



Paint Analysis Test No. 14-545 Summary Report

This test was sent to 139 participants. Each sample set consisted of two items containing "questioned" paint chips and a "known" paint sample. Participants were requested to compare the items and report their findings. Data were returned from 119 participants (86% response rate) and are compiled into the following tables:

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This report contains the data received from the participants in this test. Since these participants are located in many countries around the world, and it is their option how the samples are to be used (e.g., training exercise, known or blind proficiency testing, research and development of new techniques, etc.), the results compiled in the Summary Report are not intended to be an overview of the quality of work performed in the profession and cannot be interpreted as such. The Summary Comments are included for the benefit of participants to assist with maintaining or enhancing the quality of their results. These comments are not intended to reflect the general state of the art within the profession.

Participant results are reported using a randomly assigned "WebCode". This code maintains participant's anonymity, provides linking of the various report sections, and will change with every report.

Manufacturer's Information

Each sample set consisted of three items with layered paint and primer: one known sample (Item 1) and two questioned samples (Items 2 and 3) were cut from painted sections of drywall. Items 1 and 3 came from a single drywall section with the same primer and topcoat. Item 2 was prepared with the same primer as, but a different topcoat from, what was used for Items 1 and 3. Examiners were instructed to examine the questioned samples and determine if either questioned sample could have originated from the same source as the known paint sample.

SAMPLE PREPARATION-

The drywall substrate was wiped down to remove dust before painting. For the following preparations, each coat was allowed to dry overnight before applying the next coat. The painted drywall panels were then stored at room temperature in a controlled humidity environment for several days.

ITEM 2 (ELIMINATION): The questioned Item 2 samples were prepared by applying two coats of primer (Behr Premium Plus®, Exterior 436, water-based multi-surface primer & sealer) to a drywall substrate. Then two layers of topcoat (Glidden® Exterior Premium Paint Flat Mate Base 2 GL6112, orange marmalade (color code -01YY 36/694)) were applied. The painted drywall was scored into squares that were approximately 1/2" x 1/2" and chiseled out using a utility knife. One 1/2" x 1/2" piece was packaged into a glassine bag and then a pre-labeled Item 2 coin envelope. This process was repeated until all of the items were created. Item 2 was packaged into the sample sets as described below.

ITEMS 1 and 3 (IDENTIFICATION): The known Item 1 and questioned Item 3 samples were prepared by applying two coats of primer (Behr Premium Plus®, Exterior 436, water-based multi-surface primer & sealer) to a drywall substrate. Then two layers of topcoat (Behr Premium Plus® Interior Flat Matte, Deep Base 1300 Acrylic paint, Summer Citrus (S-G-270)) were applied. For Item 1, paint samples were scored into squares that were approximately 1/2" x 1/2" and chiseled out using a utility knife. One 1/2" x 1/2" piece was packaged into a glassine bag and then a pre-labeled Item 1 coin envelope. For Item 3, paint samples were scored into squares that were approximately 1/4" x 1/4" and chiseled out using a utility knife. Two 1/4" x 1/4" pieces were packaged into a glassine bag and then a pre-labeled Item 3 coin envelope. This process was repeated until all of the items were created. Items 1 and 3 were taken in close spatial proximity to one another and were kept together as an identification group and packaged into the sample sets as described below.

SAMPLE SET ASSEMBLY: For each sample pack, an Item 1 and an Item 3 from the same identification group along with an Item 2 were placed into a pre-labeled envelope and sealed with invisible tape. This process was repeated until all of the sample sets were prepared. Once verification was completed, all sample sets were further sealed with evidence tape and initialed "CTS."

VERIFICATION-

Laboratories that conducted the predistribution examination of the completed sample sets reported the expected association and elimination results. The methods employed by the predistribution laboratories included: Stereomicroscopy, Polarized Light Microscopy, Fluorescence Microscopy, Pyrolysis GC, FTIR, SEM/EDX, Microspectrophotometry, and Solubility/Chemical testing.

Summary Comments

This test was designed to allow participants to assess their proficiency in the examination, comparison and interpretation of multi-layered architectural paint chips. Each sample set consisted of three items with layered paint and primer: one known sample (Item 1) and two questioned samples (Items 2 and 3) were cut from painted sections of drywall. Items 1 and 3 came from a single section with the same primer and topcoat. Item 2 was prepared with the same primer as, but a different topcoat from, what was used for Items 1 and 3. (See Manufacturer's Information)

All 119 participants reported that Item 3 could share a common origin with Item 1, but Item 2 did not share a common origin with Item 1.

Several participants commented that the paint was on a paper/cardboard substrate which did not resemble drywall. As stated in the Manufacturer's Information Statement, the paint was deposited on drywall but chiseled out with a utility knife which only removed a portion of the drywall substrate. The entire drywall substrate was not provided as part of the samples.

Examination Results

Could the questioned paint chips from either of the two sources (Items 2 or 3) have originated from the damaged area of the dining room wall as represented by Item 1?

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
3CRUNH	No	Yes	DAPHDY	No	Yes
3E8FVL	No	Yes	DCWMH9	No	Yes
3EJNQR	No	Yes	DH64V4	No	Yes
3J9CZ4	No	Yes	DUFKGE	No	Yes
3RAFGN	No	Yes	DZJGET	No	Yes
474FP3	No	Yes	EE7VGK	No	Yes
4BTYPC	No	Yes	EPYH8N	No	Yes
6999J2	No	Yes	EWLCF8	No	Yes
6EDYTY	No	Yes	FCUW7B	No	Yes
6TDXNH	No	Yes	GBEWML	No	Yes
6VJ9QD	No	Yes	GVZD4T	No	Yes
6VYQC7	No	Yes	GZ6LY3	No	Yes
747R9Q	No	Yes	H9GYGX	No	Yes
76QE9L	No	Yes	HTNBEZ	No	Yes
77AK3P	No	Yes	HU8VND	No	Yes
78HUVN	No	Yes	JP74YD	No	Yes
7F2Y8V	No	Yes	JWZKYG	No	Yes
82WADR	No	Yes	K4KRN2	No	Yes
8DDRCQ	No	Yes	K78KCP	No	Yes
8GQTB3	No	Yes	KDNXBN	No	Yes
8QGF6K	No	Yes	KDRH2C	No	Yes
ABY34X	No	Yes	KMWNKY	No	Yes
AD89PY	No	Yes	KUP3DQ	No	Yes
BLTPME	No	Yes	LDGEFW	No	Yes
BNXPCD	No	Yes	LFCRNH	No	Yes
BVHKHN	No	Yes	LLM2V6	No	Yes
CAFXMC	No	Yes	MF9ND6	No	Yes
CV2LHX	No	Yes	MUKBCZ	No	Yes
CXH7Q7	No	Yes	NA2NKE	No	Yes
CYTV9W	No	Yes	NAX23Z	No	Yes
D3RQ8Q	No	Yes	NJAXCD	No	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
NKYCUV	No	Yes	WFZK4C	No	Yes
NNV6JK	No	Yes	WK89JY	No	Yes
NNYP99	No	Yes	WQERUK	No	Yes
NRZL3A	No	Yes	WVQRW4	No	Yes
NXPAN8	No	Yes	X82D3H	No	Yes
P7WALM	No	Yes	XFCW3T	No	Yes
PJHR84	No	Yes	XG7M98	No	Yes
PK84NW	No	Yes	XJPTFG	No	Yes
Q2CRR9	No	Yes	XJTD76	No	Yes
Q6H867	No	Yes	XQ823T	No	Yes
QK94C3	No	Yes	XQRVFN	No	Yes
QLLK23	No	Yes	XTHYDP	No	Yes
QPE3JL	No	Yes	XXQD4Z	No	Yes
QTL63X	No	Yes	Y2P3V8	No	Yes
R73HE7	No	Yes	Y32Z6H	No	Yes
RF8KLN	No	Yes	YJAPLP	No	Yes
RJUBZZ	No	Yes	YNUYJ2	No	Yes
RTAZLX	No	Yes	YPXHNG	No	Yes
RVJY68	No	Yes	YYGZYB	No	Yes
RWFEFJ	No	Yes	Z24ZQ4	No	Yes
RXQCVL	No	Yes	Z8UAZ3	No	Yes
TK2W37	No	Yes	Z9HKYH	No	Yes
TKFC6L	No	Yes	ZP8ZT7	No	Yes
UCMGZN	No	Yes			
UER3JU	No	Yes			
UFFEEU	No	Yes			
UQ3DBQ	No	Yes			
URK99K	No	Yes			
UWWAB4	No	Yes			
V3CJM6	No	Yes			
V8LLNF	No	Yes			
VX2BHU	No	Yes			
WBKJDX	No	Yes			
WDD26Y	No	Yes			

Response Summary					
		Item 2		Item 3	
Responses	Yes	0	(0 %)	119	(100.0%)
	No	119	(100.0%)	0	(0 %)
	Inc	0	(0 %)	0	(0 %)
Participants: 119					

Examination Methods

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/Chemical	XRF/XRF	SEM/EDX	Microspectrophotometry	Other
3CRUNH	✓	✓	✓		✓			✓		Comparison Microscope
3E8FVL	✓		✓		✓			✓		
3EJNQR	✓	✓		✓	✓	✓				
3J9CZ4	✓				✓			✓		
3RAFGN	✓				✓			✓		
474FP3	✓	✓	✓	✓	✓	✓		✓		
4BTYPC	✓	✓			✓			✓	✓	
6999J2	✓	✓	✓		✓	✓		✓		Pyrolysis GC/MS
6EDYTY	✓	✓	✓	✓	✓			✓		JUDGE II Multi-Illuminant View Chamber
6TDXNH	✓				✓		✓			
6VJ9QD	✓		✓	✓	✓	✓	✓		✓	
6VYQC7	✓			✓	✓				✓	
747R9Q	✓				✓	✓				magnifying glass
76QE9L	✓	✓			✓			✓	✓	
77AK3P	✓				✓	✓				
78HUVM	✓				✓	✓				
7F2Y8V	✓				✓		✓			
82WADR	✓	✓	✓	✓	✓			✓		
8DDRCQ	✓				✓	✓		✓		
8GQTB3	✓				✓			✓		
8QGF6K	✓				✓			✓		
ABY34X	✓	✓	✓		✓			✓		Pyrolysis GC MS
AD89PY	✓	✓	✓	✓	✓			✓		
BLTPME	✓	✓	✓		✓			✓	✓	
BNXPCD	✓				✓	✓				
BVHKHN	✓	✓	✓		✓			✓	✓	Phase contrast microscopy, comparison microscopy

