.5–8.2
USS-2030/SSH520/US-5	Sherwin-Williams	one stage/hardener/reducer	4:1:2	1.070	8.929	7.5–8.7
P6A48/V6V79/US-3	Sherwin-Williams	primer/hardener/reducer	8:1:2	1.179	9.842	9.84
P6A48/V6V79/US-5	Sherwin-Williams	primer/hardener/reducer	8:1:2	1.180	9.848	9.89
P6A48/V6V79/US-1	Sherwin-Williams	primer/hardener/reducer	8:1:2	1.167	9.737	9.78
E6H59/V6V79/US-1/ES15	Sherwin-Williams	sealer/hardener/reducer/solvent	4:1:2:2	1.119	9.338	9.17
E6H59/V6V79/US-3/ES15	Sherwin-Williams	sealer/hardener/reducer/solvent	4:1:2:2	1.124	9.378	9.24
CC645HS/CCH690/US3	Sherwin-Williams	urethane/activator/reducer	4:1:2	0.960	8.011	7.94

Table 9. Method 24 VOC Analysis Results

Sample ID	Manufacturer	Components	M24 VOCs weight%	Report/Calc. VOCs weight%	M24 Calc. VOCs (lb/gal)	Report/Calc. VOCs LE (lb/gal)
071333/075192	Akzo Nobel	4.0 production clear/hardener	57.80	59.60	4.57	4.2
096062(1K3)/074295	Akzo Nobel	basecoat/reducer	69.54	82.6	6.02	6.52
072086/074295/075624	Akzo Nobel	primer/reducer/hardener	46.44	54.17	4.75	4.2
Diamont 84479/UR50	BASF	basecoat/reducer	73.34	71–88	6.09	—
DC92/DH46/UR50	BASF	clearcoat/hardener/reducer	51.52	55	4.14	4.2
DP20/PH12/UR50	BASF	primer/hardener/reducer	42.71	49	4.73	4.7
817A/793S/8022S	DuPont	acrylic enamel/hardener/reducer	47.82	56.48	3.93	4.6
380S/3661S	DuPont	actylic lacquer clear/thinner	88.63	88.87	6.27	6.0
817K/7160S	DuPont	chromabase basecoat/basemaker	80.48	82.21	6.18	6.0
99K/7175S	DuPont	chromabase basecoat/basemaker	87.40	85.42	6.22	6.1
99K/7160S	DuPont	chromabase basecoat/basemaker	88.04	85.42	6.22	6.1
131S/3661S	DuPont	lacquer primer/thinner	65.84	70.55	6.15	5.7
817L/3661S	DuPont	lacquer/thinner	77.05	77.99	5.79	5.4
1140S/1125S/1135S	DuPont	urethane primer/hardener/reducer	43.64	46.65	4.78	4.6
817G/7005S/7075S	DuPont	urethane topcoat/hardener/reducer	45.56	51.22	4.23	4.5
V7500S/V7565S (PB)	DuPont	urethane/fast activator	54.04	55.96	4.30	4.4
V7500S/V7565S (TC)	DuPont	urethane/fast activator	54.51	55.96	4.36	4.4
V7500S/V7565S (GR)	DuPont	urethane/fast activator	54.31	55.96	4.32	4.4
V7500S/V7565S (LH)	DuPont	urethane/fast activator	54.56	55.96	4.37	4.4
7500S/7575S	Dupont	urethane/mid temp. activator	61.05	63.99	4.92	5.2
V7500S/V7575S	Dupont	urethane/mid temp. activator	52.89	55.94	4.23	4.4
DBC-2185/DT-870	PPG	basecoat/thinner	67.94	67–94	5.93	—
DCU-2021/DT-870/DCX-61	PPG	clear coat/thinner/hardener	50.98	53.15	4.05	—
K-36/K-201	PPG	primer/catalyst	33.86	38.23	4.01	—
F8W2030/V6V247/R7K212	Sherwin-Williams	acrylic enamel/hardener/reducer	58.31	—	4.98	4.7–5.8
P2A43/R7K248	Sherwin-Williams	acrylic lacquer primer/thinner	66.57	—	5.71	5.71
E2-G980/R7-K981	Sherwin-Williams	bare metal primer/reducer	76.99	—	5.97	6.00
UB-2030/BCS605	Sherwin-Williams	basecoat(7000)/std. stabilizer	78.35	—	6.21	5.6–6.6
USS-2030/SSH520/US-5	Sherwin-Williams	one stage/hardener/reducer	53.23	—	4.75	4.9–5.5
P6A48/V6V79/US-3	Sherwin-Williams	primer/hardener/reducer	46.61	—	4.59	4.70
P6A48/V6V79/US-5	Sherwin-Williams	primer/hardener/reducer	46.11	—	4.54	4.75
P6A48/V6V79/US-1	Sherwin-Williams	primer/hardener/reducer	45.11	—	4.39	4.65
E6H59/V6V79/US-1/ES15	Sherwin-Williams	sealer/hardener/reducer/solvent	50.64	—	4.73	3.34
E6H59/V6V79/US-3/ES15	Sherwin-Williams	sealer/hardener/reducer/solvent	40.90	—	3.84	3.39
CC645HS/CCH690/US3	Sherwin-Williams	urethane/activator/reducer	61.78	—	4.95	4.95

facilitated this identification of unexpected compounds that were not listed by the MSDS literature. This made it possible to eventually quantify these components after system calibration. Flame ionization detection would not have allowed such a process to occur without great effort.

Section 4

Quality Assurance/Quality Control

A Quality Assurance Project Plan (QAPP) was not prepared for this project because Quality Assurance/Quality Control (QA/QC) is included in the two EPA Methods being used.

Method 24

To perform the Method 24 analyses, the following quality control procedures were implemented:

- The analytical balances were calibrated;
- The weight per gallon cups were calibrated;
- Type IIA Forced Draft Oven was used;
- Technical grade toluene was used; and
- Type II of Specification D 1193 water was used.

Method 24 states, “The variety of coatings that may be subject to analysis makes it necessary to verify the ability of the analyst and the analytical procedures to obtain reproducible results for the coatings tested. Verification is accomplished by running duplicate analyses on each sample tested and comparing the results with the intra-laboratory precision statements for each parameter.” The intra-laboratory precision statements are given in Table 10.

Table 10. Analytical Precision Statements

Parameter	Intra-laboratory precision
Volatile matter content, W_v	$\pm 0.015W_v$
Density, D_c	$\pm 0.001 \text{ kg/L}$

Four laboratory personnel ran duplicate Method 24 analyses of one of the coatings. The results are shown in Table 8 for DuPont sample V7500S/V7565S.

Method 311

Quality assurance was maintained by adhering to strict parameters laid out by Method 311. The following method/instrumental quality control parameters were monitored:

- Reagent blanks and a method blank (DMF) demonstrated that none of the target or interfering peaks/ions were detected.
- The analytical balance was calibrated (see Method 24).
- The initial calibration was performed in triplicate at 5 different levels rather than just 3 (method minimum). The RSD of each component for all calibrations components were less than 15%.
- Daily calibration checks were within the 90% to 110% range. Once the system was proven to be out of calibration, re-calibration was performed (provided that the sample had the “out of calibration” component present).
- A quality control check standard (QCCS) was prepared and analyzed (ref PLB 1802 p. 20). Mid- and a low-level check spikes were independently prepared gravimetrically at concentrations of 200 µg/mL and 1000 µg/mL respectively. The recoveries for each of four compounds (MEK, MIBK, MIAK, and n-butyl acetate) were all close to 100%.
- A surrogate compound, d10-p-xylene, was added to most samples prior to sample extraction as an additional (not required) means of determining extraction efficiency. All percent recoveries were between 90% and 110%.
- Samples were shaken for 120 seconds rather than the specified time in the method of 60 seconds to ensure proper extraction time.
- New 7 mL amber vials were used to minimize cross-contamination and light effects.
- Cloudy samples were centrifuged for 15 minutes at 2000 rpm. This removed solids from each sample needing it. The clear portion was injected onto the GC/MS system.
- All peaks were manually integrated to ensure that there was no chance of poor integration that would cause poor results.
- Baseline drift/stability was less than 5% of full scale.
- The retention times were extremely stable (less than 0.02 minutes) because the GC/MS system has electronic pressure control (EPC) capability. EPC increases the inlet head pressure as the oven temperature ramps upward to always give a 1 mL/min flow at all times.

Data Analysis and Calculations

Target analyte concentrations are calculated using the equation

$$HAP_{wt\%} = 100 \times (A_X)(W_{is}) / (A_{is})(RRF_X)(W_X)$$

where

$HAP_{wt\%}$ = Weight percent of the analyte in coating

A_X = Ion abundance of the analyte in the sample

W_{is} = Weight of internal standard added to sample, g

A_{is} = Ion abundance of the internal standard in the sample

RRF_X = Mean relative response factor for the analyte in the calibration standard

W_X = Weight of coating add to the sample solution, g.

Calculate percent accuracy for analytes in the QCCS by

$$\% \text{ accuracy}_X = 100 \times X_X/T_X$$

where

X_X = the mean measured value

T_X = the known true value of the analyte in the QCCS.

Obtain retention times (RTs) from the data station, and calculate the RTs for analytes in the calibration standards as follows:

RT= number of minutes from injection to peak maximum.

The response factor (RF) for the internal standard was calculated by

$$RF_{istd} = A_{istd}/W_{istd}$$

where:

A_{istd} = ion abundance of the internal standard

W_{istd} = weight of the internal standard.

The relative response factor for analytes (RRF) in the calibration standards are calculated as follows:

$$RRF_X = A_X/RF_{istd} C_X$$

where:

RF_{istd} = response factor for the internal standard

A_X = ion abundance of the analyte being measured

C_x = weight of the analyte being measured.

The percent relative standard deviation was automatically calculated by the Agilent software package. The software package used equation 7 found in Method 311.

Section 5

Definitions^{3,11}

(1) ADHESION PROMOTER is a coating designed to facilitate the bonding of a primer or topcoat on surfaces such as trim moldings, door locks, and door sills, where sanding is impractical, and on plastic parts and the edges of sanded areas.

(2) AUTOMOBILE REFINISH COATING COMPONENT means any portion of a coating such as a reducer or thinner, hardener, additive, etc. recommended by its manufacturer or importer to distributors or end-users for automobile refinishing. The raw materials used to produce the components that are mixed by the end-user to prepare a coating for application are not considered automobile refinish coating components. Any reference to automobile refinishing made by a manufacturer or importer on a container or in product literature constitutes a recommendation for automobile refinishing.

(3) AUTOMOBILE REFINISH COATING OR COATING COMPONENT IMPORTER, OR IMPORTER, means any company, group, or individual that brings automobile refinish coatings or coating components from a location outside the United States into the United States for sale or distribution in the United States.

(4) AUTOMOBILE REFINISH COATING OR COATING COMPONENT MANUFACTURER, OR MANUFACTURER, means any company, group, or individual that produces or packages automobile refinish coatings or coating components for sale or distribution in the United States, including an entity which produces or packages such coatings or coating components under a private label for another party.

(5) AUTOMOBILE REFINISHING means the process of coating automobiles or their parts, including partial body collision repairs, that is subsequent to the original coating applied at an automobile original equipment manufacturing plant.

(6) BASECOAT is a pigmented topcoat which is the first topcoat applied as part of a multistage topcoat system.

(7) BASECOAT/CLEARCOAT TOPCOAT SYSTEM is a topcoat system composed of a basecoat portion and a clearcoat portion. The VOC content of a basecoat/clearcoat topcoat system shall be calculated according to

$$VOC_{ms} = (VOC_{bc} + 2 VOC_{cc}) / 3$$

where:

VOC_{ms} = the composite VOC content, less water and less exempt compounds to be used for compliance determination under the multistage topcoat system coating category

VOC_{bc} = the VOC content, less water and less exempt compounds as applied, of any given basecoat

VOC_{cc} = the VOC content, less water and less exempt compounds as applied, of any given clearcoat.

(8) CLEARCOAT is a topcoat which contains no pigments or only transparent pigments and which is the final topcoat applied as a part of a multistage topcoat system.

(9) COATING is a material which is applied to a surface and which forms a film in order to beautify and/or protect such surface.

(10) EXEMPT COMPOUNDS means specific organic compounds that are not considered volatile organic compounds due to negligible photochemical reactivity. The exempt compounds are specified in § 51.100(s) of 40 CFR Chapter 1.

(11) GENERAL TOPCOAT is any type of topcoat except extreme performance topcoat, metallic/iridescent topcoat, and any topcoat applied as part of a multistage topcoat system.

(12) GRAMS OF VOC PER LITER (density) OF COATING LESS WATER AND LESS EXEMPT COMPOUNDS, is the weight of VOC per combined volume of VOC and coating solids and shall be calculated by the equation

$$\text{Density of coating, less water and less exempt compounds} = (W_s - W_w - W_{es}) / (V_m - V_w - V_{es})$$

where:

Density = Grams of VOC per liter

W_s = weight of volatile compounds in grams

W_w = weight of water in grams
 W_{es} = weight of exempt compounds in grams
 V_m = volume of material in liters
 V_w = volume of water in liters
 V_{es} = volume of exempt compounds in liters

(13) GRAMS OF VOC PER LITER OF MATERIAL is the weight of VOC per volume of material and shall be calculated by the equation:

$$\text{Grams of VOC per Liter of Material} = (W_s - W_w - W_{es})/V_m$$

where:

W_s = weight of volatile compounds in grams
 W_w = weight of water in grams
 W_{es} = weight of exempt compounds in grams
 V_m = volume of material in liters

(14) GROUP I VEHICLES AND EQUIPMENT are large sized trucks, buses, and mobile equipment.

(15) GROUP II VEHICLES are passenger cars, small sized trucks and vans, medium sized trucks and vans, motor homes, and motorcycles.

(16) HARDENER means a coating component specifically designed to promote a faster cure of an enamel finish.

(17) HIGH VOLUME, LOW PRESSURE (HVLP) SPRAY is an equipment used to apply coatings by means of a spray gun which is designed to be operated and which is operated between 0.1 and 10 pounds per square inch gauge (psig) air pressure measured dynamically at the center of the air cap and at the air horns.

(18) LABEL means any written, printed, or graphic matter affixed to or appearing upon any automobile refinishing coating or coating component container or package for purposes of identifying or giving information on the product, use of the product, or contents of the container or package.

(19) LACQUER means a thermoplastic coating which dries primarily by solvent

evaporation, and which is resolvable in its original solvent.

(20) LOW-GLOSS COATING means a coating which exhibits a gloss reading less than or equal to 25 on a 60° glossmeter.

(21) MIDCOAT is a semi transparent topcoat which is the middle topcoat applied as part of a three stage topcoat system.

(22) MIXING INSTRUCTIONS means the coating or coating component manufacturer's or importer's specification of the quantities of coating components for mixing a coating.

(23) MULTI COLORED TOPCOAT is a coating which exhibits more than one color when applied, and which is packaged in a single container and applied in a single coat.

(24) MULTI COLORED MULTISTAGE TOPCOAT SYSTEM is a basecoat/clearcoat topcoat system in which the basecoat portion is a multi colored topcoat.

(25) MULTISTAGE TOPCOAT SYSTEM is any basecoat/clearcoat topcoat system or any three stage topcoat system, manufactured as a system, and used as specified by the manufacturer.

(26) PASSENGER CAR is any motor vehicle designed primarily for transportation of persons and having a design capacity of 12 persons or less.

(27) PRECOAT COATING is a coating applied to bare metal primarily to deactivate the metal surface for corrosion resistance to a subsequent water base primer.

(28) PRETREATMENT COATING is a coating which contains no more than 16 percent solids by weight and at least ½% acid by weight, is used to provide surface etching, and is applied directly to bare metal surfaces to provide corrosion resistance and promote adhesion for subsequent coatings.

(29) PRIMER is a coating applied for purposes of corrosion resistance or adhesion of subsequent coatings.

(30) PRIMER SEALER is a coating applied prior to the application of a topcoat for the purpose of color uniformity or to promote the ability of an underlying coating to resist

penetration by the topcoat.

(31) PRIMER SURFACER is a coating applied for the purpose of corrosion resistance or adhesion and which promotes a uniform surface by filling in surface imperfections.

(32) REDUCER means any solvent used to thin enamels.

(33) SINGLE-STAGE TOPCOAT means a topcoat consisting of only one coating.

(34) SOLVENT CLEANING OPERATIONS is the removal of loosely held uncured adhesives, uncured inks, uncured coatings, and contaminants which include, but are not limited to, dirt, soil, and grease from parts, products, tools, machinery, equipment, and general work areas. Each distinct method of cleaning in a cleaning process that consists of a series of cleaning methods shall constitute a separate solvent cleaning operation.

(35) SPECIALTY COATING is any of the following coatings: adhesion promoters, uniform finish blenders, elastomeric materials, anti glare safety coatings, impact resistant coatings, rubberized asphaltic underbody coatings, water hold out coatings, weld thru coatings, and bright metal trim repair coatings.

(36) SPOT REPAIRS are repairs to motor vehicles in which the damaged area to be repaired is limited to only a portion of any given panel so that an entire panel need not be repaired.

(37) STENCIL COATING is an ink or a pigmented coating which is rolled or brushed onto a template or a stamp in order to add identifying letters, symbols, and/or numbers to motor vehicles, mobile equipment, or their parts and components.

(38) THINNER means any solvent used to reduce the viscosity or solids content of a coating.

(39) THREE STAGE TOPCOAT SYSTEM is a topcoat system composed of a basecoat portion, a midcoat portion and a transparent clearcoat portion. The VOC content of a three stage topcoat system shall be calculated according to the formula

$$VOC_{ms} = VOC_{bc} + VOC_{mc} + 2 VOC_{cc}/4$$

where

VOC_{ms} = the composite VOC content, less water and less exempt compounds to be used for compliance determination under the multistage topcoat system coating category.

VOC_{bc} = the VOC content, less water and less exempt compounds as applied, of any given basecoat.

VOC_{mc} = the VOC content, less water and less exempt compounds as applied, of any given midcoat.

VOC_{cc} = the VOC content, less water and less exempt compounds as applied, of any given clearcoat.

(40) TOPCOAT is a coating applied over any coating for the purpose of appearance, identification, or protection.

(41) TOUCH UP COATING is a coating applied by brush, air brush, or non refillable aerosol can to cover minor surface damage and dispensed in containers of no more than eight (8) ounces.

(42) TRANSFER EFFICIENCY is the ratio of the weight of coating solids deposited on an object to the total weight of coating solids used in a coating application step, expressed as a percentage.

(43) TWO-STAGE TOPCOAT means a topcoat consisting of a pigmented basecoat and a transparent clearcoat.

(44) VEHICLE is a device by which any person or property may be propelled, moved, or drawn upon a highway, excepting a device moved exclusively by human power or used exclusively upon stationary rails or tracks.

(45) VOLATILE ORGANIC COMPOUND (VOC) is any volatile compound containing the element carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and exempt compounds.

(46) VOC CONTENT means the weight of VOC per volume of coating, calculated according to the procedures in § 59.104(a) of 40 CFR Chapter 1.

Section 6

References

1. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Alternative Control Techniques Document: Automobile Refinishing. EPA 453/R-94/031 (NTIS PB94-191699). Research Triangle Park, NC. April 1994. pp. 2-7 to 2-10.
2. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Volatile Organic Compound Emissions from Automobile Refinishing. Background Information for Proposed Standards. EPA 453/D-95/005a (NTIS PB96-172457). Research Triangle Park, NC. August 1995. pp. 3-1 to 3-8.
3. 40 CFR Chapter 1, Part 59, Subpart B. July 1999.
4. E.I. du Pont de Nemours & Co. DuPont Automotive Finishes (MSDS). Wilmington, DE. January 1998.
5. Akzo Nobel Coatings Inc. Lesonal Technical Reference Manual. Norcross, GA. November 1999.
6. PPG Industries, Inc. PPG FaxBack: Material Safety Data Sheets. Strongsville, OH. March 1999.
7. BASF Corporation. BASF SmartFax: Material Safety Data Sheets. Whitehouse, OH. December 1999.
8. Sherwin-Williams Automotive Finishes Corp. Paint-Safe Material Safety Data Sheets (Booklet 1). Cleveland, OH. June, 1996.
9. ASTM D 2369-81, 87, 90, 92, 93, or 95, Standard Test Method for Volatile Content of Coatings.
10. ASTM D 1475-60, 80, or 90, Standard Test Method for Density of Paint, Varnish, Lacquer, and Related Products.
11. South Coast Air Quality Management District, Rule 1151. Motor Vehicle and Mobile Equipment Non-assembly Line Coating Operations. December 1998.
<http://www.aqmd.gov/rules/download.html> (accessed December 2004)

Section 7

Bibliography

1. Kline & Company, Inc. prepared for the National Paint & Coatings Association. Paint and Coatings “2000”: Review and Forecast. Fairfield, NJ. November 1995. pp. 149–152.
2. Anderson, Steve P. and Charlie Rubick, Texas Natural Resource Commission, Air Quality Planning Division. Quantifying Automobile Refinishing VOC Air Emissions: A Methodology with Estimates and Forecasts. The Emission Inventory: Key to Planning, Permits, Compliance, and Reporting (The proceedings of a specialty conference cosponsored by AWMA and U.S. EPA), New Orleans, LA. September 1996.
3. U.S. Environmental Protection Agency, Office of Research and Development. Guides to Pollution Prevention: The Automotive Refinishing Industry. EPA/625/7-91/016 (NTIS PB-129139). Cincinnati, OH. October 1991. pp. 5.

Appendix A

Method 24

METHOD 24 - DETERMINATION OF VOLATILE MATTER CONTENT,
WATER CONTENT, DENSITY, VOLUME SOLIDS, AND
WEIGHT SOLIDS OF SURFACE COATINGS

1.0 Scope and Application.

1.1 *Analytes.*

Analyte	CAS No.
Volatile organic compounds	no CAS number assigned
Water	7732-18-5

1.2 *Applicability.* This method is applicable for the determination of volatile matter content, water content, density, volume solids, and weight solids of paint, varnish, lacquer, or other related surface coatings.

1.3 *Precision and Bias.* Intra- and inter-laboratory analytical precision statements are presented in Section 13.1. No bias has been identified.

2.0 Summary of Method.

2.1 Standard methods are used to determine the volatile matter content, water content, density, volume solids, and weight solids of paint, varnish, lacquer, or other related surface coatings.

3.0 Definitions.

3.1 *Waterborne coating* means any coating which contains more than 5 percent water by weight in its volatile fraction.

3.2 *Multicomponent coatings* are coatings that are packaged in two or more parts, which are combined before application. Upon combination a coreactant from one part of the coating chemically reacts, at ambient conditions, with a coreactant from another part of the coating.

3.3 *Ultraviolet (UV) radiation-cured coatings* are coatings which contain unreacted monomers that are polymerized by exposure to ultraviolet light.

4.0 Interferences. [Reserved]

5.0 Safety.

5.1 *Disclaimer.* This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to

performing this test method.

5.2 *Hazardous Components*. Several of the compounds that may be contained in the coatings analyzed by this method may be irritating or corrosive to tissues (e.g., heptane) or may be toxic (e.g., benzene, methyl alcohol). Nearly all are fire hazards. Appropriate precautions can be found in reference documents, such as Reference 3 of Section 16.0.

6.0 Equipment and Supplies.

The equipment and supplies specified in the ASTM methods listed in Sections 6.1 through 6.6 (incorporated by reference—see § 60.17 [40 CFR] for acceptable versions of the methods) are required:

6.1 ASTM D 1475-60, 80, or 90, Standard Test Method for Density of Paint, Varnish, Lacquer, and Related Products.

6.2 ASTM D 2369-81, 87, 90, 92, 93, or 95, Standard Test Method for Volatile Content of Coatings.

6.3 ASTM D 3792-79 or 91, Standard Test Method for Water Content of Water Reducible Paints by Direct Injection into a Gas Chromatograph.

6.4 ASTM D 4017-81, 90, or 96a, Standard Test Method for Water in Paints and Paint Materials by the Karl Fischer Titration Method.

6.5 ASTM 4457-85 (Reapproved 1991), Standard Test Method for Determination of Dichloromethane and 1,1,1-Trichloroethane in Paints and Coatings by Direct Injection into a Gas Chromatograph.

6.6 ASTM D 5403-93, Standard Test Methods for Volatile Content of Radiation Curable Materials.

7.0 Reagents and Standards.

7.1 The reagents and standards specified in the ASTM methods listed in Sections 6.1 through 6.6 are required.

8.0 Sample Collection, Preservation, Storage, and Transport.

8.1 Follow the sample collection, preservation, storage, and transport procedures described in Reference 1 of Section 16.0.

9.0 Quality Control.

9.1 *Reproducibility* (**NOTE:** Not applicable to UV radiation-cured coatings). The variety of coatings that may be subject to analysis makes it necessary to verify the ability of the analyst and the analytical procedures to obtain reproducible results for the coatings tested. Verification is accomplished by running duplicate analyses on each sample tested

(Sections 11.2 through 11.4) and comparing the results with the intra-laboratory precision statements (Section 13.1) for each parameter.

9.2 Confidence Limits for Waterborne Coatings. Because of the inherent increased imprecision in the determination of the VOC content of waterborne coatings as the weight percent of water increases, measured parameters for waterborne coatings are replaced with appropriate confidence limits (Section 12.6). These confidence limits are based on measured parameters and inter-laboratory precision statements.

10.0 Calibration and Standardization.

10.1 Perform the calibration and standardization procedures specified in the ASTM methods listed in Sections 6.1 through 6.6.

11.0 Analytical Procedure.

Additional guidance can be found in Reference 2 of Section 16.0.

11.1 Non Thin-film Ultraviolet Radiation-cured (UV radiation-cured) Coatings.

11.1.1 *Volatile Content.* Use the procedure in ASTM D 5403 to determine the volatile matter content of the coating except the curing test described in NOTE 2 of ASTM D 5403 is required.

11.1.2 *Water Content.* To determine water content, follow Section 11.3.2.

11.1.3 *Coating Density.* To determine coating density, follow Section 11.3.3.

11.1.4 *Solids Content.* To determine solids content, follow Section 11.3.4.

11.1.5 To determine if a coating or ink can be classified as a thin-film UV cured coating or ink, use the equation in Section 12.2. If C is less than 0.2 g and A is greater than or equal to 225 cm² (35 in²), then the coating or ink is considered a thin-film UV radiation-cured coating and ASTM D 5403 is not applicable.

NOTE: As noted in Section 1.4 of ASTM D 5403, this method may not be applicable to radiation curable materials wherein the volatile material is water.

11.2 Multi-component Coatings.

11.2.1 Sample Preparation.

11.2.1.1 Prepare about 100 mL of sample by mixing the components in a storage container, such as a glass jar with a screw top or a metal can with a cap. The storage container should be just large enough to hold the mixture. Combine the components (by weight or volume) in the ratio recommended by the manufacturer. Tightly close the container between additions and during mixing to prevent loss of volatile materials. However, most manufacturers mixing instructions are by volume. Because of possible error caused by expansion of the liquid when measuring the volume, it is recommended that the

components be combined by weight. When weight is used to combine the components and the manufacturer's recommended ratio is by volume, the density must be determined by Section 11.3.3.

11.2.1.2 Immediately after mixing, take aliquots from this 100 mL sample for determination of the total volatile content, water content, and density.

11.2.2 *Volatile Content.* To determine total volatile content, use the apparatus and reagents described in ASTM D2369 Sections 3 and 4 (incorporated by reference—see § 60.17 for the approved versions of the standard), respectively, and use the following procedures:

11.2.2.1 Weigh and record the weight of an aluminum foil weighing dish. Add 3 ± 1 mL of suitable solvent as specified in ASTM D2369 to the weighing dish. Using a syringe as specified in ASTM D2369, weigh to 1 mg, by difference, a sample of coating into the weighing dish. For coatings believed to have a volatile content less than 40 weight percent, a suitable size is 0.3 ± 0.10 g, but for coatings believed to have a volatile content greater than 40 weight percent, a suitable size is 0.5 ± 0.1 g.

NOTE: If the volatile content determined pursuant to Section 12.4 is not in the range corresponding to the sample size chosen repeat the test with the appropriate sample size. Add the specimen dropwise, shaking (swirling) the dish to disperse the specimen completely in the solvent. If the material forms a lump that cannot be dispersed, discard the specimen and prepare a new one. Similarly, prepare a duplicate. The sample shall stand for a minimum of 1 hour, but no more than 24 hours prior to being oven cured at 110 ± 5 °C (230 ± 9 °F) for 1 hour.