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry	Other
CAFXMC	✓				✓			✓		
CV2LHX	✓				✓					
CXH7Q7	✓				✓					
CYTV9W	✓				✓					
D3RQ8Q	✓	✓			✓		✓			Polilight alternate light source (various wavelengths)
DAPHDY	✓				✓					✓
DCWMH9	✓		✓		✓			✓		Digital microscopy
DH64V4	✓			✓	✓			✓	✓	
DUFKGE	✓		✓		✓	✓		✓	✓	
DZJGET	✓		✓		✓	✓				
EE7VGK	✓	✓		✓	✓	✓		✓		Raman Spectroscopy
EPYH8N	✓		✓		✓	✓		✓		
EWLCF8	✓		✓		✓			✓		
FCUW7B	✓				✓			✓		
GBEWML	✓	✓	✓	✓	✓			✓	✓	Raman Microspectrophotometry [Pyrolysis GC: "/MS"]
GVZD4T	✓				✓	✓		✓		
GZ6LY3	✓				✓			✓		
H9GYGX	✓				✓					
HTNBEZ	✓				✓					
HU8VND	✓	✓	✓		✓			✓	✓	
JP74YD	✓				✓					✓
JWZKYG	✓	✓	✓		✓	✓		✓		
K4KRN2	✓		✓		✓			✓	✓	Alternative Light Source
K78KCP	✓				✓			✓	✓	Comparison Microscope
KDNXBN	✓	✓	✓		✓			✓	✓	
KDRH2C	✓	✓	✓	✓	✓	✓				
KMWNYK	✓	✓	✓	✓	✓		✓			Macroscopic Alternate Light Source

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	XRF/XRF	SEM/EDX	Microspectrophotometry	Other
KUP3DQ	✓	✓			✓			✓		FTIR (ATR)
LDGEFW	✓				✓					
LFCRNH	✓		✓		✓	✓		✓		
LLM2V6	✓		✓		✓			✓		
MF9ND6	✓			✓	✓			✓	✓	
MUKBCZ	✓				✓	✓				
NA2NKE	✓	✓		✓	✓	✓	✓	✓		
NAX23Z	✓	✓	✓	✓	✓		✓		✓	
NJAXCD	✓	✓			✓	✓				
NKYCUV	✓			✓	✓			✓	✓	Raman spectroscopy
NNV6JK	✓			✓	✓					
NNYP99	✓	✓	✓		✓		✓			Raman
NRZL3A	✓			✓	✓	✓		✓	✓	
NXPAN8	✓	✓			✓			✓		
P7WALM	✓				✓				✓	Raman spectroscopy
PJHR84	✓				✓	✓				
PK84NW	✓				✓					
Q2CRR9	✓	✓			✓				✓	
Q6H867	✓		✓		✓					
QK94C3	✓				✓			✓		
QLLK23	✓				✓					
QPE3JL	✓	✓			✓			✓	✓	
QTL63X	✓	✓	✓	✓	✓	✓	✓	✓		VSC 8000, FT-Raman
R73HE7	✓	✓	✓		✓			✓		
RF8KLN	✓				✓			✓		Spectrophotometry
RJUBZZ	✓			✓	✓	✓		✓	✓	
RTAZLX	✓				✓	✓				
RVJY68	✓	✓	✓	✓	✓			✓		

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry	Other
RWFEFJ	✓				✓	✓		✓		
RXQCVL	✓	✓		✓	✓	✓	✓	✓		
TK2W37	✓	✓	✓							
TKFC6L	✓	✓		✓	✓					
UCMGZN	✓		✓		✓					
UER3JU	✓	✓			✓	✓		✓		
UFFEEU	✓	✓	✓		✓			✓	✓	
UQ3DBQ	✓		✓	✓	✓	✓				
URK99K	✓				✓	✓				
UWWAB4	✓		✓		✓			✓		
V3CJM6	✓	✓		✓	✓			✓	✓	
V8LLNF	✓	✓	✓		✓			✓		Raman
VX2BHU	✓			✓	✓			✓		XRD
WBKJDX	✓				✓			✓		Raman
WDD26Y	✓				✓	✓				
WFZK4C	✓				✓					Raman
WK89JY	✓	✓			✓				✓	
WQERUK	✓	✓		✓	✓			✓		
WVQRW4	✓	✓	✓		✓	✓				
X82D3H	✓	✓	✓		✓	✓				
XFCW3T	✓				✓					visual colour comparison
XG7M98	✓	✓	✓		✓	✓		✓		
XJPTFG	✓	✓			✓			✓		Pyrolysis GC/MS
XJTD76	✓				✓			✓		PyGC/MS, colorimetry
XQ823T	✓	✓		✓	✓					Macroscopic
XQRVPN	✓			✓	✓			✓		
XTHYDP	✓		✓		✓			✓		
XXQD4Z	✓	✓		✓	✓	✓		✓	✓	

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry	Other
Y2P3V8	✓				✓	✓		✓		
Y32Z6H	✓			✓	✓			✓		
YJAPLP	✓			✓	✓					
YNUYJ2	✓	✓	✓		✓			✓		
YPXHNG	✓			✓	✓					
YYGZYB	✓				✓		✓			
Z24ZQ4	✓			✓	✓	✓		✓		
Z8UAZ3	✓				✓	✓		✓		Comparison Microscope, Pyrolysis GCMS
Z9HKYH	✓				✓			✓		
ZP8ZT7	✓	✓		✓	✓			✓	✓	

Response Summary

Participants	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	XRS/XRF	SEM/EDX	Microspectrophotometry
119	119	48	42	35	118	37	12	70	29
Percent	100%	40%	35%	29%	99%	31%	10%	59%	24%

Conclusions

TABLE 3

WebCode	Conclusions
3CRUNH	Items 1 through 3 individually consist of two layer (orange/white) architectural paint samples. The Item 1 two layer paint was analyzed and compared to the two layer architectural paints recovered from the victim's hair (Item 2) and the knot of the trash bag (Item 3). Items 1 and 3 are similar in colors, textures, types, layer structure, and chemical composition. It was concluded that the paints in Items 1 and 3 either originated from the same source or different sources painted in a similar manner. Due to differences in color and chemical composition, Item 1 was excluded as the source of the paint in Item 2. Items 1 through 3 were analyzed using stereomicroscopy, comparison microscopy, fluorescence microscopy, scanning electron microscopy with energy dispersive x-ray spectrometry, and Fourier transform infrared micro-spectrometry.
3E8FVL	The recovered paint fragment from the victims hair was examined when it was found to have the following cross sectional layer structure: orange/ white. The recovered paint fragment from the knot of the trash bag when it was found to have the following cross sectional layer structure: Orange/ White. The control sample of paint from the damaged dining room wall was examined when it was found to have the following cross sectional layer structure: Orange/ white. The two recovered samples were compared with control sample when the paint fragment from the victim's hair was found to be a different shade of orange in the top coat colour. As such, it could not have originated from the dining room wall. The recovered paint fragment from the knot of the trash bag was compared with the control sample when it was found to be similar in colour, cross-sectional layer structure, chemical characteristics and elemental composition, such that, they could have had a common origin.
3EJNQR	Questioned two-layer orange and white paint recovered from the knot of the trash bag (Item 3) is similar in visual color, layer sequence, paint type, and paint composition to the known two-layer orange and white paint from the damaged dining room wall (Item 1). It is our opinion that the questioned two-layer orange and white paint recovered from the knot of the trash bag could have come from the damaged dining room wall or any other painted surface with similar characteristics. Questioned two-layer orange and white paint recovered from the victim's hair (Item 2) is similar in visual color and layer sequence, but dissimilar in paint type to the known two-layer orange and white paint from the damaged dining room wall (Item 1). It is our opinion that the questioned two-layer orange and white paint recovered from the victim's hair did not come from the sampled area of the dining room wall.
3J9CZ4	Based on FTIR analysis, the paint chip recovered from the victim's hair did not originate from the damaged dining room wall. Based on FTIR and SEM/EDS analyses, the paint chips from the trash bag knot could have originated from the damaged dining room wall.
3RAFGN	ITEMS: 1 a sealed manila envelope identified as "2014 CTS Forensic Testing Program TEST NO. 14-545: PAINT ANALYSIS Sample Pack: P1" containing: 1-1, an orange chip of paint sealed in a white envelope identified as "Test No. 14-545 Item 1 known paint sample" 1-2, an orange chip of paint sealed in a white envelope identified as "Test No. 14-545 Item 2 questioned chip from victim's hair" 1-3, 2 chips of orange paint sealed in a white envelope identified as "Test No. 14-545 Item 3 questioned paint chips from knot of trash bag" RESULTS: The known paint, item #1-1, consisted of the layer structure: orange/drywall. The paint chip in item #1-2 found in the victim's hair had the same layer structure as the paint chip in item #1-1. The paint chip in item #1-3 found in the knot of the trash bag had the same layer structure as the paint chip in item #1-1. The orange layer of paint in item #1-2 did not correspond in color, microscopic appearance, infrared spectrum, and energy dispersive x-ray spectrum to the layer of orange paint in item #1-1. The orange layer of paint in item #1-3 corresponded in color, thickness, microscopic appearance, infrared spectrum and energy

TABLE 3

WebCode	Conclusions
	<p>dispersive x-ray spectrum to the layer of orange paint in item #1-1. OPINION: The paint in item #1-1 and the paint in item #1-3 could have originated from the same source and have a Type III Association. See Association Key below. The paint in item #1-1 and the paint in item #1-2 did not originate from the same source. This is an Elimination. See Association Key below. Terminology Key for Associative Evidence: Type I Association: A positive identification; an association in which items share individual characteristics that show that the items were once from the same source. Type II Association: An association in which items are consistent in all measured physical properties and/or chemical composition and share unusual characteristic(s) that would not be expected to be found in the population of this evidence type. Type III Association: An association in which items are consistent in all measured physical properties and/or chemical composition and could have originated from the same source. Because similar items have been manufactured or could exist in nature and would be indistinguishable from the submitted evidence, an individual source cannot be determined. Type IV Association: An association in which items are consistent in measured physical properties and/or chemical composition. This sample type is commonly encountered in our environment and may have limited associative value. Type V Association: An association in which items are consistent in some, but not all, physical properties and/or chemical composition. Some minor variation exists between the known and questioned items and sample due to factors such as sample heterogeneity, contamination of the sample(s), or the quality of the sample. Inconclusive: No conclusion could be reached regarding an association between the items. Elimination: The items were dissimilar in physical properties and/or chemical composition and did not originate from the same source.</p>
474FP3	<p>Examination of Items #1 (Known paint sample representative of the damaged dining room wall.), #2 (Large questioned paint chip recovered from the victim's hair.) and #3 (Questioned paint chips recovered from the knot of the trash bag.) revealed the presence of paint chips with the following layer structure: orange / white. The paint in Item #3 was found to be physically and chemically consistent with the paint in Item #1. Therefore, the paint in Item #3 could have originated from the same source as the paint in Item #1. The paint in Item #2 was found to be physically and chemically different from the paint in Item #1. Therefore, the paint in Item #2 could not have originated from the same source as the paint in Item #1.</p>
4BTYPC	<p>Item 1 is excluded as a possible source of item 2. Therefore, item 2 could not have originated from item 1 as represented by the submitted exemplar. Item 1 could not be excluded as a possible source of item 3. Therefore, item 3 could have originated from item 1 as represented by the submitted exemplar or from another source exhibiting all of the same analyzed/measured characteristics.</p>
6999J2	<p>Examination of Item 1 revealed a paint chip with the following layers: medium orange paint/white paint/cardboard-type substrate. The examination of Item 2 also revealed a paint chip with the following layers: medium orange paint/white paint/cardboard-type substrate. In addition, the examination of Item 3 revealed paint chips with the following layers: medium orange paint/white paint/cardboard-type substrate. The paint from Item 1 was found to be physically and chemically consistent with the paint from Item 3. Therefore, the paint from Item 1 could have originated from the same source as the paint from Item 3. The paint from Item 2 is not consistent with the paint from Item 1. Therefore, the paint from Item 2 could not have originated from the same source as the paint from Item 1.</p>
6EDYTY	<p>1. Comparative examinations of Item 2 (questioned paint chip recovered from the victim's hair) with Item 1 (known paint sample representative of the damaged dining room wall) disclosed them to be dissimilar in their physical characteristics. As a result of these findings, the questioned paint chip submitted in Item 2 did not originate from the source for the known paint submitted as Item 1. 2. Comparative examinations of Item 3 (questioned paint chips recovered from the knot of the trash bag) with Item 1 (known paint sample representative of</p>

TABLE 3

WebCode	Conclusions
	the damaged dining room wall) disclosed them to be consistent in their physical characteristics (texture, layer structure, and layer colors). In addition, these paints were found to be consistent in the organic and elemental composition of their orange and white layers, respectively. Based on these results, the questioned paint chips in Item 3 could have originated from the source for the known paint sample in Item 1 or a source of paint with identical physical properties and composition.
6TDXNH	Exhibit 2 (paint from victim's car[sic]) is chemically dissimilar to Exhibit 1 (paint from dining room) and therefore could not have originated from this source. Exhibit 3 (paint from knot of garbage bag) is visually, chemically, and elementally consistent with Exhibit 1 (paint from dining room) and therefore could have originated from this source, or a similarly painted source.
6VJ9QD	The paint sample from the damaged dining room wall (Item 1) and the paint chips from the knot of the trash bag (Item 3) were found to be indistinguishable from each other in all aspects tested. The paint chips from the trash bag could therefore have originated from the dining room wall. The paint chip from the victim's hair (Item 2) was found to be different from the known paint sample (Item 1), and could not have originated from the same source.
6VYQC7	[No Conclusions Reported]
747R9Q	On examination and analysis, I found as follows: 1) The Large question paint chip recovered from the victim's hair 'Item 2' is not similar with known paint sample 'Item 1'. 2) The questioned paint chip recovered from the knot of the trash bag 'Item 3' is similar with known paint sample 'Item 1'.
76QE9L	Items #1, 2 and 3 each consisted of paint chips with a layering of orange over white. The paint samples were examined via stereomicroscopy, polarized light microscopy (PLM), infrared spectroscopy (FTIR), visible microspectrophotometry (MSP) and scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDS). The questioned paint chips from Item #3 were consistent in color, layering, chemical and elemental composition with the known paint chip from Item #1 and could have originated from the same source (Level III association). The orange layer of the questioned paint chip from Item #2 differed in chemical composition with the known paint chip from Item #1 and did not originate from the same source (Elimination). Terminology Key for Associative Evidence: The following descriptions are meant to provide context to the levels of opinions reached in this report. Every level of conclusion may not be applicable in every case nor for every material type. Level I Association: A physical match; items physically fit back to one another, indicating that the items were once from the same source. Level II Association: An association in which items are consistent in observed and measured physical properties and/or chemical composition and share atypical characteristic(s) that would not be expected to be readily available in the population of this evidence type. Level III Association: An association in which items are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. Because other items have been manufactured that would also be indistinguishable from the submitted evidence, an individual source cannot be determined. Level IV Association: An association in which items are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. As compared to a Level III association, items categorized within a Level IV share characteristics that are more common amongst these kinds of manufactured products. Alternatively, an association between items would be categorized as a Level IV if a limited analysis was performed due to characteristics or size of the specimen(s). Level V Association: An association in which items are consistent in some, but not all, physical properties and/or chemical composition. Some minor variation(s) exists between the known and questioned items and could be due to factors such as sample

TABLE 3

WebCode	Conclusions
	heterogeneity, contamination of the sample(s), or having a sample of insufficient size to adequately assess homogeneity of the entity from which it was derived. Inconclusive: No conclusion could be reached regarding an association/elimination between the items. Elimination: The items were dissimilar in physical properties and/or chemical composition, indicating that they did not originate from the same source.
77AK3P	On analysis, I found: (i) The questioned paint chips recovered from the knot of the trash bag (Item 3) to be similar to the known paint sample representative of damaged dining room wall (Item 1). (ii) The questioned paints chip recovered from the victim's hair (Item 2) to be dissimilar to the known paint sample representative of damaged dining room wall (Item 1). I am of the opinion that questioned paint chips (Item 3) could have originated from the damaged dining room wall (Item 1).
78HUV M	The questioned paint chip mark as Item 2 is not similar with known paint sample marked as Item 1, while the questioned paint chip marked as Item 3 is similar with Item 1. In conclusion, the paint chip marked as Item 3 could have originated from the damaged area of the dining room wall.
7F2Y8V	Visual examination, microscopic examination, and instrumental analysis (FTIR) of questioned paint Q1 and comparison to known paint K1 disclosed that they are different with respect to color (slight variation in the shade of layer 1) and chemical type. Therefore, it is the opinion of the undersigned that Q1 could not have originated from the source represented by K1. Visual examination, microscopic examination, and instrumental analysis (FTIR & XRF) of questioned paint Q2a and comparison to known paint K1 disclosed that they are indistinguishable with respect to color, texture (soft/pliable), layer structure, chemical type (FTIR), and elemental composition (XRF). Therefore, it is the opinion of the undersigned that Q2a could have originated from the source represented by K1, or any other source painted in the same manner. Q2b was not instrumentally analyzed. No further conclusions can be made regarding this sample
82WADR	Item 2 (multi-layered paint chip from the victims hair) is chemically different from item 1 (multi-layered paint chip from dining room wall) and did not originate from that same source. Item 3 (2 multilayered paint chips from the knot of the trash bag) is the same distinct kind of paint as that of Item 1 (multilayered paint chip from dining room wall) and originated from the same source or a source of paint having the same characteristics.
8DDRCQ	On analysis, I found the questioned paint chips recovered from the knot of the trash bag (Item 3) to be similar with the known paint sample representative of the damaged dining room wall (Item 1) but dissimilar with the large questioned paint chip recovered from the victim's hair (Item 2). Hence I am of the opinion that: i) The questioned paint chips recovered from the knot of the trash bag (Item 3) and known paint sample representative of the damaged dining room wall (Item 1) could have originated from the same source. ii) The large questioned paint chip recovered from the victim's hair (Item 2) did not originate from the same source with the known paint sample representative of the damaged dining room wall (Item 1).
8GQTB3	Two layers of a paint-like substance (orange/white), on a paper-like substrate, were located in item #1 (known paint sample from damaged dining room wall). Instrumental analysis (FTIR and SEM) was performed on item #1 layers 1 and 2. Two layers of a paint-like substance (orange/white), on a paper-like substrate, were located in item #2 (questioned paint chip recovered from the victim's hair). Instrumental analysis (FTIR) was performed on item #2 layers 1 and 2. This paint sample (item #2) exhibited dissimilar instrumental characteristics (FTIR) to the orange paint (layer 1) in item #1 (known paint sample representative of the damaged dining room wall). This paint (item #2) exhibited similar instrumental characteristics (FTIR) to the white paint (layer 2) located in item #1. Two (2) paint chips with two layers of a paint-like substance (orange/white), on a paper-like substrate, were located in item #3 (questioned