11.2.2.2 Heat the aluminum foil dishes containing the dispersed specimens in the forced draft oven for 60 min at 110 ± 5 °C (230 ± 9 °F). Caution—provide adequate ventilation, consistent with accepted laboratory practice, to prevent solvent vapors from accumulating to a dangerous level.

11.2.2.3 Remove the dishes from the oven, place immediately in a desiccator, cool to ambient temperature, and weigh to within 1 mg.

11.2.2.4 Run analyses in pairs (duplicate sets) for each coating mixture until the criterion in Section 11.4 is met. Calculate W_v following Equation 24-2 and record the arithmetic average.

11.2.3 *Water Content.* To determine water content, follow Section 11.3.2.

11.2.4 *Coating Density.* To determine coating density, follow Section 11.3.3.

11.2.5 *Solids Content.* To determine solids content, follow Section 11.3.4.

11.2.6 *Exempt Solvent Content*. To determine the exempt solvent content, follow Section 11.3.5.

NOTE: For all other coatings (i.e., water- or solvent-borne coatings) not covered by multicomponent or UV radiation-cured coatings, analyze as shown below:

11.3 *Water- or Solvent-borne coatings*.

11.3.1 *Volatile Content*. Use the procedure in ASTM D 2369 to determine the volatile matter content (may include water) of the coating.

11.3.1.1 Record the following information:

W_1 = weight of dish and sample before heating, g

W_2 = weight of dish and sample after heating, g

W_3 = sample weight, g.

11.3.1.2 Calculate the weight fraction of the volatile matter (W_v) for each analysis as shown in Section 12.3.

11.3.1.3 Run duplicate analyses until the difference between the two values in a set is less than or equal to the intra-laboratory precision statement in Section 13.1.

11.3.1.4 Record the arithmetic average ($\overline{W}_v$).

11.3.2 *Water Content*. For waterborne coatings only, determine the weight fraction of water (W_w) using either ASTM D 3792 or ASTM D 4017.

11.3.2.1 Run duplicate analyses until the difference between the two values in a set is less than or equal to the intra-laboratory precision statement in Section 13.1.

11.3.2.2 Record the arithmetic average ($\overline{W}_w$).

11.3.3 *Coating Density*. Determine the density (D_c , kg/L) of the surface coating using the procedure in ASTM D 1475.

11.3.3.1 Run duplicate analyses until each value in a set deviates from the mean of the set by no more than the intra-laboratory precision statement in Section 13.1.

11.3.3.2 Record the arithmetic average ($\overline{D}_c$).

11.3.4 *Solids Content*. Determine the volume fraction (V_s) solids of the coating by calculation using the manufacturer's formulation.

11.3.5 *Exempt Solvent Content*. Determine the weight fraction of exempt solvents

(W_E) by using ASTM Method D4457. Run a duplicate set of determinations and record the arithmetic average (W_E).

11.4 *Sample Analysis Criteria.* For W_v and W_w , run duplicate analyses until the difference between the two values in a set is less than or equal to the intra-laboratory precision statement for that parameter. For D_c , run duplicate analyses until each value in a set deviates from the mean of the set by no more than the intra-laboratory precision statement. If, after several attempts, it is concluded that the ASTM procedures cannot be used for the specific coating with the established intra-laboratory precision (excluding UV radiation-cured coatings), the U.S. Environmental Protection Agency (EPA) will assume responsibility for providing the necessary procedures for revising the method or precision statements upon written request to: Director, Emissions, Monitoring, and Analysis Division, MD-14, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

12.0 Calculations and Data Analysis.

12.1 *Nomenclature.*

A = Area of substrate, cm^2 , (in^2).

C = Amount of coating or ink added to the substrate, g.

D_c = Density of coating or ink, g/cm^3 (g/in^3).

F = Manufacturer's recommended film thickness, cm (in).

W_o = Weight fraction of nonaqueous volatile matter, g/g.

W_s = Weight fraction of solids, g/g.

W_v = Weight fraction of the volatile matter, g/g.

W_w = Weight fraction of the water, g/g.

12.2 To determine if a coating or ink can be classified as a thin-film UV cured coating or ink, use the equation

$$C = F A D_c \quad (24-1)$$

12.3 Calculate W_v for each analysis as shown below:

$$W_v = (W_1 - W_2)/W_3 \quad (24-2)$$

12.4 *Nonaqueous Volatile Matter.*

12.4.1 Solvent-borne Coatings.

$$W_o = W_v \quad (24-3)$$

12.4.2 Waterborne Coatings.

$$W_o = W_v - W_w \quad (24-4)$$

12.4.3 Coatings Containing Exempt Solvents.

$$W_o = W_v - W_E - W_w \quad (24-5)$$

12.5 Weight Fraction Solids.

$$W_s = 1 - W_v \quad (24-6)$$

12.6 Confidence Limit Calculations for Waterborne Coatings. To calculate the lower confidence limit, subtract the appropriate inter-laboratory precision value from the measured mean value for that parameter. To calculate the upper confidence limit, add the appropriate inter-laboratory precision value to the measured mean value for that parameter. For W_v and D_c , use the lower confidence limits; for W_w , use the upper confidence limit. Because W_s is calculated, there is no adjustment for this parameter.

13.0 Method Performance.

13.1 Analytical Precision Statements. The intra- and inter-laboratory precision statements are given in Table 24-1 in Section 17.0.

14.0 Pollution Prevention. [Reserved]

15.0 Waste Management. [Reserved]

16.0 References.

Same as specified in Section 6.0, with the addition of the following:

1. Standard Procedure for Collection of Coating and Ink Samples for Analysis by Reference Methods 24 and 24A. EPA-340/1-91-010. U.S. Environmental Protection Agency, Stationary Source Compliance Division, Washington, D.C. September 1991.
2. Standard Operating Procedure for Analysis of Coating and Ink Samples by Reference Methods 24 and 24A. EPA-340/1-91-011. U.S. Environmental Protection Agency, Stationary Source Compliance Division, Washington, D.C. September 1991.
3. Handbook of Hazardous Materials: Fire, Safety, Health. Alliance of American Insurers. Schaumburg, IL. 1983.

17.0 Tables, Diagrams, Flowcharts, and Validation Data.

TABLE 24-1. ANALYTICAL PRECISION STATEMENTS.

Parameter	Intra-laboratory	Inter-laboratory
Volatile matter content, W_v	$\pm 0.015 \bar{W}_v$	$\pm 0.047 \bar{W}_v$
Water content, W_w	$\pm 0.029 \bar{W}_w$	$\pm 0.075 \bar{W}_w$
Density, D_c	$\pm 0.001 \text{ kg/L}$	$\pm 0.002 \text{ kg/L}$

Appendix B

Method 311

METHOD 311 - ANALYSIS OF HAZARDOUS AIR POLLUTANT COMPOUNDS
IN PAINTS AND COATINGS BY DIRECT INJECTION INTO A
GAS CHROMATOGRAPH

1. Scope and Application

1.1 *Applicability.* This method is applicable for determination of most compounds designated by the U.S. Environmental Protection Agency as volatile hazardous air pollutants (HAPs) (See Reference 1) that are contained in paints and coatings. Styrene, ethyl acrylate, and methyl methacrylate can be measured by ASTM D 4827-93 or ASTM D 4747-87. Formaldehyde can be measured by ASTM PS 9-94 or ASTM D 1979-91. Toluene diisocyanate can be measured in urethane prepolymers by ASTM D 3432-89. Method 311 applies only to those volatile HAPs which are added to the coating when it is manufactured, not to those which may form as the coating cures (reaction products or cure volatiles). A separate or modified test procedure must be used to measure these reaction products or cure volatiles in order to determine the total volatile HAP emissions from a coating. Cure volatiles are a significant component of the total HAP content of some coatings. The term “coating” used in this method shall be understood to mean paints and coatings.

1.2 *Principle.* The method uses the principle of gas chromatographic separation and quantification using a detector that responds to concentration differences. Because there are many potential analytical systems or sets of operating conditions that may represent useable methods for determining the concentrations of the compounds cited in Section 1.1 in the applicable matrices, all systems that employ this principle, but differ only in details of equipment and operation, may be used as alternative methods, provided that the prescribed quality control, calibration, and method performance requirements are met. Certified product data sheets (CPDS) may also include information relevant to the analysis of the coating sample including, but not limited to, separation column, oven temperature, carrier gas, injection port temperature, extraction solvent, and internal standard.

2. Summary of Method

Whole coating is added to dimethylformamide, and a suitable internal standard compound is added. An aliquot of the sample mixture is injected onto a chromatographic column containing a stationary phase that separates the analytes from each other and from other volatile compounds contained in the sample. The concentrations of the analytes are determined by comparing the detector responses for the sample to the responses obtained using known concentrations of the analytes.

3. Definitions [Reserved]

4. Interferences.

4.1 Coating samples of unknown composition may contain the compound used as the internal standard. Whether or not this is the case may be determined by following the procedures of Section 11 and deleting the addition of the internal standard specified in

Section 11.5.3. If necessary, a different internal standard may be used.

4.2 The GC column and operating conditions developed for one coating formulation may not ensure adequate resolution of target analytes for other coating formulations. Some formulations may contain nontarget analytes that coelute with target analytes. If there is any doubt about the identification or resolution of any gas chromatograph (GC) peak, it may be necessary to analyze the sample using a different GC column or different GC operating conditions.

4.3 Cross-contamination may occur whenever high-level and low-level samples are analyzed sequentially. The order of sample analyses specified in Section 11.7 is designed to minimize this problem.

4.4 Cross-contamination may also occur if the devices used to transfer coating during the sample preparation process or for injecting the sample into the GC are not adequately cleaned between uses. All such devices should be cleaned with acetone or other suitable solvent and checked for plugs or cracks before and after each use.

5. Safety

5.1 Many solvents used in coatings are hazardous. Precautions should be taken to avoid unnecessary inhalation and skin or eye contact. This method may involve hazardous materials, operations, and equipment. This test method does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and to determine the applicability of regulatory limitations in regards to the performance of this test method.

5.2 Dimethylformamide is harmful if inhaled or absorbed through the skin. The user should obtain relevant health and safety information from the manufacturer. Dimethylformamide should be used only with adequate ventilation. Avoid contact with skin, eyes, and clothing. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If eyes are affected, consult a physician. Remove and wash contaminated clothing before reuse.

5.3 User's manuals for the gas chromatograph and other related equipment should be consulted for specific precautions to be taken related to their use.

6. Equipment and Supplies

NOTE: Certified product data sheets (CPDS) may also include information relevant to the analysis of the coating sample including, but not limited to, separation column, oven temperature, carrier gas, injection port temperature, extraction solvent, and internal standard.

6.1 Sample Collection.

6.1.1 *Sampling Containers.* Dual-seal sampling containers, four to eight fluid ounce capacity, should be used to collect the samples. Glass sample bottles or plastic containers

with volatile organic compound (VOC) impermeable walls must be used for corrosive substances (e.g., etch primers and certain coating catalysts such as methyl ethyl ketone (MEK) peroxide). Sample containers, caps, and inner seal liners must be inert to the compounds in the sample and must be selected on a case-by-case basis.

6.1.1.1 Other routine sampling supplies needed include waterproof marking pens, tubing, scrappers/spatulas, clean rags, paper towels, cooler/ice, long handle tongs, and mixing/stirring paddles.

6.1.2 Personal safety equipment needed includes eye protection, respiratory protection, a hard hat, gloves, steel toe shoes, etc.

6.1.3 Shipping supplies needed include shipping boxes, packing material, shipping labels, strapping tape, etc.

6.1.4 Data recording forms and labels needed include coating data sheets and sample can labels.

NOTE: The actual requirements will depend upon the conditions existing at the source sampled.

6.2 Laboratory Equipment and Supplies.

6.2.1 *Gas Chromatograph (GC).* Any instrument equipped with a flame ionization detector and capable of being temperature programmed may be used. Optionally, other types of detectors (e.g., a mass spectrometer), and any necessary interfaces, may be used provided that the detector system yields an appropriate and reproducible response to the analytes in the injected sample. Autosampler injection may be used, if available.

6.2.2 *Recorder.* If available, an electronic data station or integrator may be used to record the gas chromatogram and associated data. If a strip chart recorder is used, it must meet the following criteria: A 1 to 10 millivolt (mV) linear response with a full scale response time of 2 seconds or less and a maximum noise level of ± 0.03 percent of full scale. Other types of recorders may be used as appropriate to the specific detector installed provided that the recorder has a full scale response time of 2 seconds or less and a maximum noise level of ± 0.03 percent of full scale.

6.2.3 *Column.* The column must be constructed of materials that do not react with components of the sample (e.g., fused silica, stainless steel, glass). The column should be of appropriate physical dimensions (e.g., length, internal diameter) and contain sufficient suitable stationary phase to allow separation of the analytes. DB-5, DB-Wax, and FFAP columns are commonly used for paint analysis; however, it is the responsibility of each analyst to select appropriate columns and stationary phases.

6.2.4 *Tube and Tube Fittings*. Supplies to connect the GC and gas cylinders.

6.2.5 *Pressure Regulators*. Devices used to regulate the pressure between gas cylinders and the GC.

6.2.6 *Flow Meter*. A device used to determine the carrier gas flow rate through the GC. Either a digital flow meter or a soap film bubble meter may be used to measure gas flow rates.

6.2.7 *Septa*. Seals on the GC injection port through which liquid or gas samples can be injected using a syringe.

6.2.8 *Liquid Charging Devices*. Devices used to inject samples into the GC such as clean and graduated 1, 5, and 10 microliter (μL) capacity syringes.

6.2.9 *Vials*. Containers that can be sealed with a septum in which samples may be prepared or stored. The recommended size is 25 mL capacity. Mininert[®] valves have been found satisfactory and are available from Pierce Chemical Company, Rockford, Illinois.

6.2.10 *Balance*. Device used to determine the weights of standards and samples. An analytical balance capable of accurately weighing to 0.0001 g is required.

7. Reagents and Standards

7.1 *Purity of Reagents*. Reagent grade chemicals shall be used in all tests. Unless otherwise specified, all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used provided it is first ascertained that the reagent is of sufficient purity to permit its use without lessening the accuracy of determination.

7.2 *Carrier Gas*. Helium carrier gas shall have a purity of 99.995 percent or higher. High purity nitrogen may also be used. Other carrier gases that are appropriate for the column system and analyte may also be used. Ultra-high purity grade hydrogen gas and zero-grade air shall be used for the flame ionization detector.