TABLE 3

WebCode	Conclusions
	<p>paint chips recovered from the knot of the trash bag). One chip was analyzed instrumentally (FTIR and SEM layers 1 and 2) and designated #3A. This paint (Item #3A) exhibited similar microscopic and instrumental characteristics (FTIR and SEM) to the two layers of paint (orange/white) located in item #1 (known paint sample representative of the damaged dining room wall). The remaining paint-like chip was designated item 3B and was not analyzed instrumentally.</p>
8QGF6K	<p>The questioned orange paint chips marked "Item 3", recovered from the knot of the trash bag, could have originated from the same source as the known orange paint sample marked "Item 1", collected from the damaged dining room wall, or another source of orange paint with characteristics. The questioned orange paint chip marked "Item 2", recovered from the victim's hair, did not originate from the same source as the known orange paint sample marked "Item 1", collected from the damaged dining room wall.</p>
ABY34X	<p>The questioned paint chips recovered from the knot of the trash bag (item 3) could have come from the damaged dining room wall (represented by item 1) or any other object with a similar paint system.</p>
AD89PY	<p>The paints in Items 1 and 3 could have originated from the same source. The paints in Items 1 and 2 did not originate from the same source.</p>
BLTPME	<p>The submitted known (Item 1) and questioned (Items 2 and 3) paint chips were examined and found to have layer structure of orange over white. Samples of both layers of each item were analyzed by microscopy, infrared spectroscopy (IR), and scanning electron microscopy - energy dispersive spectroscopy (SEM-EDS). Samples of the orange layer from each item were also analyzed by microspectrophotometry (MSP). The orange and white layers from the questioned paint sample reportedly recovered from the knot of a trash bag (Item 3) were consistent in all tests performed to the orange and white layers from the known paint sample reportedly collected from a damaged dining room wall (Item 1). The questioned paint from Item 3 could have originated from the same source as the known paint from Item 1 (Level 3 - Association). Because other objects or surfaces may have been painted with paint indistinguishable from the submitted evidence, an individual source cannot be determined. The white layer from the questioned paint sample reportedly recovered from the victim's hair (Item 2) was consistent in all tests performed to the white layer from the known paint sample (Item 1). The questioned orange layer from Item 2 and the known orange layer from Item 1 were discriminated by IR and MSP. The questioned paint from Item 2 was eliminated as having originated from the source of paint represented by Item 1 (Elimination/Non-association).</p>
BNXPCD	<p>The questioned paint chip mark as Item 2 is not similar with known paint sample marked as Item 1, while the next questioned paint chip marked as Item 3 is similar with Item 1. In my conclusion, the paint chip marked as Item 3 could have originated from the damaged area of the dining room wall.</p>
BVHKHN	<p>Item 2, the paint sample labeled "paint from victim's hair" is not consistent with item 1, the paint sample labeled "known paint from living room wall." A conclusion of "not consistent" indicates that the physical, chemical, and/or optical characteristics of the analyzed sample are different from those of the comparison sample or from a unique source. Item 3, the paint sample labeled "questioned paint from knot of trash bag" is consistent with item 1, the paint sample labeled "known paint from living[sic] room wall". A conclusion of "consistent" indicates that the analyzed sample possesses identical physical, chemical, and/or optical characteristics as those detected within a comparison sample. However, the analyzed sample lacks sufficient individualizing characteristics to identify a unique source.</p>
CAFXMC	<p>The paint from the dining room wall (item 1) consisted of an orange top coat and a white undercoat. The paint chip recovered from the victims hair (item 2) consisted of an orange top</p>

TABLE 3

WebCode	Conclusions
	coat and a white undercoat. The orange top coat was found to have a different chemical composition to the orange top coat from the dining room wall (item 1) and therefore could not have originated from this source. The paint chips recovered from the knot of the trash bag (item 3) consisted of an orange top coat and a white undercoat. In relation to colour, chemical composition and elemental composition the orange top coat and white second coat of these chips were indistinguishable from the corresponding coats of the paint from the dining room wall (item 1). These items may therefore share a common origin.
CV2LHX	The infrared spectra obtained of the topcoats of items 1 and 3 as well as of the total chips of these items were consistent with each other. The spectral band locations and intensities of the bands were representative of the same pattern. Item 2 was not consistent with the other items. The spectral band locations and intensities were similar to those obtained from Items 1 and 3 but were not deemed chemically consistent. Additionally, the texture of the top surface of Item 2 was noticeably different than that of Item 1. Item 1 had a slight surface roughness with a slight orange peel texture, and Item 2 had deep ridges and valleys present on the surface.
CXH7Q7	The known paint sample (Item 1) and the two questioned paint chips (Item 2 and Item 3) consist each of two paint layers. The two layers of the known paint sample (Item 1) cannot be distinguished from the corresponding layers of the questioned paint chip (Item 3) recovered from the knot of the trash bag. Therefore this questioned paint chip (Item 3) could have originated from the damaged area of the dining room wall as represented by Item 1. The upper of the two layers of the known paint sample (Item 1) differs from the corresponding layer of the questioned paint chip (Item 2) recovered from the victim's hair. Therefore this questioned paint chip (Item 2) cannot have come from the damaged area of the dining room wall as represented by Item 1.
CYT9W	A preliminary microscopic + FTIR analysis determined: Items 1, 2 and 3 consisted of orange paint sample pieces. Item 3 was visually, microscopically, and chemically consistent with item 1. Item 2 was visually, microscopically and chemically inconsistent with item 1. Item 2 can be excluded from item 1.
D3RQ8Q	Lab items 2 and 3 were submitted to the Police Laboratory for paint analysis and comparison to lab item 1. Visual and microscopic examinations of known paint K1 (one particle) disclosed the following layer structure: orange coat (layer 1)/white coat (layer 2)/possible paper substrate Visual and microscopic examinations of questioned paint Q1 (one particle) disclosed the following layer structure: orange coat (layer 1)/white coat (layer 2)/possible paper substrate Visual and microscopic examinations of questioned paint Q2 (two particles) disclosed the following layer structure: orange coat (layer 1)/white coat (layer 2)/possible paper substrate Visual and microscopic examinations of the questioned paint Q1 and comparison to the known paint K1 disclosed that the orange coat of Q1 is a slightly different color than the orange coat of K1 when viewed in daylight. In addition, the color of Q1 layer 1 is different from the color of K1 layer 1 when viewed with an alternate light source (ALS). Orange coat surface texture of Q1 was observed to be slightly different from K1. Fourier Transform Infrared Spectroscopy (FTIR) instrumental analysis of Q1 and comparison to K1 disclosed small differences with respect to chemical type. X-Ray Fluorescence Spectrometry (XRF) instrumental analysis of Q1 and comparison to K1 disclosed small variations in peak intensities. Therefore, it is in the opinion of the undersigned that the questioned paint sample Q1 could not have originated from the same source as represented by the known paint sample K1. Visual (including ALS) and microscopic examinations and instrumental analysis (FTIR, XRF) of the questioned paint Q2 and comparison to the known paint K1 disclosed they are indistinguishable with respect to color, texture, layer structure, chemical type, and elemental composition. Only one particle of Q2 was analyzed instrumentally. No further conclusions can be reached about the unanalyzed particle. Therefore, it is in the opinion of the undersigned that the questioned paint sample Q2 could have originated from the same

TABLE 3

WebCode	Conclusions
	source as represented by the known paint sample K1 or from any other source painted in the same manner.
DAPHDY	1. Microscopic Examination - Item 1, Item 2 and Item 3 are indistinguishable in their appearance; They all have two layers of orange and white. 2. Microspectrophotometry - Orange layers of Item 1 and Item 3 have similar absorption spectrum. But orange layer of Item 2 is different from Item 1. 3. FT-IR Analysis - Chemical compositions of layers of Item 3 are similar to those of Item 1. But Item 2 differs from Item 1 in orange layer.
DCWMH9	Item 2 (The large paint chip recovered from the victim's hair) and Item 3 (The paint chips recovered from the knot of the trash bag) were analyzed and compared to Item 1 (The known paint sample from the dining room wall). Analysis of Item 2 revealed that the microscopic and chemical characteristics are dissimilar from those of Item 1. It is concluded that Item 2 could not have originated from Item 1. Analysis of Item 3 revealed that the microscopic and chemical characteristics are like those of Item 1. It is concluded that Item 3 is of the same distinct type of paint as Item 1 and originated from the same source or from another source of paint having the same characteristics.
DH64V4	The paint from the dining room (item 1) comprised an orange acrylic topcoat with a white coat underneath. Paint recovered from the victim (item 2) and trash bag (item 3) were also comprised of orange acrylic over white. The orange paint of item 2 was excluded as coming from the dining room as the samples supplied could be differentiated based on texture, colour, filler and polymer composition. Based on the analyses conducted, neither the orange paint nor the white paint of item 3 was differentiated from the corresponding dining room paint sample. The paint of item 1 could be the source of the recovered paint in item 3.
DUFKGE	Item 1: Two layer orange paint standard. Item 2: One, two layer orange paint chip was found. The unknown paint and the standard paint (Item 1) are not the same in physical characteristics, and chemical characteristics. The unknown paint could not have originated from the standard. Item 3: Two, two layer orange paint chips were found. The unknown paint and the standard paint (Item 1) are the same in physical characteristics, and chemical characteristics. The unknown paint either originated from the standard or another source of paint possessing the same distinct physical and chemical characteristics.
DZJGET	The paint in item 3 is similar in color, layer structure, solubility, fluorescence and infra-red absorbance spectra to the paint in item 1. Therefore the paint in items 1 and 3 could have originated from the same source. The paint in item 2 is similar in color and layer structure to the paint in item 1, however, it is dissimilar in infra-red absorbance spectra. Therefore the paint in items 1 + 2 could not have originated from the same source.
EE7VGK	Items 1 and 3 are consistent with having originated from the same source. Differences in the binder chemistry of item 2 indicate that it originated from a different source than items 1 and 3.
EPYH8N	Items 1, 2 and 3 were examined visually, and using stereomicroscopy and fluorescence microscopy. Items 1 and 3 were further examined using microsolubility tests, microchemical tests, Fourier Transform Infrared Spectrophotometry (FTIR) and Scanning Electron Microscopy-Energy Dispersive X-Ray Spectrometry (SEM-EDS). The Item 1 and 3 two-layered orange paints were consistent in colors, textures, types, layer sequence, and chemical composition. It was concluded that the paints in Items 1 and 3 either originated from the same source or different sources painted in the same manner. The two-layered orange paint in item 2 could not be associated with the two-layered orange paint in Item 1 due to differences in color and fluorescence.
EWLCF8	1 The paint in item 2 could not have originated from the same source as that in item 1. 2 In my opinion the findings provide strong evidence to support the view that the paint in item 3

TABLE 3

WebCode	Conclusions
	has originated from the same source as that in item 1.
FCUW7B	The known paint sample Item 1 of the damaged dining room wall comprised a double-layered paint fragment having a top orange paint layer and a bottom white filler layer. The large questioned paint sample Item 2 recovered from the victim's hair comprised a double-layered paint fragment having a top orange paint layer and a bottom white filler layer. The top orange paint layer of Item 2 resembled the top orange paint layer of Item 1 in colour but there was a disagreement in chemical composition between the two samples. This indicated that the questioned paint sample Item 2 did not originate from the same source as the known paint sample Item 1. The questioned paint sample Item 3 from the knot of the trash bag comprised 2 double-layered paint fragments, each having a top orange paint layer and a bottom white filler layer, agreeing with each other in colour and chemical composition of the corresponding layers. Furthermore, the questioned paint sample Item 3 could have originated from the same source as the known paint sample Item 1 since there were agreements in colour and chemical composition of the corresponding paint layers of the two samples.
GBEWML	The questioned paint chips recovered from the knot of the trash bag, Item 001-3, were indistinguishable from the known paint sample of the damaged dining room wall, Item 001-1. Therefore, the questioned paint chips, Item 001-3, could have come from the damaged dining room wall or from another source of paint with the same physical and chemical characteristics. The questioned paint recovered from the victims' hair, Item 001-2 did not come from the damaged dining room wall, Item 001-1.
GVZD4T	Conclusions: Questioned paint (item 2), reportedly from the victim's hair, was examined and found to be one chip of orange paint. This questioned paint (item 2) was subsequently found to be inconsistent with the known paint (item 1) regarding color, texture, and physical properties. Questioned paint (item 3), reportedly from the knot of the trash bag, was examined and found to be two chips of orange paint. This questioned paint (item 3) was subsequently found to be consistent with the known paint (item 1) regarding color, texture, microchemical and physical properties and gross elemental composition. Based upon these observations, it is the opinion of this analyst that the known paint (item 1) and the questioned paint (item 3) are of the same type and could have come from the same source. This analyst recognizes that another source of paint with properties consistent with the above paint exists.
GZ6LY3	Both questioned samples are primarily acrylics, as is the reference sample. The FTIR spectrum of #2 does not, however, provide a good match to the reference while #3 is an exact match to the reference. Analysis by SEM-EDX shows that the inorganic components of #3 match the reference while the inorganic components of #2 do not match the reference. The FT-IR differences are most likely due to differences in the inorganic components of #2 from the reference and #3.
H9GYGX	1. Microscope Analysis: Item 1, item 2 and item 3 are the same color and 2 layers painted samples. 2. Chemical Analysis: The layers of orange paint of item 1 and 3 have the same FT-IR spectrum but that of item 2 is different from the others. 3. Result: The paint chips recovered from the knot of the trash bag (item 3) have originated from the damaged area of the dining room wall (item 1).
HTNBEZ	According to the methods used, large questioned paint chip recovered from the victim's hair is different of the paint sample representative of the damaged dining room wall. So, paint chip recovered from the victim's hair can't come from the suspect's dining room wall. Paint particles recovered from the knot of the trash bag and paint sample representative of the damaged dining room wall are indistinguishable. So, we can't exclude the possibility that paint particles found on the knot of the trash bag come from the suspect's dining room wall.
HU8VND	The questioned paint chip from the victim's hair (Item 2) did not originate from the damaged dining room wall (Item 1). The orange layers of these two samples exhibited different hues and

TABLE 3

WebCode	Conclusions
	the organic binder characteristics were different. The questioned paint chips from the knot of the trash bag (Item 3) and the known paint from the dining room wall (Item 1) were like each other with respect to their layer structures, colors, textures, organic binders, and inorganic pigment and filler characteristics of their respective layers. The paint chips in Item 3 could have come from the damaged area of the dining room wall, or from another source of paint that exhibits the same array of physical and chemical characteristics.
JP74YD	Items 1 (Known) and 2 (Questioned - Victim's Hair) were found to be dissimilar in appearance (Stereomicroscope), color (Stereomicroscope / MSP), and organic composition (FTIR). Items 1 (Known) and 3 (Questioned - Knot of Trash Bag) were found to be similar in appearance, color (Stereomicroscope / MSP), and organic composition (FTIR).
JWZKYG	Items 1, 2 and 3 were examined visually and using stereomicroscopy, fluorescence microscopy and an ultraviolet light. Items 1 and 3 were further examined using microsolubility tests, microchemical tests, polarized light microscopy (PLM), Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy-Energy Dispersive X-Ray Spectrometry (SEM-EDS). The two-layered orange over white paint in Items 1 and 3 were consistent in colors, textures, types, layer sequence and chemical composition. It was concluded that the paints in Items 1 and 3 either originated from the same source or different sources painted in the same manner. The orange paint particles in Items 1 and 2 could not be associated due to differences in color and texture.
K4KRN2	Item 1, Item 2 and Item 3 are each composed of a 2 layer paint system. The top layer is an orange color coat and the second layer is a white primer. The orange paint chips recovered from the knot of the trash bag (Item 3) are similar in color, physical appearance, chemistry and elemental composition in comparison to the orange paint sample representative of the damaged dining room wall (Item 1). The orange paint from Item 3 could have come from Item 1, or any other orange paint source that is similar in color, physical appearance, chemistry and elemental composition. The orange paint sample recovered from the victim's hair (Item 2) is different in color, physical appearance, chemistry and elemental composition in comparison to the orange paint sample representative of the damaged dining room wall (Item 1). The orange paint from Item 2 could not share a common origin with Item 1 or Item 3.
K78KCP	Item #2- The paint chip recovered from the victim's hair exhibits a 2-layer paint structure: 1) Orange, 2) White. Neither the orange nor the white paint layers physically or chemically compare to the corresponding paint layers in the known reference sample. The known reference sample (item #1) is therefore ruled out as the source of the paint chip found in the victim's hair (item #2). Item #3- The paint chips (2) recovered from the trash bag knot exhibit a 2-layer paint structure: 1) Orange, 2) White. The orange and white paint layers in the recovered paint chips (item #3) physically and chemically compare to the corresponding paint layers in the known reference sample (item #1). Therefore the known reference paint from the dining room wall of the suspect's house could be the source of the paint chips recovered from the knot of the trash bag the victim's body was found inside, a Type III association.
KDNXBN	Item 1, the known paint sample reportedly from the damaged dining room wall, is composed of a two layered paint chip. The top layer is orange and the underlying layer is white in color. Item 2, a questioned paint chip reportedly from the victim's hair, is composed of a two layered paint chip. The top layer is orange and the underlying layer is white in color. Item 3, a questioned paint chip from a knot in a trash bag, is composed of a two layered paint chip. The top layer is orange and the underlying layer is white in color. Item 1 is similar to item 3 in color, layer structure and chemistry using light microscopy, scanning electron microscopy-energy dispersive spectroscopy, infra-red spectroscopy and micro-spectrophotometry. The paint chip from item 3 could have originated from paint similar

TABLE 3

WebCode	Conclusions
	to that found on the dining room wall as represented by item 1. Item 2 contains diatoms as one of the filler ingredients in the orange top coat and is thus dissimilar to items 1 and 3. Item 2 did not originate from paint similar to that found on the dining room wall as represented by item 1.
KDRH2C	The two layered orange paint chips from the knot of the trash bag (Item 3) are similar in color, layer sequence, paint type, and composition to the known two layered orange paint from the damaged area of the dining room wall (Item 1). It is my opinion that these paint chips could have originated from the damaged area of the dining room wall, or another source with similar characteristics. The top orange layer from the paint chip from the victim's hair (Item 2) is dissimilar in paint type to the top orange layer of paint from the damaged area of the dining room wall (Item 1). Additional slight differences in color and gloss were noted between these layers. It is my opinion that this paint chip did not originate from the damaged area of the dining room wall.
KMWNYK	One of the paint chips from the knot of the trash bag (#3) could have come from the paint on the dining room wall (#1) or another source of similar paint. The paint chip from the victim's hair (#2) is from a source other than the paint on the dining room wall (#1).
KUP3DQ	The questioned paint in Item 3 is consistent with the known paint in Item 1 on the basis of color, texture, layer structure, organic and elemental composition. Therefore, the paint in Item 3 could have originated from the known sample in Item 1. The paint in Item 2 is not consistent with the paint in Item 1 on the basis of organic composition.
LDGEFW	The source of item 1 is excluded as a possible source of the unknown paint sample in item 2, based on class characteristics. The source of item 1 is included as a possible source of the unknown paint sample in item 3, based on class characteristics.
LFCRNH	Items 1, 2, and 3 were examined using stereomicroscopy, fluorescence microscopy, and Fourier Transform Infrared Spectrophotometry. Items 1 and 3 were further examined using microsolubility tests, a microchemical test, and Scanning Electron Microscopy-Energy Dispersive X-Ray Spectrometry (SEM-EDS). The two-layered orange paint particles in Items 1 and 3 were consistent in colors, textures, types, layer sequence and chemical composition. It was concluded that the Item 3 paint could have had a common origin with Item 1 or another source of paint with the same colors, textures, types, layer sequence and chemical compositions. The two-layered orange paint particles in Items 1 and 2 could not be associated due to differences in color, texture and organic composition.
LLM2V6	The examination of Item 1 and Item 2 showed that the samples were not consistent with one another and therefore could not have originated from the same source. Examination of Item 1 and Item 3 revealed they are like one another with respect to their layer structures, layer colors, layer textures, binder characteristics of their respective layers, and pigment characteristics of their respective layers. Accordingly, these samples could have originated from the same source, or another source of paint having the same characteristics.
MF9ND6	The questioned orange paint in item 2 was instrumentally different from the known orange paint in item 1. This indicates that Item 2 did not originate from item 1. The questioned orange paint in item 3 was visually, microscopically, and instrumentally consistent with the known orange paint in item 1. This indicates that Item 3 could have originated from item 1.
MUKBCZ	I am of the opinion that: i) The questioned paint chips recovered from the knot of the trash bag 'Item 3' was found to be similar with the known paint sample representative of the damaged dining room wall 'Item 1' and therefore 'Item 3' could have come from the 'Item 1'. ii) The large questioned paint chips recovered from the victim's hair 'Item 2' was found not to be similar with the known paint sample representative of the damaged dining room wall 'Item 1' and therefore 'Item 2' could not have come from the 'Item 1'.