7.3 *Dimethylformamide (DMF)*. Solvent for all standards and samples. Some other suitable solvent may be used if DMF is not compatible with the sample or coelutes with a target analyte.

NOTE: DMF may coelute with ethylbenzene or *p*-xylene under the conditions described in the note under Section 6.2.3.

7.4 *Internal Standard Materials*. The internal standard material is used in the quantitation of the analytes for this method. It shall be gas chromatography spectrophotometric quality or, if this grade is not available, the highest quality available.

Obtain the assay for the internal standard material and maintain at that purity during use. The recommended internal standard material is 1-propanol; however, selection of an appropriate internal standard material for the particular coating and GC conditions used is the responsibility of each analyst.

7.5 Reference Standard Materials. The reference standard materials are the chemicals cited in Section 1.1 which are of known identity and purity and which are used to assist in the identification and quantification of the analytes of this method. They shall be the highest quality available. Obtain the assays for the reference standard materials and maintain at those purities during use.

7.6 Stock Reference Standards. Stock reference standards are dilutions of the reference standard materials that may be used on a daily basis to prepare calibration standards, calibration check standards, and quality control check standards. Stock reference standards may be prepared from the reference standard materials or purchased as certified solutions.

7.6.1 Stock reference standards should be prepared in dimethylformamide for each analyte expected in the coating samples to be analyzed. The concentrations of analytes in the stock reference standards are not specified but must be adequate to prepare the calibration standards required in the method. A stock reference standard may contain more than one analyte provided all analytes are chemically compatible and no analytes coelute. The actual concentrations prepared must be known to within 0.1 percent (e.g., 0.1000 ± 0.0001 g/g solution). The following procedure is suggested. Place about 35 mL of dimethylformamide into a tared ground-glass stoppered 50 mL volumetric flask. Weigh the flask to the nearest 0.1 mg. Add 12.5 g of the reference standard material and reweigh the flask. Dilute to volume with dimethylformamide and reweigh. Stopper the flask and mix the contents by inverting the flask several times. Calculate the concentration in grams per gram of solution from the net gain in weights, correcting for the assayed purity of the reference standard material.

NOTE: Although a glass-stoppered volumetric flask is convenient, any suitable glass container may be used because stock reference standards are prepared by weight.

7.6.2 Transfer the stock reference standard solution into one or more Teflon-sealed screw-cap bottles. Store, with minimal headspace, at $-10\text{ }^{\circ}\text{C}$ to $0\text{ }^{\circ}\text{C}$ and protect from light.

7.6.3 Prepare fresh stock reference standards every six months, or sooner if analysis results from daily calibration check standards indicate a problem. Fresh stock reference standards for very volatile HAPs may have to be prepared more frequently.

7.7 Calibration Standards. Calibration standards are used to determine the response of the detector to known amounts of reference material. Calibration standards must be prepared at a minimum of three concentration levels from the stock reference standards (see Section 7.6). Prepare the calibration standards in dimethylformamide (see Section

7.3). The lowest concentration standard should contain a concentration of analyte equivalent either to a concentration of no more than 0.01% of the analyte in a coating or to a concentration that is lower than the actual concentration of the analyte in the coating, whichever concentration is higher. The highest concentration standard should contain a concentration of analyte equivalent to slightly more than the highest concentration expected for the analyte in a coating. The remaining calibration standard should contain a concentration of analyte roughly at the midpoint of the range defined by the lowest and highest concentration calibration standards. The concentration range of the standards should thus correspond to the expected range of analyte concentrations in the prepared coating samples (see Section 11.5). Each calibration standard should contain each analyte for detection by this method expected in the actual coating samples (e.g., some or all of the compounds listed in Section 1.1 may be included). Each calibration standard should also contain an appropriate amount of internal standard material (response for the internal standard material is within 25 to 75 percent of full scale on the attenuation setting for the particular reference standard concentration level). Calibration Standards should be stored for 1 week only in sealed vials with minimal headspace. If the stock reference standards were prepared as specified in Section 7.6, the calibration standards may be prepared by either weighing each addition of the stock reference standard or by adding known volumes of the stock reference standard and calculating the mass of the standard reference material added. Alternative 1 (Section 7.7.1) specifies the procedure to be followed when the stock reference standard is added by volume. Alternative 2 (Section 7.7.2) specifies the procedure to be followed when the stock reference standard is added by weight.

NOTE: To assist with determining the appropriate amount of internal standard to add, as required here and in other sections of this method, the analyst may find it advantageous to prepare a curve showing the area response versus the amount of internal standard injected into the GC.

7.7.1 Preparation Alternative 1. Determine the amount of each stock reference standard and dimethylformamide solvent needed to prepare approximately 25 mL of the specific calibration concentration level desired. To a tared 25 mL vial that can be sealed with a crimp-on or Mininert valve, add the total amount of dimethylformamide calculated to be needed. As quickly as practical, add the calculated amount of each stock reference standard using new pipets (or pipet tips) for each stock reference standard. Reweigh the vial and seal it. Using the known weights of the standard reference materials per mL in the stock reference standards, the volumes added, and the total weight of all reagents added to the vial, calculate the weight percent of each standard reference material in the calibration standard prepared. Repeat this process for each calibration standard to be prepared.

7.7.2 Preparation Alternative 2. Determine the amount of each stock reference standard and dimethylformamide solvent needed to prepare approximately 25 mL of the specific calibration concentration level desired. To a tared 25 mL vial that can be sealed with a crimp-on or Mininert valve, add the total amount of dimethylformamide calculated to

be needed. As quickly as practical, add the calculated amount of a stock reference standard using a new pipet (or pipet tip) and reweigh the vial. Repeat this process for each stock reference standard to be added. Seal the vial after obtaining the final weight. Using the known weight percents of the standard reference materials in the stock reference standards, the weights of the stock reference standards added, and the total weight of all reagents added to the vial, calculate the weight percent of each standard reference material in the calibration standard prepared. Repeat this process for each calibration standard to be prepared.

8. Sample Collection, Preservation, Transport, and Storage

8.1 Copies of material safety data sheets (MSDSs) for each sample should be obtained prior to sampling. The MSDSs contain information on the ingredients, and physical and chemical properties data. The MSDSs also contain recommendations for proper handling or required safety precautions. Certified product data sheets (CPDS) may also include information relevant to the analysis of the coating sample including, but not limited to, separation column, oven temperature, carrier gas, injection port temperature, extraction solvent, and internal standard.

8.2 A copy of the blender's worksheet can be requested to obtain data on the exact coating being sampled. A blank coating data sheet form (see Section 18) may also be used. The manufacturer's formulation information from the product data sheet should also be obtained.

8.3 Prior to sample collection, thoroughly mix the coating to ensure that a representative, homogeneous sample is obtained. It is preferred that this be accomplished using a coating can shaker or similar device; however, when necessary, this may be accomplished using mechanical agitation or circulation systems.

8.3.1 Water-thinned coatings tend to incorporate or entrain air bubbles if stirred too vigorously; mix these types of coatings slowly and only as long as necessary to homogenize.

8.3.2 Each component of multicomponent coatings that harden when mixed must be sampled separately. The component mix ratios must be obtained at the facility at the time of sampling and submitted to the analytical laboratory.

8.4 *Sample Collection.* Samples must be collected in a manner that prevents or minimizes loss of volatile components and that does not contaminate the coating reservoir. A suggested procedure is as follows. Select a sample collection container which has a capacity at least 25 percent greater than the container in which the sample is to be transported. Make sure both sample containers are clean and dry. Using clean, long-handled tongs, turn the sample collection container upside down and lower it into the coating reservoir. The mouth of the sample collection container should be at approximately the midpoint of the reservoir (do not take the sample from the top surface). Turn the sample collection container over and slowly bring it to the top of the coating reservoir. Rapidly pour the collected coating into the sample container, filling it completely. It is important to fill the sample container completely to avoid any loss of volatiles due to volatilization into the

headspace. Return any unused coating to the reservoir or dispose as appropriate.

NOTE: If a company requests a set of samples for its own analysis, a separate set of samples, using new sample containers, should be taken at the same time.

8.5 Once the sample is collected, place the sample container on a firm surface and insert the inner seal in the container by placing the seal inside the rim of the container, inverting a screw cap, and pressing down on the screw cap which will evenly force the inner seal into the container for a tight fit. Using clean towels or rags, remove all residual coating material from the outside of the sample container after inserting the inner seal. Screw the cap onto the container.

8.5.1 Affix a sample label (see Section 18) clearly identifying the sample, date collected, and person collecting the sample.

8.5.2 Prepare the sample for transportation to the laboratory. The sample should be maintained at the coating's recommended storage temperature specified on the Material Safety Data Sheet, or, if no temperature is specified, the sample should be maintained within the range of 5 °C to 38 °C.

8.9 The shipping container should adhere to U.S. Department of Transportation specification DOT 12 B. Coating samples are considered hazardous materials; appropriate shipping procedures should be followed.

9. Quality Control

9.1 Laboratories using this method should operate a formal quality control program. The minimum requirements of the program should consist of an initial demonstration of laboratory capability and an ongoing analysis of blanks and quality control samples to evaluate and document quality data. The laboratory must maintain records to document the quality of the data generated. When results indicate atypical method performance, a quality control check standard (see Section 9.4) must be analyzed to confirm that the measurements were performed in an in-control mode of operation.

9.2 Before processing any samples, the analyst must demonstrate, through analysis of a reagent blank, that there are no interferences from the analytical system, glassware, and reagents that would bias the sample analysis results. Each time a set of analytical samples is processed or there is a change in reagents, a reagent blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.

9.3 Required instrument quality control parameters are found in the following sections:

9.3.1 Baseline stability must be demonstrated to be ≤ 5 percent of full scale using the procedures given in Section 10.1.

9.3.2 The GC calibration is not valid unless the retention time (RT) for each analyte at each concentration is within ± 0.05 min of the retention time measured for that analyte in the stock standard.

9.3.3 The retention time (RT) of any sample analyte must be within ± 0.05 min of the average RT of the analyte in the calibration standards for the analyte to be considered tentatively identified.

9.3.4 The GC system must be calibrated as specified in Section 10.2.

9.3.5 A one-point daily calibration check must be performed as specified in Section 10.3.

9.4 To establish the ability to generate results having acceptable accuracy and precision, the analyst must perform the following operations.

9.4.1 Prepare a quality control check standard (QCCS) containing each analyte expected in the coating samples at a concentration expected to result in a response between 25 percent and 75 percent of the limits of the calibration curve when the sample is prepared as described in Section 11.5. The QCCS may be prepared from reference standard materials or purchased as certified solutions. If prepared in the laboratory, the QCCS must be prepared independently from the calibration standards.

9.4.2 Analyze three aliquots of the QCCS according to the method beginning in Section 11.5.3 and calculate the weight percent of each analyte using Equation 1, Section 12.

9.4.3 Calculate the mean weight percent ($\bar{X}$) for each analyte from the three results obtained in Section 9.4.2.

9.4.4 Calculate the percent accuracy for each analyte using the known concentrations (T_i) in the QCCS using Equation 3, Section 12.

9.4.5 Calculate the percent relative standard deviation (percent RSD) for each analyte using Equation 7, Section 12, substituting the appropriate values for the relative response factors (RRFs) in said equation.

9.4.6 If the percent accuracy (Section 9.4.4) for all analytes is within the range 90 percent to 110 percent and the percent RSD (Section 9.4.5) for all analytes is ≤ 20 percent, system performance is acceptable and sample analysis may begin. If these criteria are not met for any analyte, then system performance is not acceptable for that analyte, and the test must be repeated for those analytes only. Repeated failures indicate a general problem with the measurement system that must be located and corrected. In this case, the entire test, beginning at Section 9.4.1, must be repeated after the problem is corrected.

9.5 Great care must be exercised to maintain the integrity of all standards. It is recommended that all standards be stored at -10 °C to 0 °C in screw-cap amber glass bottles with Teflon liners.

9.6 Unless otherwise specified, all weights are to be recorded within 0.1 mg.

10. Calibration and Standardization.

10.1 *Column Baseline Drift.* Before each calibration and series of determinations and before the daily calibration check, condition the column using procedures developed by the laboratory or as specified by the column supplier. Operate the GC at initial (i.e., before sample injection) conditions on the lowest attenuation to be used during sample analysis. Adjust the recorder pen to zero on the chart and obtain a baseline for at least one minute. Initiate the GC operating cycle that would be used for sample analysis. On the recorder chart, mark the pen position at the end of the simulated sample analysis cycle. Baseline drift is defined as the absolute difference in the pen positions at the beginning and end of the cycle in the direction perpendicular to the chart movement. Calculate the percent baseline drift by dividing the baseline drift by the chart width representing full-scale deflection and multiply the result by 100.

10.2 *Calibration of GC.* Bring all stock standards and calibration standards to room temperature while establishing the GC at the determined operating conditions.

10.2.1 Retention Times (RT's) for Individual Compounds.

NOTE: The procedures of this subsection are required only for the initial calibration. However, it is good laboratory practice to follow these procedures for some or all analytes before each calibration. The procedures were written for chromatogram output to a strip chart recorder. More modern instruments (e.g., integrators and electronic data stations) determine and print out or display retention times automatically.

The RT for each analyte should be determined before calibration. This provides a positive identification for each peak observed from the calibration standards. Inject an appropriate volume (see NOTE in Section 11.5.2) of one of the stock reference standards into the gas chromatograph and record on the chart the pen position at the time of the injection (see Section 7.6.1). Dilute an aliquot of the stock reference standard as required in dimethylformamide to achieve a concentration that will result in an on-scale response. Operate the gas chromatograph according to the determined procedures. Select the peak(s) that correspond to the analyte(s) [and internal standard, if used] and measure the retention time(s). If a chart recorder is used, measure the distance(s) on the chart from the injection point to the peak maxima. These distances, divided by the chart speed, are defined as the RTs of the analytes in question. Repeat this process for each of the stock reference standard solutions.

NOTE: If gas chromatography with mass spectrometer detection (GC-MS) is used, a stock reference standard may contain a group of analytes, provided all analytes are adequately separated during the analysis. Mass spectral library matching can be used to identify the analyte associated with each peak in the gas chromatogram. The retention time for the analyte then becomes the retention time of its peak in the chromatogram.

10.2.2 *Calibration.* The GC must be calibrated using a minimum of three concentration levels of each potential analyte. (See Section 7.7 for instructions on preparation of the calibration standards.) Beginning with the lowest concentration level calibration standard, carry out the analysis procedure as described beginning in Section 11.7. Repeat the procedure for each progressively higher concentration level until all calibration standards have been analyzed.

10.2.2.1 Calculate the RTs for the internal standard and for each analyte in the calibration standards at each concentration level as described in Section 10.2.1. The RTs for the internal standard must not vary by more than 0.10 minutes. Identify each analyte by comparison of the RTs for peak maxima to the RTs determined in Section 10.2.1.

10.2.2.2 Compare the retention times (RTs) for each potential analyte in the calibration standards for each concentration level to the retention times determined in Section 10.2.1. The calibration is not valid unless all RTs for all analytes meet the criteria given in Section 9.3.2.

10.2.2.3 Tabulate the area responses and the concentrations for the internal standard and each analyte in the calibration standards. Calculate the response factor for the internal standard (RF_{is}) and the response factor for each compound relative to the internal standard (RRF) for each concentration level using Equations 5 and 6, Section 12.

10.2.2.4 Using the RRFs from the calibration, calculate the percent relative standard deviation (percent RSD) for each analyte in the calibration standard using Equation 7, Section 12. The percent RSD for each individual calibration analyte must be less than 15 percent. This criterion must be met in order for the calibration to be valid. If the criterion is met, the mean RRF's determined above are to be used until the next calibration.

10.3 *Daily Calibration Checks.* The calibration curve (Section 10.2.2) must be checked and verified at least once each day that samples are analyzed. This is accomplished by analyzing a calibration standard that is at a concentration near the midpoint of the working range and performing the checks in Sections 10.3.1, 10.3.2, and 10.3.3.

10.3.1 For each analyte in the calibration standard, calculate the percent difference in the RRF from the last calibration using Equation 8, Section 12. If the percent difference for each calibration analyte is less than 10 percent, the last calibration curve is assumed to be valid. If the percent difference for any analyte is greater than 5 percent, the analyst should consider this a warning limit. If the percent difference for any one calibration analyte

exceeds 10 percent, corrective action must be taken. If no source of the problem can be determined after corrective action has been taken, a new three-point (minimum) calibration must be generated. This criterion must be met before quantitative analysis begins.

10.3.2 If the RF_{is} for the internal standard changes by more than ± 20 percent from the last daily calibration check, the system must be inspected for malfunctions and corrections made as appropriate.

10.3.3 The retention times for the internal standard and all calibration check analytes must be evaluated. If the retention time for the internal standard or for any calibration check analyte changes by more than 0.10 min from the last calibration, the system must be inspected for malfunctions and corrections made as required.

11. Procedure

11.1 All samples and standards must be allowed to warm to room temperature before analysis. Observe the given order of ingredient addition to minimize loss of volatiles.

11.2 Bring the GC system to the determined operating conditions and condition the column as described in Section 10.1. **NOTE:** The temperature of the injection port may be an especially critical parameter. Information about the proper temperature may be found on the CPDS.

11.3 Perform the daily calibration checks as described in Section 10.3. Samples are not to be analyzed until the criteria in Section 10.3 are met.

11.4 Place the as-received coating sample on a paint shaker, or similar device, and shake the sample for a minimum of 5 minutes to achieve homogenization.

11.5 **NOTE:** The steps in this section must be performed rapidly and without interruption to avoid loss of volatile organics. These steps must be performed in a laboratory hood free from solvent vapors. All weights must be recorded to the nearest 0.1 mg.

11.5.1 Add 16 g of dimethylformamide to each of two tared vials (A and B) capable of being septum sealed.

11.5.2 To each vial add a weight of coating that will result in the response for the major constituent being in the upper half of the linear range of the calibration curve. **NOTE:** The magnitude of the response obviously depends on the amount of sample injected into the GC as specified in Section 11.8. This volume must be the same as used for preparation of the calibration curve, otherwise shifts in compound retention times may occur. If a sample is prepared that results in a response outside the limits of the calibration curve, new samples must be prepared; changing the volume injected to bring the response within the calibration curve limits is not permitted.

11.5.3 Add a weight of internal standard to each vial (A and B) that will result in the response for the internal standard being between 25 percent and 75 percent of the linear range of the calibration curve.

11.5.4 Seal the vials with crimp-on or Mininert septum seals.

11.6 Shake the vials containing the prepared coating samples for 60 seconds. Allow the vials to stand undisturbed for ten minutes. If solids have not settled out on the bottom after 10 minutes, then centrifuge at 1,000 rpm for 5 minutes. The analyst also has the option of injecting the sample without allowing the solids to settle.

11.7 Analyses should be conducted in the following order: daily calibration check sample, method blank, up to 10 injections from sample vials (i.e., one injection each from up to five pairs of vials, which corresponds to analysis of 5 coating samples).

11.8 Inject the prescribed volume of supernatant from the calibration check sample, the method blank, and the sample vials onto the chromatographic column and record the chromatograms while operating the system under the specified operating conditions. **NOTE:** The analyst has the option of injecting the unseparated sample.

12. Data Analysis and Calculations

12.1 *Qualitative Analysis.* An analyte (e.g., those cited in Section 1.1) is considered tentatively identified if two criteria are satisfied: (1) elution of the sample analyte within ± 0.05 min of the average GC retention time of the same analyte in the calibration standard; and (2) either (a) confirmation of the identity of the compound by spectral matching on a gas chromatograph equipped with a mass selective detector or (b) elution of the sample analyte within ± 0.05 min of the average GC retention time of the same analyte in the calibration standard analyzed on a dissimilar GC column.

12.1.1 The RT of the sample analyte must meet the criteria specified in Section 9.3.3.

12.1.2 When doubt exists as to the identification of a peak or the resolution of two or more components possibly comprising one peak, additional confirmatory techniques (listed in Section 12.1) must be used.

12.2 *Quantitative Analysis.* When an analyte has been identified, the quantification of that compound will be based on the internal standard technique.

12.2.1 A single analysis consists of one injection from each of two sample vials (A and B) prepared using the same coating. Calculate the concentration of each identified analyte in the sample as follows:

$$HAP_{at\%} = 100 \times \frac{(A_x)(W_{is})}{(A_{is})(RRF_x)(W_x)} \quad \text{Eq. (1)}$$

where:

$HAP_{wt\%}$ = weight percent of the analyte in coating.

A_x = Area response of the analyte in the sample.

W_{is} = Weight of internal standard added to sample, g.

A_{is} = Area response of the internal standard in the sample.

$\overline{RRF}_x$ = Mean relative response factor for the analyte in the calibration standards.

W_x = Weight of coating added to the sample solution, g.

12.2.2 Report results for duplicate analysis (sample vials A and B) without correction.

12.3 *Precision Data.* Calculate the percent difference between the measured concentrations of each analyte in vials A and B as follows.

12.3.1 Calculate the weight percent of the analyte in each of the two sample vials as described in Section 12.2.1.

12.3.2 Calculate the percent difference for each analyte as:

$$\%Dif_i = 100 \times \frac{|A_i - B_i|}{\frac{(A_i + B_i)}{2}} \quad \text{Eq. (2)}$$

where A_i and B_i are the measured concentrations of the analyte in vials A and B.

12.4 Calculate the percent accuracy for analytes in the QCCS (See Section 9.4) as follows:

$$\%Accuracy_x = 100 \times \frac{\overline{X}_x}{T_x} \quad \text{Eq. (3)}$$

where $\overline{X}_x$ is the mean measured value and T_x is the known true value of the analyte in the QCCS.

12.5 Obtain retention times (RTs) from data station or integrator or, for chromatograms from a chart recorder, calculate the RTs for analytes in the calibration standards (See Section 10.2.2.2) as follows:

$$RT = \frac{\text{Distance from injection to peak maximum}}{\text{Recorder chart speed}} \quad \text{Eq. (4)}$$

12.6 Calculate the response factor for the internal standard (See Section 10.2.2.3) as follows:

$$RF_{is} = \frac{A_{is}}{C_{is}} \quad \text{Eq. (5)}$$

where:

A_{is} = Area response of the internal standard.

C_{is} = Weight percent of the internal standard.

12.7 Calculate the relative response factors for analytes in the calibration standards (See Section 10.2.2.3) as follows:

$$RRF_x = \frac{A_x}{RF_{is} C_x} \quad \text{Eq. (6)}$$

where:

RRF_x = Relative response factor for an individual analyte.

A_x = Area response of the analyte being measured.

C_x = Weight percent of the analyte being measured.

12.8 Calculate the percent relative standard deviation of the relative response factors for analytes in the calibration standards (See Section 10.2.2.4) as follows:

$$\%RSD = 100 \times \frac{\sqrt{\frac{\sum_{i=1}^n (RRF_x - \overline{RRF_x})^2}{n-1}}}{\overline{RRF_x}} \quad \text{Eq. (7)}$$

where:

n = Number of calibration concentration levels used for an analyte.

RRF_x = Individual RRF for an analyte.

$\overline{RRF_x}$ = Mean of all RRF's for an analyte.

12.9 Calculate the percent difference in the relative response factors between the calibration curve and the daily calibration checks (See Section 10.3) as follows:

$$\% \text{Difference} = 100 \times \frac{|\overline{RRF_x} - RRF_c|}{\overline{RRF_x}} \quad \text{Eq. (8)}$$

where:

$\overline{RRF_x}$ = mean relative response factor from last calibration.

RRF_c = relative response factor from calibration check standard.

13. Measurement of Reaction Byproducts That are HAP. [Reserved]

14. Method Performance. [Reserved]

15. Pollution Prevention. [Reserved]

16. Waste Management

16.1 The coating samples and laboratory standards and reagents may contain compounds which require management as hazardous waste. It is the laboratory's responsibility to ensure all wastes are managed in accordance with all applicable laws and regulations.

16.2 To avoid excessive laboratory waste, obtain only enough sample for laboratory analysis.

16.3 It is recommended that discarded waste coating solids, used rags, used paper towels, and other nonglass or nonsharp waste materials be placed in a plastic bag before disposal. A separate container, designated "For Sharp Objects Only," is recommended for collection of discarded glassware and other sharp-edge items used in the laboratory. It is recommended that unused or excess samples and reagents be placed in a solvent-resistant plastic or metal container with a lid or cover designed for flammable liquids. This container should not be stored in the area where analytical work is performed. It is recommended that a record be kept of all compounds placed in the container for identification of the contents upon disposal.

17. References

1. Clean Air Act Amendments, Public Law 101-549, Titles I-XI, November, 1990.
2. Standard Test Method for Water Content of Water-Reducible Paints by Direct Injection into a Gas Chromatograph. ASTM Designation D3792-79
3. Standard Practice for Sampling Liquid Paints and Related Pigment Coatings. ASTM Designation D3925-81.
4. Standard Test Method for Determination of Dichloromethane and 1,1,1-Trichloroethane in Paints and Coatings by Direct Injection into a Gas Chromatograph. ASTM Designation D4457-85.
5. Standard Test Method for Determining the Unreacted Monomer Content of Latexes Using Capillary Column Gas Chromatography. ASTM Designation D4827 93.
6. Standard Test Method for Determining Unreacted Monomer Content of Latexes Using Gas-Liquid Chromatography. ASTM Designation D 4747 87.
7. Method 301 - "Field Validation of Pollutant Measurement Methods from Various Waste Media," 40 CFR 63, Appendix A.

8. "Reagent Chemicals, American Chemical Society Specifications," American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards" by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY and the "United States Pharmacopeia."

18. Tables, Diagrams, Flowcharts, and Validation Data

Agency: _____ Inspector: _____

Sample ID# : _____ Date/Time: _____

Source ID : _____

Coating Name/Type : _____

Plant Witness : _____

Type Analysis Required: _____

Special Handling : _____

Sample Container Label

COATING DATA

Date: _____ Source: _____

Data	Sampling ID No.	Sampling ID No.
Coating:		
Supplier		
Name and Color of Coating		
Type of Coating (primer, clearcoat, etc.)		
Identification Number for Coating		
Coating Density (lbs/gal)		
Total Volatiles Content (wt percent)		
Water Content (wt percent)		
VOC Content (wt percent)		
Solids Content (wt percent)		
Diluent Properties:		
Name		
Identification Number		
Diluent Solvent Density (lbs/gal)		
VOC Content (wt percent)		
Water Content (wt percent)		
Exempt Solvent Content (wt percent)		
Diluent/Solvent Ratio (gal diluent solvent/gal coating)		

STOCK REFERENCE STANDARD

Name of Reference Material: _____

Supplier Name: _____

Lot Number: _____

Purity: _____

Name of Solvent Material: Demethylformamide

Supplier Name: _____

Lot Number: _____

Purity: _____

Date Prepared: _____ Prepared By: _____

Notebook/page No.: _____

Preparation Information

1. Weight Empty Flask: _____, g
2. Weight Plus DMF: _____, g
3. Weight Plus Reference Material: _____, g
4. Weight After Made to Volume: _____, g
5. Weight DMF (lines 2-1+3-4): _____, g
6. Weight Ref. Material (lines 3-2): _____, g
7. Corrected Weight of Reference Material (line 6 times purity): _____, g
8. Fraction Reference Material in Standard Soln. (line 7 ÷ line 5): _____, g
9. Total Volume of Standard Solution: _____, mL
10. Weight Reference Material per mL of Solution (line 7 ÷ line 9): _____, g/mL

Laboratory ID No. for this Standard: _____

Expiration Date for this Standard: _____

CALIBRATION STANDARD

Date Prepared: _____

Prepared By: _____

Date Expires : _____

Notebook/page: _____

Calibration Standard Identification No.: _____

Preparation Information

Final Weight Flask Plus Reagents: _____, g

Weight Empty flask _____, g

Total Weight Of Reagents _____, g

Analyte name ^a	Stock reference standard ID No.	Amount of stock reference standard added (by volume or by weight)				Calculated weight analyte added, g	Weight percent analyte in calibration standard ^b
		Volume added, mL	Amount in standard, g/mL	Weight added, g	Amount in standard, g/g soln		

^a Include internal standard(s).

^b Weight percent = Weight analyte added ÷ include internal standard(s).

QUALITY CONTROL CHECK STANDARD

Date Prepared: _____
 Date Expires : _____

Prepared By: _____
 Notebook/page: _____

Quality Control Check Standard Identification No.: _____

Preparation Information

Final Weight Flask Plus Reagents: _____, g
 Weight Empty flask _____, g
 Total Weight Of Reagents _____, g

09

Analyte name ^a	Stock reference standard ID No.	Amount of stock reference standard added (by volume or by weight)				Calculated weight analyte added, g	Weight percent analyte in QCC standard ^b
		Volume added, mL	Amount in standard, g/mL	Weight added, g	Amount in standard, g/g soln		

^a Include internal standard(s).