TABLE 3

WebCode	Conclusions
NA2NKE	The questioned paint recovered from the victim's hair (item 1B) did not originate from the area of the dining room wall as represented by the paint sample (item 1A). The questioned paint recovered from the trash bag knot (item 1C) is the same distinct type of paint as the known paint on the dining room wall (item 1A) and originated either from that source or another source of paint having the same distinct characteristics.
NAX23Z	Item 2: Large questioned paint chip recovered from the victim's hair - One paint chip was analyzed. The paint consisted of two layers: an orange layer on top and a white layer on the bottom. Unexplainable and significant differences were found to exist between the Item 2 paint and the Item 1 Known Paint. Therefore, the Item 2 paint could not have originated from the same source as the Item 1 paint. Item 3: Questioned paint chips recovered from the knot of the trash bag - One of two visually similar paint chips was analyzed. The paint consisted of two layers: an orange layer on top and a white layer on the bottom. The Item 3 paint and the Item 1 Known Paint have indistinguishable physical, microscopic, chemical, and elemental compositions. Therefore, the paint from Item 3 could have originated from the same source as the Item 1 paint or any source of paint containing the same respective layers with indistinguishable physical, microscopic, chemical, and elemental compositions.
NJAXCD	The orange paint that was recovered from the knot of the trash bag (Item 3) had the same organic chemical composition as, and could have originated from, the damaged area of the dining room wall (Item 1) or another source with the same paint system. The orange paint from the damaged dining room wall (Item 1) was eliminated as the source of the orange paint chip that was recovered from the victim's head (Item 2) as they were found to have different organic chemical composition.
NKYCUV	Item 1 comprised a paint chip with an orange topcoat and a white layer beneath. The orange topcoat was identified as an acrylic-styrene type paint, with a feldspar-type mineral additive. The white layer was identified as an acrylic-styrene type paint, with feldspar-type mineral and titanium dioxide additives. Item 2 comprised a paint chip with an orange topcoat and a white layer beneath. The chemical composition of the orange topcoat differed to that of Item 1. Therefore it is concluded that Item 2 (paint chip recovered from the victim's hair) did not originate from the damaged dining room wall (Item 1). Item 3 comprised two paint chips, each with an orange topcoat and a white layer beneath. The orange and white layers were observed to have no significant differences in chemical composition to the orange and white layers of Item 1. Therefore the results support the proposition that Item 3 (paint chips recovered from the knot of the trash bag) originated from the damaged dining room wall (Item 1).
NNV6JK	Item 2 (paint chip recovered from the victim's hair) IS NOT CONSISTENT with item 1 (known paint sample from the dining room wall). Item 3 (paint chips recovered from the knot of the trash bag) IS CONSISTENT with item 1 (known paint sample from the dining room wall)
NNYP99	Item 1, Item 2 and Item 3 have been examined. As analysis methods carried out, it is possible to conclude that: - the orange paint chip which were found in the knot of the trash bag (Item 3) could come from the damaged area of the suspect's wall (Item 1). - the orange paint chip recovered from the victim's hair (Item 2) don't correspond with the known paint sample representative of the damage dining room wall (Item 1).
NRZL3A	The questioned paints collected from the victim's hair (Item 2) and the knot of the trash bag (Item 3) were compared to the known paint sample from the damaged dining room wall (Item 1). The questioned paint from Item 3 corresponded to the Item 1 known paint in color and layer structure (orange-white), general microscopic appearance (compound microscope), chemical solubilities, chemical composition (FTIR), visible spectra (MSP), elemental composition (SEM-EDS), and chemical composition (PGC). Therefore, these paints could have come from a common source (Type 3 Association). It should be noted that since similar items

TABLE 3

WebCode	Conclusions
	<p>may have been manufactured which would be indistinguishable from the submitted evidence an individual source cannot be determined. The questioned paint from Item 2 is similar in layer structure (orange-white) to the Item 1 known paint; however, the Item 2 orange layer differed in color (slightly darker), visible spectra (MSP), and chemical composition (FTIR). Therefore, these paints can be eliminated as coming from a common source (Elimination). KEY for instrument acronyms: FTIR – Fourier Transform Infrared Spectroscopy, PGC – Pyrolysis Gas Chromatography, MSP – Microspectrophotometry, SEM/EDS – Scanning Electron Microscopy/Energy Dispersive Spectroscopy. Interpretation: The following descriptions are meant to provide context to the opinions reached in this report. Every type of conclusion may not be applicable in every case or for every material type. Type 1 Association: Identification- An association in which items share individual characteristics and/or physically fit together that demonstrate the items were once from the same source. Type 2 Association: Highly likely - An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and share distinctive characteristic(s) that would not be expected to be found in the population of this evidence type. The distinctive characteristics were not sufficient for a Type 1 Association. Type 3 Association: Could have - An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and could have originated from the same source. Because it is possible for another sample to be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Cannot eliminate - An association in which items correspond in some but possibly not all measured physical properties, chemical composition and/or microscopic characteristics and cannot be eliminated as coming from the same source. This type of evidence may be commonly encountered in the environment, may have limited comparative value and/or there may be factor(s) limiting the comparison. Inconclusive - No conclusion could be reached regarding an association between the items. Elimination: Items exhibit dissimilarities in one or more of the following: physical properties, chemical composition or microscopic characteristics and, therefore, conclusively did not originate from the same source. Non-Association: Items exhibit dissimilarities but certain details or features are not sufficient for an Elimination.</p>
NXPAN8	The questioned paint chip item-2 could not have originated from item-1. The questioned paint chip Item-3 could have originated from the same source as Item-1.
P7WALM	Paint chips of Item 1 and Item 3 are coincident and Item 2 has different[sic] spectrums (FTIR/Raman/Microspectrophotometry).
PJHR84	The questioned paint chip recovered from the knot of the trash bag (Item 3) is similar to the known paint sample representative of the damaged dining room wall (Item 1), while the large questioned paint chip recovered from the victim's hair (Item 2) is not similar to Item 1. In conclusion, the paint chips marked as Item 3 could have originated from the damaged area of the dining room wall as represented by Item 1.
PK84NW	Item 2, questioned paint chip from the victim's hair, could not have originated from the same source as Item 1, paint sample from the damaged dining room wall. Item 3, questioned paint chip from the knot of the trash bag, could have originated from the same source as Item 1, paint sample from the damaged dining room wall.
Q2CRR9	The paint recovered from the knot of the trash bag (Item 3) either originated from the damaged dining room wall (source of Item 1) or from another source with indistinguishable color, surface texture, chemical characteristics, MSP characteristics, and microscopic particles and similar layer thickness range. The paint recovered from the victim's hair (Item 2) is dissimilar to the known paint sample representative of the dining room wall with respect to color, surface texture, chemical characteristics, MSP characteristics, and microscopic particles, demonstrating that they are from different sources.

TABLE 3

WebCode	Conclusions
Q6H867	Based on FTIR spectra and microscopic examination, paint from Item 2 was found to be significantly different to paint from Item 1. Based on FTIR spectra and microscopic examination, no significant differences could be found between paint from Item 3 and paint from Item 1.
QK94C3	Physical and microscopic examination of Items 1, 2 and 3 revealed the presence of multi-layered paint samples with the following layer structure: an orange architectural paint layer and a white primer layer. Microscopic and instrumental comparison of the paint from Item 3 with the paint from Item 1 revealed them to be consistent with respect to color, texture, type, layering sequence, binder composition, and pigment composition. Therefore, the paint recovered from the knot of the trash bag could have come from the damaged dining room wall or another paint source with the same paint history. Microscopic and instrumental comparison of the paint from Item 2 with the paint from Item 1 revealed them to be inconsistent with respect to color, binder composition, and pigment composition. Therefore, the paint recovered from the victim's hair did not originate from the damaged dining room wall.
QLLK23	Conclusions 1. The paint in Exhibit 3 originated either from the source of the paint in Exhibit 1, or from another source painted in an indistinguishable manner. 2. The paint in Exhibit 2 did not originate from the source of the paint in Exhibit 1 (see Remark 1).
QPE3JL	Samples 1A (known paint), 1B (paint from victim's hair) and 1C (paint from trash bag) are all single layer orange paint samples. Sample 1A (known paint) was compared to 1B (paint from victim's hair) and 1C (paint from trash bag) using microscopy, Fourier Transform Infrared Spectroscopy (FTIR), Microspectrophotometry (MSP) and Scanning Electron Microscopy with Energy Dispersive Spectrometry (SEM/EDS). Samples 1A (known paint) and 1B (paint from victim's hair) could not have originated from the same source due to differences in color and chemical composition. Samples 1A (known paint) and 1C (Paint from trash bag) are similar in color, texture and chemical and elemental composition. Sample 1C (paint from trash bag) could have originated from sample 1A (known paint) or another source with the same color, texture and chemical and elemental components.
QTL63X	The questioned paint chips recovered from the knot of the trash bag (Item 3) could have originated from the damaged area of the dining room wall as represented by (item 1).
R73HE7	Item 2, the two layer orange architectural paint sample labeled "questioned paint from the victim's hair", is not consistent with item 1, the two layer orange architectural paint sample labeled "known paint sample representative of the damaged dining room wall". Item 3, the two layer orange architectural paint sample labeled "questioned paint from the knot of the trash bag", is consistent with item 1, the two layer orange architectural paint sample labeled "known paint sample representative of the damaged dining room wall".
RF8KLN	The paint samples Item 1 (Damaged dining room wall) and Item 3 (Knot of the trash bag) matched in appearance (texture), visual color (spectrophotometry) and chemical composition (both elemental and molecular). These samples could have shared a common origin. Differences were observed between the paint samples Item 1 (Damaged dining room wall) and Item 2 (Victim's hair) in appearance (texture), visual color (spectrophotometry) and chemical composition (both elemental and molecular). These samples are of different origins.
RJUBZZ	The orange paint in Item 3 was identical to the orange paint in Item 1 in color, type, texture, layer structure, and elemental composition. This means the paint recovered from the knot of the trash bag could have come from the damaged dining room wall. The orange paint in Item 2 was different from the orange paint in Item 1. This means the paint recovered from the victim's hair did not come from the damaged dining room wall.
RTAZLX	On analysis, I found: i) the questioned paint chips recovered from the knot of the trash bag