^b Weight percent = Weight analyte added ÷ include internal standard(s).

QUALITY CONTROL CHECK STANDARD ANALYSIS

Date QCCS analyzed: _____

Analyst: _____

QCCS Identification No.: _____

QCC Expiration Date: _____

Analysis Results

Analyte	Weight percent determined			Mean Wt percent	Percent accuracy	Percent RSD	Meets criteria in Section 9.4.6	
	Run 1	Run 2	Run3				Percent accuracy	Percent RSD

CALIBRATION OF GAS CHROMATOGRAPH

Calibration Date: _____

Calibrated By: _____

PART 1. Retention Times for Individual Analytes

Analyte	Stock standard ID No.	Recorder chart speed		Distance from injection point to peak maximum		Retention time, minutes ^a
		Inches/min	cm/min	Inches	Centimeters	

^a Retention time = distance to peak maxima ÷ chart speed

CALIBRATION OF GAS CHROMATOGRAPH

Calibration Data: _____ Calibrated By: _____

PART 2. Analysis of Calibration Standards

Analyte Calib. STD ID No.

_____ Calib. STD ID No.

_____ Calib. STD ID No.

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Name:

Conc. in STD

Area Response

RT

Internal Standard

Name:

Conc. in STD

Area Response

RT

CALIBRATION OF GAS CHROMATOGRAPH

Calibration Date: _____

Calibrated By: _____

PART 3. Data Analysis for Calibration Standards

Analyte	Calib. STD ID	Calib. STD ID	Calib. STD ID	Mean	percent RSD of RF	Is RT within ± 0.05 min of RT for stock? (Y/N)	Is percent RSD <30% (Y/N)
Name: RT RF							
Name: RT RF							
Name: RT RF							
Name: RT RF							
Name: RT RF							
Name: RT RF							

DAILY CALIBRATION CHECK

Date: _____ Analyst: _____

Calibration Check Standard ID No.: _____

Expiration Date: _____

Analyte Retention Time (RT)

Last This Difference^a

Response Factor (RF)

Last This Difference^b

^a Retention time (RT) change (difference) must be less than ± 0.10 minutes.

^b Response factor (RF) change (difference) must be less than 20 percent for each analyte and for the internal standard.

Sample Analysis

Vial A ID No.: _____

Vial B ID No.: _____

Analyzed By: _____ Date: _____

Sample preparation information

Vial A

(g) Vial B

(g)

Measured:

wt empty vial

wt plus DMF

wt plus sample

wt plus internal standard

Calculated:

wt DMF

wt sample

wt internal standard

Analysis Results: Duplicate Samples

Analyte	Area response RF		Wt percent in sample		Average
	Vial A	Vial B	Vial A	Vial B	

Internal Standard

Appendix C

Method 311 Results

Coatings In-House Evaluation: Detection Limit Study
Based on 0.05 g sample size

Substance	% Detection Limit
acetone	0.50
ethyl acetate	0.50
methanol	0.19
isopropyl acetate	0.08
MEK	0.16
dichloromethane	0.50
isopropanol	0.13
ethanol	0.22
2-pentanone	0.50
MIBK	0.06
toluene	0.10
n-butyl acetate	0.11
ethyl benzene	0.12
p-xylene	0.05
m-xylene	0.07
MIAC	0.14
butyl propionate	0.09
p-chlorobenzotrifluoride	0.50
o-xylene	0.09
2-heptanone	0.50
1-methoxy-2-propanol acetate	0.50
1,3,5-trimethylbenzene	0.09
1,2,4-trimethylbenzene	0.08
2-butoxyethanol	0.71
2-butoxyethyl acetate	0.50
dibutyl phthalate	0.37

Coatings In-House Evaluation: SW CC637

surrogate recovery = 98.02

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.12	J		NA
ethyl acetate	0.00			NA
methanol	0.00			NA
isopropyl acetate	0.00			NA
MEK	15.59			NA
dichloromethane	0.00			NA
isopropanol	0.00			NA
ethanol	0.00			NA
2-pentanone	0.00			NA
MIBK	12.01			NA
toluene	0.00			NA
n-butyl acetate	4.37			NA
ethyl benzene	0.00			NA
p-xylene	0.06	J	0.2	NA
m-xylene	0.13	J		NA
MIAC	0.00			NA
butyl propionate	0.00			NA
p-chlorobenzotrifluoride	0.00			NA
o-xylene	0.00			NA
2-heptanone	14.86			NA
1-methoxy-2-propanol acetate	0.00			NA
1,3,5-trimethylbenzene	0.00			NA
1,2,4-trimethylbenzene	0.00			NA
2-butoxyethanol	0.00			NA
2-butoxyethyl acetate	0.00			NA
dibutyl phthalate	0.00			NA

Estimated TICs

2-ethylhexyl methacrylate NA

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW SSH520
 Ultra One Stage System
 surrogate recovery = 117.79

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	8.20			8.0
ethyl benzene	12.95			7.0
p-xylene	10.65		39.3	40.0
m-xylene	23.03			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	5.63			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW BCS605

surrogate recovery = 103.91

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.19	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.30	J		
n-butyl acetate	31.42			39.0
ethyl benzene	12.34			9.0
p-xylene	12.42		46.7	49.0
m-xylene	26.57			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	7.75			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 1440S

surrogate recovery = 108.25

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.10	J		
ethyl acetate	0.09			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.43	J		
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.33	J		
n-butyl acetate	0.10	J		
ethyl benzene	5.25			1 to 3
p-xylene	5.52		20.9	19 to 21
m-xylene	11.77			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	3.59			
2-heptanone	5.25			Not Specified
1-methoxy-2-propanol acetate	5.80			Not Specified
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 817L

surrogate recovery = 99.27

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	6.81			Not Found
ethyl acetate	0.80	J		Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	5.34			Not Found
dichloromethane	0.00			Not Found
isopropanol	8.69			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	20.04			Not Found
n-butyl acetate	2.20			Not Found
ethyl benzene	2.72			Not Found
p-xylene	3.01		11.1	Not Found
m-xylene	6.31			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	1.77			Not Found
2-heptanone	1.17	J		Not Found
1-methoxy-2-propanol acetate	1.50			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.00			Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.00			Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
dimethyl ester butanedioic acid	0.64			Not Found
butanoic acid	0.31			Not Found
dimethyl ester pentaedioic acid	2.08			Not Found
dimethyl ester hexanedioic acid	0.75			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW U7F2030

surrogate recovery = 111.43

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.05	J		Not Found
ethyl acetate	0.24	J		Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	2.24			Not Found
dichloromethane	0.00			Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	0.88	J		Not Found
n-butyl acetate	22.76	E		Not Found
ethyl benzene	6.49			Not Found
p-xylene	5.92		22.4	Not Found
m-xylene	12.52			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	3.93			Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	0.00			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.00			Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.71	J		Not Found
dibutyl phthalate	0.00			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 99K

surrogate recovery = 88.47

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	9.95			
ethyl acetate	1.12	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	1.01	J		12.0
dichloromethane	0.00			
isopropanol	1.02	J		
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	21.06			31.0
n-butyl acetate	19.62			
ethyl benzene	3.76			0 to 1
p-xylene	3.96		15.1	8 to 9
m-xylene	8.54			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	2.56			
2-heptanone	0.04	J		
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: BASF RM-84479

surrogate recovery = 103.51

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.11	J		Not Found
ethyl acetate	0.00			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.00			Not Found
dichloromethane	0.00			Not Found
isopropanol	2.24			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	6.89			Not Found
toluene	0.00			Not Found
n-butyl acetate	25.95	E		Not Found
ethyl benzene	3.45			Not Found
p-xylene	3.69		15.6	Not Found
m-xylene	8.40			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	3.52			Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	1.29	J		Not Found
1,3,5-trimethylbenzene	0.13	J		Not Found
1,2,4-trimethylbenzene	0.45	J		Not Found
2-butoxyethanol	0.02	J		Not Found
2-butoxyethyl acetate	1.64	J		Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
1-butanol	0.60			Not Found
2,2-dimethyl-1,3-propanediol	0.35			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: BASF RM-DC92

surrogate recovery = 92.41

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	7.10			1 to 10
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.85	J		
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	1.09	J		
n-butyl acetate	1.22	J		
ethyl benzene	0.53	J		
p-xylene	0.63	J	2.4	
m-xylene	1.30	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.42	J		
2-heptanone	28.01	E		30 to 40
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.62	J		
1,2,4-trimethylbenzene	2.32			1 to 5
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
1-ethyl-2-methylbenzene	0.48			
1-ethyl-3-methylbenzene	1.53			
1-ethyl-2-methylbenzene	0.47			
2-methyl-2-propenoic acid	1.34			
1-methyl-2-butenolate	0.81			
benzyl butyl phthalate	NR			1 to 5

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: BASF RM-DP20

Likely low spike/sample probably OK

surrogate recovery = 70.89

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	3.63			1 to 5
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	8.76			1 to 10
ethyl benzene	1.82			1 to 3
p-xylene	1.96		8.3	5 to 15
m-xylene	4.53			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	1.82			
2-heptanone	0.19	J		
1-methoxy-2-propanol acetate	5.80			1 to 10
1,3,5-trimethylbenzene	0.28	J		
1,2,4-trimethylbenzene	0.90	J		
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.92	J		
dibutyl phthalate	0.20	J		
Estimated TIC				
1-ethyl-2-methylbenzene	0.48			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: Akzo Nobel 071333

surrogate recovery = 113.87

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	18.22			10 to 20
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	12.34			11.3
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	4.23			3.5
toluene	0.12	J		0.1
n-butyl acetate	10.64			3.0
ethyl benzene	3.94			2.7
p-xylene	3.69		13.9	11.4
m-xylene	7.68			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	2.68			1 to 5
o-xylene	2.55			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
2,2-dimethylpropanoic acid	0.37			
2-methyl-2-propenoic acid	1.23			
2-methyl-2-hydroxypropenoic acid	0.66			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: Akzo Nobel 074295

surrogate recovery = 111.58

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.18	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	33.78	E		20 to 40
ethyl benzene	0.00			
p-xylene	0.00		0.1	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.08	J		
2-heptanone	3.09			1 to 5
1-methoxy-2-propanol acetate	34.09			20 to 30
1,3,5-trimethylbenzene	0.53	J		
1,2,4-trimethylbenzene	1.80			1.6
2-butoxyethanol	0.00			
2-butoxyethyl acetate	6.13			5.0
dibutyl phthalate	0.00			
Estimated TICs				
propylbenzene	0.34			
1-ethyl-2-methylbenzene	0.47			
1-ethyl-2-methylbenzene	1.14			
1-ethyl-2-methylbenzene	0.39			
propylene glycol methyl ether	NA			10 to 20
diacetone alcohol	NA			5 to 10

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 131S

surrogate recovery = 113.6

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.10	J		
ethyl acetate	10.24			
methanol	0.00			
isopropyl acetate	0.11	J		
MEK	0.72	J		
dichloromethane	0.00			
isopropanol	7.97			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	19.72			15.0
n-butyl acetate	0.24			
ethyl benzene	2.91			1 to 3
p-xylene	3.40		12.8	8 to 10
m-xylene	7.23			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	2.16			
2-heptanone	0.06	J		
1-methoxy-2-propanol acetate	0.19	J		
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW WU6590

surrogate recovery = 114.59

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.08	J		
ethyl acetate	20.56			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.03	J		
MIBK	0.00			
toluene	20.62			
n-butyl acetate	21.23			
ethyl benzene	4.18			
p-xylene	4.86		18.2	
m-xylene	10.86			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	2.52			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	11.29			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	13.37			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW US2

surrogate recovery = 114.1

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	34.89			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			40.0
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	25.65			24.0
MIBK	1.17	J		1.0
toluene	0.00			
n-butyl acetate	23.72			20.0
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	7.50			5.0
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW US5

surrogate recovery = 114.17

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.49	J		
ethyl acetate	0.03	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.04	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	11.63			9.0
MIBK	0.6	J		
toluene	0.00			
n-butyl acetate	23.57			20.0
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	28.23			25.0
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	22.82			20.0
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW US5 DUPLICATE

surrogate recovery = 113.78

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.49	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	11.43			9.0
MIBK	0.64			
toluene	0.00			
n-butyl acetate	22.73			20.0
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	26.42			25.0
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	22.82			20.0
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW R7K981

surrogate recovery = 113.78

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.23	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.57	J		
MEK	0.00			
dichloromethane	0.00			
isopropanol	49.62	E		45.0
ethanol	0.00			
2-pentanone	0.00			
MIBK	38.72			41.0
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	1.11	J		
p-xylene	1.08	J	3.9	4.0
m-xylene	2.17	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.60			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	5.26			5.0
2-butoxyethyl acetate	1.72			2.0
dibutyl phthalate	0.06	J		

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW R7K981 DUPLICATE

surrogate recovery = 113.78

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.20	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.43	J		
MEK	0.00			
dichloromethane	0.00			
isopropanol	42.98	E		45.0
ethanol	0.00			
2-pentanone	0.00			
MIBK	35.05	E		41.0
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	0.90	J		
p-xylene	0.87	J	3.4	4.0
m-xylene	2.00	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.51			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	4.42			5.0
2-butoxyethyl acetate	1.50			2.0
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 7160S

surrogate recovery = 106.3

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.70			
ethyl acetate	0.13			
methanol	0.00			
isopropyl acetate	0.00			
MEK	18.79			18.0
dichloromethane	0.12	J		
isopropanol	11.05			
ethanol	0.00			
2-pentanone	0.09			
MIBK	0.00			
toluene	13.81			1 to 4
n-butyl acetate	12.35			
ethyl benzene	1.32	J		0 to 2
p-xylene	1.46	J	6.0	4 to 6
m-xylene	3.10	J		
MIAC	0.00			
butyl propionate	0.08	J		
p-chlorobenzotrifluoride	0.04	J		
o-xylene	1.41	J		
2-heptanone	3.80			
1-methoxy-2-propanol acetate	0.13	J		
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
2-methylhexane	4.33			
3-methylhexane	5.88			
heptane	7.80			
c-1,2-dimethylcyclopentane	4.39			
1,2,4-trimethylcyclopentane	0.91			
methylcyclohexane	6.60			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 193S

surrogate recovery = 102.98

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	14.99			4.0
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	7.87			
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	5.27			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 3440S

surrogate recovery = 101.03

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.17	J		Not Found
ethyl acetate	1.16	J		Not Found
methanol	0.14			Not Found
isopropyl acetate	0.00			Not Found
MEK	3.36			Not Found
dichloromethane	0.03	J		Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	5.83			Not Found
n-butyl acetate	5.21			Not Found
ethyl benzene	0.21	J		Not Found
p-xylene	0.23	J	0.9	Not Found
m-xylene	0.49	J		Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	0.19	J		Not Found
2-heptanone	26.62			Not Found
1-methoxy-2-propanol acetate	0.00			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.09	J		Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	3.05			Not Found
dibutyl phthalate	0.00			Not Found