TABLE 3

WebCode	Conclusions
	(Item 3) to be similar to the paint sample representative of the damaged dining room wall (Item 1) in texture, layering, solubility properties and IR spectrum. I am of the opinion that the questioned paint chips in Item 3 could have come from the damaged dining room wall. ii) the questioned paint chip recovered from the victim's hair (Item 2) to be dissimilar to the known paint sample representative of the damaged dining room wall (Item 1) in texture, layering, solubility properties and IR spectrum. I am of the opinion that the questioned paint chip in Item 2 could not have come from the damaged dining room wall.
RVJY68	Item 2 (multi-layered paint chip recovered from the victim's hair) was found to be chemically different from Item 1 (known paint sample from the dining room wall) and did not originate from that source. Item 3 (multi-layered paint chips recovered from the knot of a trash bag) is the same distinct type of paint as that of item 1 (known paint sample from the dining room wall) and originated from either that source or from another source of paint having the same characteristics.
RWFEFJ	The paint fragments in Item #1 and Item #3 were alike with respect to their color, texture, layer structure, chemical solubilities, inorganic composition, and organic composition. It was concluded that Item #3 paint could have had a common origin with Item #1 or another source painted in the same manner. The paint fragments from Item #1 and Item #2 could not be associated due to differences in the orange layer of paint on each.
RXQCVL	The questioned paint recovered from the victim's hair (Item 002) did not originate from the damaged dining room wall represented by Item 001. The questioned paint recovered from the trash bag (Item 003) is the same distinct type of paint as the known paint on the damaged dining room wall (Item 001) and originated either from that wall or another source of architectural paint having the same distinct characteristics.
TK2W37	Samples 1 and 3 are indistinguishable using the tests employed. Samples 1 and 2 were distinguished by the tests employed.
TKFC6L	The paint chips (Item 1, Item 2 and Item 3) consist of 2 layers; orange and white layer. Top coat layer of the paint samples are similar in color and morphology. But the paint chip of item 2 is different with item 1 in component.
UCMGZN	Paint fragments recovered from the trash bag formed a two layer match with paint from the dining room wall. In my opinion, there is strong support for a proposition that the paint from the trash bag originated from the damaged area of the dining room wall. The paint fragment recovered from the victim's hair was different from the paint from the dining room wall and could not have originated from the sampled area of the wall.
UER3JU	Item 1-3 were examined chemically, microscopically and instrumentally using Fourier Transform Infrared Spectrometry and Scanning Electron Microscopy/ Energy Dispersive Spectroscopy. Items 1 and 3 were consistent with respect to measured properties including approximate layer thickness and sequence, chemical structure (absorbance spectra) and elemental profiles. Therefore items 1 and 3 may share a common source of origin. Item 2 was not consistent with item 1 with respect to all measured properties.
UFFEEU	Items 1, 2 and 3 each contained multi-layered paint chips consisting of an orange layer over a white layer. Items 2 and 3 questioned paints were compared to Item 1 known paint using microscopy, fluorescence, infrared spectroscopy (IR), microspectrophotometry and scanning electron microscopy/energy dispersive spectroscopy. Each layer of Item 1 was similar in all tests performed to the respective layer of Item 3. The known paint from Item 1 and the questioned paint from Item 3 could have originated from the same source (Level 3 Association). The orange layer in Item 1 was dissimilar to the orange layer in Item 2 in chemical composition by IR analysis. The known paint from Item 1 and the questioned paint from Item 2 did not originate from the same source (Elimination).

TABLE 3

WebCode	Conclusions
UQ3DBQ	Paint Examination and Comparison: Comparative examinations of the paint from Item #1 (dining room wall) and #2 (victim's hair) gave different microscopic, chemical and instrumental (Fourier Transform InfraRed, Gas Chromatography Pyrolysis) results, indicating that, in the opinion of this examiner, Items #1 and #2 do not have common origin. Comparative examinations of the paint from Item #1 (dining room wall) and #3 (knot of trash bag) gave indistinguishable microscopic, chemical and instrumental (Fourier Transform InfraRed, Gas Chromatography Pyrolysis) results, indicating that, in the opinion of this examiner, Items #1 and #3 could have common origin.
URK99K	The questioned paint chip from the victim's hair (Item 2) did not originate from the known paint sample from the damaged area of the dining room wall (Item 1). The questioned paint chips from the knot of the trash bag (Item 3) could have a common origin with the known paint sample from the damaged area of the dining room wall (Item 1).
UWWAB4	The paint chip from Item #1 is consistent with the paint chip from Item #3. The paint chip from Item #2 is not consistent with the paint chip from Item #1 or Item #3.
V3CJM6	Paint examinations were performed on the following: Item 1 Known paint sample representative of the damaged dining room wall. Item 2 Large questioned paint chip recovered from the victim's hair Item 3 Questioned paint chips recovered from the knot of the trash bag. Analysis Result: The paint chips of Item 1, 2 and 3 all consist of an orange paint layer on a white primer layer. The orange paint chip of Item 3 is similar in color, layer structure and chemical composition to the orange paint of Item 1. Therefore, the orange paint of Item 3 could have originated from the same source as the paint of Item 1. The orange paint of Item 2 has a different color and chemical composition than orange paint of Item 1. Therefore, the orange paint of Item 2 did not originate from the same source as the paint of Item 1. Analysis was performed using microscopy, Fourier transform infrared spectroscopy, microspectrophotometry and scanning electron microscopy with energy dispersive x-ray spectroscopy.
V8LLNF	The large questioned paint chip recovered from the victim's hair (Item 2) could not have originated from the damaged area of the dining room wall represented by Item 1. The questioned paint chip recovered from the knot of the trash bag (Item 3) could have originated from the damaged area of the dining room wall represented by Item 1.
VX2BHU	The dining room wall in the suspect's house (as represented by the paint in Item 1) cannot be eliminated as a source of the orange paint chips (Item 3) recovered from the knot of the trash bag. Either the orange paint chips came from the dining room wall in the suspect's house or from another source of paint that is indistinguishable in colour, microscopic[ic] appearance and chemical composition. Other sources of indistinguishable paint would include other items painted with the same manufacturer's formulation and colour. The dining room wall in the suspect's house (as represented by the paint in Item 1) can be eliminated as a source of the orange paint chip (Item 2) recovered from the victim's hair.
WBKJDX	1. The questioned paint chip recovered from the victim's hair (item 2) is different from the paint representative of the damaged dining room wall (item 1). 2. The questioned paint chip recovered from the knot of the trash bag (item 3) is the same as the paint representative of the damaged dining room wall (item 1).
WDD26Y	On analysis, I found that Item 3 was similar to Item 1. Hence, I am of the opinion that the questioned paint chip (Item 3) could have originated from the damaged area of the dining room wall as represented by Item 1.
WFZK4C	Item 1 consisted of one small orange colored cardboard square with the following two paint layers: orange/white. Item 2 consisted of one small orange colored cardboard square with the following two paint layers: orange/white. Analyses of the paint layers comprising Item 2