Estimated TICs

dimethyl ester butanedioic acid	1.76
dimethyl ester pentanedioic acid	3.17
dimethyl ester hexanedioic acid	1.08

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont L006H2M

surrogate recovery = 109.02

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.03	J		Not Found
ethyl acetate	0.30	J		Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	9.64			Not Found
dichloromethane	0.02	J		Not Found
isopropanol	1.89			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	0.00			Not Found
n-butyl acetate	4.45			Not Found
ethyl benzene	0.12	J		Not Found
p-xylene	0.13	J	0.5	Not Found
m-xylene	0.26	J		Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	0.07	J		Not Found
2-heptanone	8.22			Not Found
1-methoxy-2-propanol acetate	9.16			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.00			Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.00			Not Found
dibutyl phthalate	0.00			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 817A Centuri

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			Not Found
ethyl acetate	0.00			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	3.68			Not Found
dichloromethane	0.02	J		Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	12.06			Not Found
n-butyl acetate	3.34			Not Found
ethyl benzene	4.42			Not Found
p-xylene	5.18		20.0	Not Found
m-xylene	11.10			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	3.68			Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	0.00			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.21	J		Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.00			Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
octane	0.41			
c-1,3-dimethylcyclohexane	1.17			
t-1,3-dimethylcyclohexane	0.52			
2,6-dimethylheptane	1.97			
ethylcyclohexane	1.83			
1,2,4-trimethylcyclohexane	0.32			
limonene	0.37			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW R7K212

surrogate recovery = 93.10

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	15.54			15.0
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	34.04			41.0
n-butyl acetate	0.12	J		
ethyl benzene	1.41	J		1.0
p-xylene	1.44	J	5.6	6.0
m-xylene	3.23			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.96	J		
2-heptanone	0.11	J		
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.52	J		1.0
1,2,4-trimethylbenzene	2.21			2.0
2-butoxyethanol	0.00			
2-butoxyethyl acetate	4.45			3.0
dibutyl phthalate	0.00			
Estimated TICs				
2-methylhexane	1.16			
3-methylhexane	1.93			
heptane	4.98			
t-1,2-dimethylcyclopentane	5.20			
1,2,4-trimethylcyclopentane	1.52			
methylcyclohexane	10.29			
o-ethyl toluene	1.26			
o-ethyl toluene	0.47			
1,2,3,4-tetramethylbenzene	0.62			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW WB2030 REPEAT

surrogate recovery = 115.13

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.25			Not Found
ethyl acetate	0.57	J		Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.10			Not Found
dichloromethane	0.00			Not Found
isopropanol	0.09			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	0.95	J		Not Found
n-butyl acetate	21.85	E		Not Found
ethyl benzene	3.71			Not Found
p-xylene	4.41		18.9	Not Found
m-xylene	10.28			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	4.22			Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	0.00			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.05	J		Not Found
2-butoxyethanol	1.06	J		Not Found
2-butoxyethyl acetate	0.64	J		Not Found
dibutyl phthalate	0.00			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 380S

surrogate recovery = 108.0

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	20.02			Not Specified
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	6.90			6.0
dichloromethane	0.02			
isopropanol	1.81			Not Specified
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			19.0
n-butyl acetate	18.97			
ethyl benzene	0.25	J		0 to 1
p-xylene	0.78	J	3.0	2 to 3
m-xylene	1.69	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.57	J		
2-heptanone	0.01	J		
1-methoxy-2-propanol acetate	16.57			Not Specified
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
butanoic acid	0.24			
dimethyl ester pentanedioic acid	0.73			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: BASF RM-DH46

surrogate recovery = 105.6

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.03	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.02	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	0.10	J		
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	28.10	E		25 to 25
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW R7K982

surrogate recovery = 114.8

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	6.93			5.0
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	16.48			15.0
dichloromethane	0.05			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	2.85			
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	0.00			
p-xylene	0.10	J	0.3	
m-xylene	0.20	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	9.26			5.0
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
n-octane	1.00			
c,t-1,2-dimethylcyclohexane	0.89			
2-methyloctane	3.87			
butylcyclooctane	3.43			
ethylcyclohexane	3.17			
1,2,4-trimethylcyclohexane	0.73			
2-methylpropyl ester acetic acid	2.45			
isobutyl alcohol	37.06			47.0

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: BASF RM-UR50

surrogate recovery = 111.40

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.03	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	55.39	E		55 to 65
ethyl benzene	0.00			
p-xylene	0.00		0.2	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.23	J		
2-heptanone	0.00			
1-methoxy-2-propanol acetate	15.16			10 to 20
1,3,5-trimethylbenzene	0.86	J		
1,2,4-trimethylbenzene	2.75	J		1 to 3
2-butoxyethanol	0.00			
2-butoxyethyl acetate	3.75			1 to 5
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 3661S

surrogate recovery = 108.95

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	25.86			Not Specified
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.03	J		
isopropanol	19.61			Not Specified
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	15.88			0 to 2
n-butyl acetate	0.00			
ethyl benzene	0.37	J		
p-xylene	0.40	J	1.5	0 to 1
m-xylene	0.82	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.30	J		
2-heptanone	0.00			
1-methoxy-2-propanol acetate	6.55			Not Specified
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			0 to 1
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
n-butyl alcohol	NR			6
naphthalene	NR			0 to 1

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: Akzo Nobel 075624

surrogate recovery = 106.8

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.04	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.02	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	1.95	J		1.1
p-xylene	2.60		11.8	13.0
m-xylene	5.58			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	3.59			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	3.01			
1,2,4-trimethylbenzene	9.91			8.9
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
1-butanol	25.95			
1-methylethylbenzene	0.30			
propylbenzene	1.94			
4-ethyltoluene	2.56			
1-ethyl-2-methylbenzene	8.34			
1-ethyl-2-methylbenzene	2.81			
2-methylphenol	0.46			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW E6H59

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.05	J		
ethyl acetate	0.03	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.18	J		
dichloromethane	0.01	J		
isopropanol	0.04			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.02	J		
toluene	4.25			6.0
n-butyl acetate	12.86	E		16.0
ethyl benzene	2.31			1.0
p-xylene	2.03		7.9	8.0
m-xylene	4.46			
MIAC	0.0			
butyl propionate	0.1			
p-chlorobenzotrifluoride	0.0			
o-xylene	1.37			
2-heptanone	0.02			
1-methoxy-2-propanol acetate	0.17	J		
1,3,5-trimethylbenzene	0.03	J		
1,2,4-trimethylbenzene	0.09	J		
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TIC				
1-butanol	0.18			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 7175S
surrogate recovery = 102.04

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	9.97			Not Specified
ethyl acetate	0.54	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.03	J		
isopropanol	10.62			Not Specified
ethanol	0.00			
2-pentanone	0.00			
MIBK	5.77			6.0
toluene	2.15	J		0 to 3
n-butyl acetate	3.66			
ethyl benzene	1.74	J		0 to 2
p-xylene	1.90	J	8.3	6 to 8
m-xylene	4.28			
MIAC	0.00			
butyl propionate	28.89			Not Specified
p-chlorobenzotrifluoride	0.00			
o-xylene	2.08	J		
2-heptanone	10.42			Not Specified
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
2-methylhexane	1.63			
3-methylhexane	2.48			
heptane	3.10			
c-1,2-dimethylcyclohexane	1.38			
methylcyclohexane	2.67			
octane	0.42			
1,2-dimethylcyclohexane	0.65			
4,6,8-trimethyl-1-nonene	1.66			
1,1,3-trimethylcyclohexane	2.25			
1,2,4-trimethylcyclohexane	0.51			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont V7575S

surrogate recovery = 93.8

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.05	J		
ethyl acetate	0.04	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.02	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.06	J		
toluene	0.00			4.0
n-butyl acetate	18.28			Not Specified
ethyl benzene	2.26			2 to 7
p-xylene	2.61		9.2	20 to 24
m-xylene	5.34			
MIAC	0.00			
butyl propionate	0.11	J		
p-chlorobenzotrifluoride	0.00			
o-xylene	1.28	J		
2-heptanone	0.03	J		
1-methoxy-2-propanol acetate	7.67			Not Specified
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 7005S

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			Not Found
ethyl acetate	5.55			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.00			Not Found
dichloromethane	0.02	J		Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	0.00			Not Found
n-butyl acetate	18.37			Not Found
ethyl benzene	0.00			Not Found
p-xylene	0.00		0.0	Not Found
m-xylene	0.00			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.04	J		Not Found
o-xylene	0.00			Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	0.00			Not Found
1,3,5-trimethylbenzene	0.38	J		Not Found
1,2,4-trimethylbenzene	0.90			Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.00			Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
2,2,4,4-tetramethyl-3-pentanone	2.04			Not Found
1-ethyl-3-methylbenzene	4.48			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW E6C61

surrogate recovery = 106.81

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.13	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	7.98			7.0
dichloromethane	0.03	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	20.47			24.0
n-butyl acetate	8.90			8.0
ethyl benzene	4.59			3.0
p-xylene	4.30		16.0	16.0
m-xylene	9.07			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.11	J		
o-xylene	2.61			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.79	J		2.0
1,2,4-trimethylbenzene	2.08	J		3.0
2-butoxyethanol	0.00			
2-butoxyethyl acetate	1.09	J		
dibutyl phthalate	0.00			
Estimated TICs				
2-methyl-1-propanol	0.84			
propylbenzene	0.42			
1-ethyl-4-methylbenzene	0.56			
1-ethyl-3-methylbenzene	2.13			
o-ethyl toluene	0.67			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW ES20

surrogate recovery = 110.26

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	20.10			20.0
ethyl acetate	0.02	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.05	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.23	J		
n-butyl acetate	0.33	J		
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	80.11	E		80.0
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW ES15

surrogate recovery = 102.69

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	54.94	E		70.0
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.05	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	38.92			30.0
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 817G

surrogate recovery = 106.41

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.10	J		
ethyl acetate	1.38			1 to 3
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.61	J		
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.14	J		
n-butyl acetate	5.44			2 to 8
ethyl benzene	3.53			1.3 to 3.2
p-xylene	3.70		15.1	14 to 16
m-xylene	8.40			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	2.97	J		
2-heptanone	6.69			3 to 9
1-methoxy-2-propanol acetate	3.84			1 to 5
1,3,5-trimethylbenzene	0.46	J		
1,2,4-trimethylbenzene	1.56	J		0 to 2
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TIC				
1-ethyl-2-methylbenzene	0.38			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 817K

surrogate recovery = 103.93

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	8.32			2 to 14
ethyl acetate	1.02	J		1 to 3
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.80	J		
dichloromethane	0.00			
isopropanol	0.86	J		
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	16.71			19.0
n-butyl acetate	15.78			Not Specified
ethyl benzene	4.14			1.3 to 3.3
p-xylene	4.65		16.9	13 to 15
m-xylene	9.51			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	2.73			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: BASF RM-PH12

surrogate recovery = 99.25

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	22.98			20 to 30
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	18.59			15 to 25
n-butyl acetate	17.97			15 to 25
ethyl benzene	0.00			
p-xylene	0.05	J	0.2	
m-xylene	0.11	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	5.28			1 to 10
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: PPG K201

surrogate recovery = 109.17

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	10.85			5 to 10
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	8.57			5 to 10
n-butyl acetate	39.75	E		40 to 50
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.19	J		1 to 10
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: PPG DCX61

surrogate recovery = 106.62

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	16.08			10 to 20
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TIC				
1,3-butanediol	0.41			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: Akzo Nobel 075192

surrogate recovery = 111.82

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.03	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.14	J		
n-butyl acetate	2.53			1 to 5
ethyl benzene	0.00			
p-xylene	0.00		0.4	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.36	J		
2-heptanone	0.00			
1-methoxy-2-propanol acetate	30.71			20 to 30
1,3,5-trimethylbenzene	3.11			
1,2,4-trimethylbenzene	9.69			8.7
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
propylbenzene	2.0			
1-ethyl-4-methylbenzene	2.2			
1-ethyl-3-methylbenzene	8.5			
1-ethyl-2-methylbenzene	2.9			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 7075S

surrogate recovery = 112.76

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.09	J		
ethyl acetate	8.84			
methanol	0.00			
isopropyl acetate	0.00			
MEK	29.67			30.0
dichloromethane	0.04	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	53.37	E		Not Specified
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	3.65			Not Specified
1-methoxy-2-propanol acetate	2.07	J		Not Specified
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW P2A43

surrogate recovery = 110.71

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.03	J		
ethyl acetate	0.03	J		
methanol	0.00			
isopropyl acetate	0.34	J		
MEK	0.80	J		
dichloromethane	0.02	J		
isopropanol	3.91			4.0
ethanol	0.00			
2-pentanone	0.00			
MIBK	4.93			3.0
toluene	26.32			30.0
n-butyl acetate	0.99	J		
ethyl benzene	0.08	J		
p-xylene	0.09	J	0.3	
m-xylene	0.18	J		
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.07	J		
2-heptanone	0.09	J		
1-methoxy-2-propanol acetate	0.04	J		
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.86	J		
Estimated TIC				
isobutylacetate	1.74			3.0

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: Akzo Nobel 1k basecoat

surrogate recovery = 118.85

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.47	J		Not Found
ethyl acetate	0.00			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.00			Not Found
dichloromethane	0.02	J		Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.02	J		Not Found
MIBK	0.00			Not Found
toluene	0.00			Not Found
n-butyl acetate	16.58			Not Found
ethyl benzene	1.72	J		Not Found
p-xylene	2.00		8.5	Not Found
m-xylene	4.35			Not Found
MIAC	1.48			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	2.10			Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	0.09	J		Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.00			Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.00			Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
1-butanol	2.67			Not Found
butanoic acid	0.55			Not Found

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: PPG DT870

surrogate recovery = 109.92

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	32.63			30 to 40
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.07	J		
MIBK	0.00			
toluene	21.76			10 to 20
n-butyl acetate	0.00			
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	26.25			20 to 30
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
2-methylhexane	0.43			
3-methylhexane	0.79			
n-heptane	1.69			
t-1,2-dimethylcyclopentane	0.96			
1,2,4-trimethylcyclopentane	0.46			
methylcyclohexane	2.68			
octane	0.75			
c-1,3-dimethylcyclohexane	1.78			
t-1,2-dimethylcyclohexane	0.87			
2,3-dimethylheptane	3.40			
3-methyl-1-hexene	3.07			
ethylcyclohexane	3.10			
1,2,4-trimethylcyclohexane	0.74			
(c,t)-1-ethyl-3-methylcyclohexane	1.34			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW US1

surrogate recovery = 112.40

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	30.88			30.0
ethyl acetate	0.07	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	32.38			30.0
dichloromethane	0.04	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	32.42			28.0
MIBK	1.46	J		2.0
toluene	0.00			
n-butyl acetate	7.26			5.0
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.03	J		
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont V7565S

Slight contamination likely due to small positive hits in all substances

surrogate recovery = 117.36

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.22	J		
ethyl acetate	20.23			
methanol	0.32	J		
isopropyl acetate	0.24	J		
MEK	8.86			8.0
dichloromethane	0.26	J		
isopropanol	0.16	J		
ethanol	0.17	J		
2-pentanone	0.22	J		
MIBK	0.19	J		
toluene	14.27			13.0
n-butyl acetate	0.19	J		
ethyl benzene	0.20	J		
p-xylene	0.22	J	0.6	
m-xylene	0.20	J		
MIAC	0.15	J		
butyl propionate	0.25	J		
p-chlorobenzotrifluoride	0.15	J		
o-xylene	0.21	J		
2-heptanone	0.19	J		
1-methoxy-2-propanol acetate	0.21	J		
1,3,5-trimethylbenzene	0.20	J		
1,2,4-trimethylbenzene	0.20	J		
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.23	J		

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: PPG DCU2021

surrogate recovery = 116.5

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.38	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.04	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.06	J		
MIBK	0.31	J		
toluene	0.11	J		
n-butyl acetate	0.19	J		
ethyl benzene	9.24			
p-xylene	8.40		29.7	30 to 40
m-xylene	17.01			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	4.31			
2-heptanone	15.66			10 to 20
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW US3

surrogate recovery = 109.21

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.36	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	20.87			20.0
dichloromethane	0.03	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	20.43			19.0
MIBK	0.92	J		
toluene	0.37	J		
n-butyl acetate	31.88	E		35.0
ethyl benzene	0.00			
p-xylene	0.05	J	0.1	
m-xylene	0.10	J		
MIAC	0.00			
butyl propionate	0.15	J		
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	11.38			10.0
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW CCH690

surrogate recovery = 112.53

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.02	J		
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.02	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	4.09			
ethyl benzene	5.71			4.0
p-xylene	5.49		21.3	22.0
m-xylene	11.72			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	4.08			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.39	J		
1,2,4-trimethylbenzene	1.49	J		1.0
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
o-ethyltoluene	0.91			
2-ethyltoluene	0.37			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DMF Blank

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	0.00			
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont C2185

surrogate recovery = 93.97

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.08	J		Not Found
ethyl acetate	0.00			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.00			Not Found
dichloromethane	0.00			Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	0.30	J		Not Found
n-butyl acetate	25.55	E		Not Found
ethyl benzene	1.67			Not Found
p-xylene	1.62		6.2	Not Found
m-xylene	3.55			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	1.03	J		Not Found
2-heptanone	0.00			Not Found
1-methoxy-2-propanol acetate	7.29			Not Found
1,3,5-trimethylbenzene	0.05	J		Not Found
1,2,4-trimethylbenzene	0.17	J		Not Found
2-butoxyethanol	0.05	J		Not Found
2-butoxyethyl acetate	0.87	J		Not Found
dibutyl phthalate	0.00			Not Found
Estimated TIC				
1-butanol	4.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont N0000HNNH

surrogate recovery = 100.28

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.04	J		Not Found
ethyl acetate	6.66			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.86	J		Not Found
dichloromethane	0.01	J		Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	0.00			Not Found
toluene	0.15	J		Not Found
n-butyl acetate	5.86			Not Found
ethyl benzene	0.27	J		Not Found
p-xylene	0.31	J	1.2	Not Found
m-xylene	0.66	J		Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	0.19	J		Not Found
2-heptanone	5.94			Not Found
1-methoxy-2-propanol acetate	8.30			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.00			Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	4.18			Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
1-butanol	0.29			
2,2-dimethyl-1,3-propanediol	0.60			
butyl ester benzoic acid	1.10			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 8022S
surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	9.62			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.03	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	7.43			1 to 4
n-butyl acetate	19.02			Not Specified
ethyl benzene	0.00			0 to 1
p-xylene	0.00		0.0	0 to 2
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	2.26	J		
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			0 to 1
2-butoxyethanol	0.00			
2-butoxyethyl acetate	2.90	j		
dibutyl phthalate	0.00			
Estimated TICs				
2-methylhexane	3.29			
3-methylhexane	4.97			
heptane	6.73			
t-1,2-dimethylcyclopentane	3.46			
1,2,4-trimethylcyclopentane	0.85			
methylcyclohexane	5.90			
octane	0.84			
c-1,3-dimethylcyclohexane	1.23			
t-1,2-dimethylcyclohexane	1.77			
4,7-dimethylundecane	2.89			
1,2,4-trimethylcyclohexane	4.11			
ethylcyclohexane	4.40			
1,2,4-trimethylcyclohexane	1.01			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW P6A48

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.06	J		
ethyl acetate	0.03	J		
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.09	J		
dichloromethane	0.01	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	2.80			3.0
toluene	15.01			26.0
n-butyl acetate	5.08			
ethyl benzene	2.96			2.0
p-xylene	2.62		9.7	9.0
m-xylene	5.34			
MIAC	0.00			
butyl propionate	0.05	J		
p-chlorobenzotrifluoride	0.00			
o-xylene	1.79			
2-heptanone	0.05	J		
1-methoxy-2-propanol acetate	1.36			1
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW USS2030

surrogate recovery = 93.71

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.07	J		Not Found
ethyl acetate	0.00			Not Found
methanol	0.00			Not Found
isopropyl acetate	0.00			Not Found
MEK	0.00			Not Found
dichloromethane	0.00			Not Found
isopropanol	0.00			Not Found
ethanol	0.00			Not Found
2-pentanone	0.00			Not Found
MIBK	4.38			Not Found
toluene	0.38	J		Not Found
n-butyl acetate	2.57			Not Found
ethyl benzene	5.93			Not Found
p-xylene	5.15		19.6	Not Found
m-xylene	11.28			Not Found
MIAC	0.00			Not Found
butyl propionate	0.00			Not Found
p-chlorobenzotrifluoride	0.00			Not Found
o-xylene	3.17			Not Found
2-heptanone	1.05	J		Not Found
1-methoxy-2-propanol acetate	0.00			Not Found
1,3,5-trimethylbenzene	0.00			Not Found
1,2,4-trimethylbenzene	0.13	J		Not Found
2-butoxyethanol	0.00			Not Found
2-butoxyethyl acetate	0.75	J		Not Found
dibutyl phthalate	0.00			Not Found
Estimated TICs				
2-ethyl-1,3-hexanediol	0.89			
2-ethyl-1,3-hexanediol	1.37			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW UH80

surrogate recovery = 102.65

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.02	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	17.19			20.0
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW E2G980

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.25	J		
ethyl acetate	0.02	J		
methanol	0.24	J		
isopropyl acetate	3.18			3.0
MEK	1.43			
dichloromethane	0.01	J		
isopropanol	23.46	E		27.0
ethanol	1.73			2.0
2-pentanone	0.01	J		
MIBK	8.81			9.0
toluene	4.47			5.0
n-butyl acetate	0.24			
ethyl benzene	1.11			
p-xylene	0.91	J	3.6	4.0
m-xylene	2.05			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.66	J		
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	9.74			10.0
2-butoxyethyl acetate	0.00			
dibutyl phthalate	1.48			1.0
Estimated TIC				
phenol	0.47			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: Akzo Nobel 072086

surrogate recovery = 104.79

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	12.69			1 to 5
ethyl acetate	0.06			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.11	J		
dichloromethane	0.00			
isopropanol	0.15	J		
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.26	J		
toluene	0.31	J		0.2
n-butyl acetate	0.06	J		
ethyl benzene	0.98	J		0.7
p-xylene	1.34	J	5.9	6.7
m-xylene	3.09			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	4.17			10 to 20
o-xylene	1.50			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.12	J		
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
1-butanol	3.95			2.7
hexyl acetate	0.31			
hexyl acetate	0.25			
hexyl acetate	0.51			
hexyl acetate	0.44			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW V6V247

surrogate recovery = NS

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.00			
ethyl acetate	0.00			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.01	J		
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	0.00			
n-butyl acetate	13.14			15.0
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 1125S

surrogate recovery = 99.25

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.04	J		
ethyl acetate	23.97	E		Not Specified
methanol	0.10			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.05			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.03	J		
MIBK	0.00			
toluene	0.09	J		
n-butyl acetate	2.63			
ethyl benzene	5.40			2 to 7
p-xylene	6.36		23.2	20 to 25
m-xylene	13.60			
MIAC	0.00			
butyl propionate	0.02	J		
p-chlorobenzotrifluoride	0.00			
o-xylene	3.28			Not Specified
2-heptanone	0.03	J		
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.25	J		
1,2,4-trimethylbenzene	0.77	J		0 to 1
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.06	J		

Estimated TIC

1-ethyl-2-methylbenzene	0.60
-------------------------	------

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW R7K248

surrogate recovery = 111.54

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	20.03			
ethyl acetate	0.04	J		
methanol	3.17			3.0
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.03	J		
isopropanol	7.99			7.0
ethanol	0.00			
2-pentanone	0.00			
MIBK	7.51			7.0
toluene	51.93	E		55.0
n-butyl acetate	0.00			
ethyl benzene	0.00			
p-xylene	0.00		0.0	
m-xylene	0.00			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	0.00			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	2.15			2.0
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
2-methylhexane	0.57			
heptane	1.59			
1-heptene	1.09			
methylcyclohexane	2.99			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: DuPont 1135S

surrogate recovery = 111.31

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.13	J		
ethyl acetate	9.66			
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.01			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	6.85			18.0
n-butyl acetate	3.77			
ethyl benzene	1.52			2 to 5
p-xylene	1.68		7.3	16 to 20
m-xylene	3.68			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	1.90			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.03	J		
1,3,5-trimethylbenzene	0.87	J		
1,2,4-trimethylbenzene	2.87			2 to 10
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			
Estimated TICs				
1-methylethylbenzene	0.16			
n-propylbenzene	0.58			
1-ethyl-4-methylbenzene	0.71			
1-ethyl-4-methylbenzene	2.56			
o-ethyltoluene	0.83			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

Coatings In-House Evaluation: SW BCS600V

surrogate recovery = 110.8

Substance	% by weight GC/MS	Qualifier ^a	aggregate xylenes	MSDS
acetone	0.02			
ethyl acetate	23.92			23.0
methanol	0.00			
isopropyl acetate	0.00			
MEK	0.00			
dichloromethane	0.00			
isopropanol	0.00			
ethanol	0.00			
2-pentanone	0.00			
MIBK	0.00			
toluene	26.58			27.0
n-butyl acetate	0.76	J		3.0
ethyl benzene	6.89			5.0
p-xylene	7.27		29.4	26.0
m-xylene	16.20			
MIAC	0.00			
butyl propionate	0.00			
p-chlorobenzotrifluoride	0.00			
o-xylene	5.93			
2-heptanone	0.00			
1-methoxy-2-propanol acetate	0.00			
1,3,5-trimethylbenzene	0.00			
1,2,4-trimethylbenzene	0.00			
2-butoxyethanol	0.00			
2-butoxyethyl acetate	0.00			
dibutyl phthalate	0.00			

^a J = value between the detection limit and practical quantification limit; E = exceeded calibration and was reanalyzed to substitute value in calibration range.

TECHNICAL REPORT DATA <i>(Please read Instructions on the reverse before completing)</i>		
1. REPORT NO. EPA-600/R-03/127	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Emissions from Coatings Used in the Auto Refinishing Industry	5. REPORT DATE September 2004	
	6. PERFORMING ORGANIZATION CODE	
7. AUTHORS P. Barfield, G. Ramsey, T. Corwin, C. Nunez	8. PERFORMING ORGANIZATION REPORT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS See Block 12	10. PROGRAM ELEMENT NO.	
	11. CONTRACT/GRANT NO. 68-C-99-201	
12. SPONSORING AGENCY NAME AND ADDRESS U. S. EPA, Office of Research and Development Air Pollution Prevention and Control Division Research Triangle Park, North Carolina 27711	13. TYPE OF REPORT AND PERIOD COVERED Final; 01/00 – 04/01	
	14. SPONSORING AGENCY CODE EPA/600/13	
15. SUPPLEMENTARY NOTES The EPA Project Officer is Geddes H. Ramsey, Mail Drop E343-02, Phone (919) 541-7963.		
16. ABSTRACT The report presents results of EPA Methods 24 and 311 analyses of the volatile organic compound (VOC) content of selected auto refinishing coatings and their components that are sold by the five major auto coating manufacturers. These analyses were undertaken to determine the accuracy of VOC content data contained on the can label and in the material safety data sheets (MSDS) for these coatings. The results of Method 24 analyses generally agree with the VOC contents listed on the labels and in the MSDS for all the coatings and their components. Method 311 analyses were performed to quantify individual volatile paint components, and these analyses also generally agree with the MSDS data. This means that auto body shops can easily and reliably estimate their VOC emissions using that information. The information provided by this document will be useful for anyone interested in estimating emissions from automobile refinishing operations.		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Automobile Bodies Spray Painting Emissions Organic Compounds Volatility Labels	Verifying Pollution Control Stationary Sources	13B 14B 13F 13H 07D 07C 20M 13D
18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS <i>(This Report)</i> Unclassified	21. NO. OF PAGES 137
	20. SECURITY CLASS <i>(This Page)</i> Unclassified	22. PRICE