TABLE 3

WebCode	Conclusions
	revealed differences in physical characteristics and chemical properties upon comparison to the orange paint layer in Item 1. Accordingly, the source of Item 1 is excluded as a possible source of Item 2. Item 3 consisted of two very small orange colored cardboard squares each with the following two paint layers: orange/white. Analyses of the paint layers comprising Item 3 revealed similarities in physical characteristics and chemical properties upon comparison to the respective paint layers in Item 1. Accordingly, the source of Item 1 cannot be excluded as a possible source of Item 3.
WK89JY	Portions of the questioned paint chips recovered from the knot of the trash bag (Item 1-3) were examined microscopically and analyzed instrumentally and were found to be consistent in color, the sequence of layers, microscopic appearance, and instrumental properties with the examined portions of the known paint sample representative of the damaged dining room wall (Item 1-1). Accordingly, the paint chips from the knot of the trash bag could have originated from the damaged dining room wall (Item 1-1). A portion of the large questioned paint chip recovered from the victim's hair (Item 1-2) was examined microscopically and analyzed instrumentally and was found to be different in instrumental properties with the examined portions of the known paint sample representative of the damaged dining room wall (Item 1-1). Accordingly, the paint chip from the victim's hair could not have originated from the damaged dining room wall.
WQERUK	Item 2 is dissimilar in chemical composition to Item 1; therefore, Item 2 did not originate from the same source as represented by Item 1. Item 3 is similar in layer sequence and chemical composition to Item 1; therefore, these paints could have originated from the same source.
WVQRW4	All of the paint chips have an outer layer of orange paint and an inner layer of white paint. The orange paint layer of item 001-2 was noticeably different than the orange paint layers of items 001-1 and 001-3 based on the level of gloss. This difference was confirmed using infrared spectroscopy. Item 001-2 did not originate from the same source as item 001-1. No differences were observed in either the orange paint layer or white paint layer between item 001-1 and item 001-3. There is moderately strong support that item 001-3 could have originated from the same source as item 001-1.
X82D3H	The paint from the victim's hair, Item 2, exhibited physical characteristics different from the paint of the dining room wall, Item 1, and therefore could not have come from the wall. The paint from the trash bag, Item 3, exhibited the same physical characteristics as the paint from the dining room wall, Item 1, and therefore could have come from the wall.
XFCW3T	Conclusions: 1. The paint in Item 2 did not originate from the source of paint in Item 1. (See Remark 1.) 2. The paint in Item 3 originated either from the source of paint in Item 1 or from another source of paint indistinguishable in physical characteristics and chemical composition.
XG7M98	Examination of Exhibit 1 (known paint sample representative of the damaged dining room wall) disclosed the presence of a paint chip composed of a topcoat with orange paint and an undercoat of white paint. Comparative examinations of Exhibit 1 with Exhibit 3 (questioned paint chips recovered from the knot of the trash bag) disclosed them to be consistent in physical characteristics, organic compositions, and elemental compositions. Therefore, Exhibit 3 could have originated from the wall as represented by Exhibit 1. Comparative examinations of Exhibit 1 with Exhibit 2 (large questioned paint chip recovered from the victim's hair) disclosed them to be dissimilar in color and texture of the topcoat layer. Therefore, Exhibit 2 could not have originated from the wall as represented by Exhibit 1.
XJPTFG	The paint in Item 2 is dissimilar in color and chemical composition to the paint in Item 1; therefore, the paint in Item 2 did not originate from the same source as the paint in Item 1. The paint in Item 3 is similar in color and chemical composition to the paint in Item 1; therefore, the paint in Item 3 could have originated from the same source as the paint in Item 1.

TABLE 3

WebCode	Conclusions
XJTD76	Physical and chemical examinations indicate that Items 1 and 3 are indistinguishable from one another. Therefore, Item 3 originated from the same paint source as Item 1 or from another paint source that was manufactured and applied in the same manner (Level III Association - i.e., items are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. Because other items have been manufactured that would also be indistinguishable from the submitted evidence, an individual source cannot be determined.). This conclusion was reached because other paint produced at the same manufacturing plant, with the same specifications, and applied in the same manner would also be indistinguishable. Items 1 and 2 differ physically and chemically (Elimination - i.e., dissimilar in physical properties and/or chemical composition). Therefore, they do not share a common source.
XQ823T	(1) The known paint in Item 1 (from wall) was visually, microscopically and instrumentally consistent with the questioned paint in Item 3 (from trash bag). This indicates that the paint in Items 1 and 3 could share a common origin. (2) The questioned paint in Item 2 (from Victim's hair) was instrumentally different from the known paint in Item 1 (from wall). This indicates that the paint in Items 2 and 1 do not share a common origin.
XQRVPN	I formed the opinion based on the techniques used, that the foreign orange coloured paint recovered from the knot of the the[sic] trash bag (item 3) could have originated from the control orange coloured paint collected from the dining room wall (item 1). I also formed the opinion based on the techniques used, that the foreign orange coloured paint recovered from the victim's hair (item 2) could not have originated from the control orange coloured paint collected from the dining room wall (item 1).
XTHYDP	The paint chip recovered from the victim's hair (Item 2) was found to be different from the known paint sample representative of the damaged dining room wall (Item 1). In opposite to the Item 2, the paint chip recovered from the knot of the trash bag (Item 3) showed no differences to the known Item 1. The examined criteria were color of paint layers, fluorescence behavior, elemental composition (SEM/EDX) and chemical properties observed by infrared spectroscopy. Differences in Item 2 compared to Item 1 in the orange top layer were color (brighter orange), the fluorescence, the chemical properties (observed by infrared spectroscopy) and the elemental distribution (same elements, but different amount of Titanium). The second layer (white) properties were indistinguishable for all samples. The result admits the conclusion that the questioned paint chip from the knot of the trash bag (Item 3) could have originated from the damaged area of the dining room wall (Item 1).
XXQD4Z	Results of Laboratory Examination: The questioned paint in Item 3 corresponded in color and layer structure (orange top layer, white bottom layer), chemical solubility, microscopic characteristics (PLM), chemical composition (FTIR, PGC), elemental composition (SEM/EDS), and by visible light spectroscopy (MSP) to the known paint in Item 1. Therefore, Items 1 and 3 could have a common source (Type 3 Association). It should be noted that since similar items may have been manufactured that would be indistinguishable from the submitted evidence, an individual source cannot be determined. The question paint from Item 2, though visibly similar in color and layer structure (orange top layer, white bottom layer) and chemical solubility compared to the known paint in Item 1, displayed differences by chemical composition (FTIR, PGC), elemental composition (SEM/EDS) and by visible light spectroscopy (MSP). Therefore, the paint from Item 2 did not come from the same source where the known sample (Item 1) was collected (Elimination). Interpretation: The following descriptions are meant to provide context to the opinions reached in this report. Every type of conclusion may not be applicable in every case or for every material type. Type 1 Association: Identification - An association in which items share individual characteristics and/or physically fit together that demonstrate the items were once from the same source. Type 2 Association: Highly likely - An association in which items correspond in all measured physical properties, chemical composition and/or

TABLE 3

WebCode	Conclusions
	<p>microscopic characteristics and share distinctive characteristic(s) that would not be expected to be found in the population of this evidence type. The distinctive characteristics were not sufficient for a Type 1 Association. Type 3 Association: Could have - An association in which items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and could have originated from the same source. Because it is possible for another sample to be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Cannot eliminate - An association in which items correspond in some but possibly not all measured physical properties, chemical composition and/or microscopic characteristics and cannot be eliminated as coming from the same source. This type of evidence may be commonly encountered in the environment, may have limited comparative value and/or there may be factor(s) limiting the comparison. Inconclusive - No conclusion could be reached regarding an association between the items. Elimination: Items exhibit dissimilarities in one or more of the following: physical properties, chemical composition or microscopic characteristics and, therefore, conclusively did not originate from the same source. Non-Association: Items exhibit dissimilarities but certain details or features are not sufficient for an Elimination. KEY for instrument acronyms: FTIR – Fourier Transform Infrared Spectroscopy, PGC – Pyrolysis Gas Chromatography, PLM – Polarized Light Microscopy, MSP – Microspectrophotometry, SEM/EDS – Scanning Electron Microscopy/Energy Dispersive Spectroscopy.</p>
Y2P3V8	<p>The wall, as represented by item 1, is excluded as the source of the orange paint in item 2. The paint in item 3 could have originated from the same source as item 1, or from another source of a similar two-layer paint system.</p>
Y3Z26H	<p>Item 3 is similar in color, layer sequence, and chemical composition to Item 1, therefore Item 3 could have originated from the same source as Item 1. Item 2 is dissimilar in color to Item 1.</p>
YJAPLP	<p>The known paint sample (Item 1) and the questioned paint chips (Item 3) are each composed of two paint layers. Each of the two layers in the known paint sample (Item 1) cannot be distinguished from the corresponding layers in the questioned paint chips (Item 3). The questioned paint chips recovered from the knot of the trash bag (Item 3) could have come from the damaged area of the dining room wall (Item 1). The top layer in the questioned paint chip (Item 2) is distinguishable from the top layer in the known paint sample (Item 1). Therefore the large questioned paint chip recovered from the victim's hair (Item 2) could not have come from the damaged area of the dining room wall (Item 1).</p>
YNUYJ2	<p>Item 2, the two layer, orange paint sample labeled "questioned paint from the victim's hair", is not consistent with item 1, the two layer, orange paint sample labeled "known paint from the damaged dining room wall". Item 3, the two layer, orange paint sample labeled "questioned paint from the knot of the trash bag", is consistent with item 1, the two layer, orange paint sample labeled "known paint from the damaged dining room wall".</p>
YPXHNG	<p>Questioned paint chip of Item 2 exhibits different physical characteristics as known paint sample of Item 1, therefore they do not come from a common origin. Questioned paint chips of Item 3 exhibit similar physical and chemical characteristics as known paint sample of Item 1, which is consistent with a common origin.</p>
YYGZYB	<p>Items 1 and 2 are distinguishable in colors and chemical composition. It was concluded that the questioned paint chip (Item 2) could not have come from the damaged dining room wall (Item 1). Items 1 and 3 are indistinguishable in colors and chemical composition. It was concluded that the questioned paint chip (Item 3) could have come from the damaged dining room wall (Item 1).</p>
Z24ZQ4	<p>Examination of Items #1, 2 & 3 revealed the presence of orange paint chips with the following layer structure: orange & white. The paint chip recovered from the victim's hair (Item</p>

TABLE 3

WebCode	Conclusions
	<p>#2) was not consistent with the paint from the damaged dining room wall (Item #1). Therefore, the paint from Item #2 could not have originated from the same source as the paint from Item #1. The paint chip recovered from the knot of the trash bag (Item #3) was physically and chemically consistent with the paint from the damaged dining room wall (Item #1). Therefore, the paint from Item #3 could have originated from the same source as the paint from Item #1.</p>
Z8UAZ3	<p>Examination of Items #1, #2, and #3 revealed the presence of orange paint chips with the following layer structure: orange and white. The questioned paint chip recovered from the victim's hair, Item #2, is not physically or chemically consistent with the paint chip of the known paint sample from the damaged dining room wall, Item #1. Therefore, the paint chips in Item #2 did not originate from the same source as the paint chips in Item #1. The questioned paint chips from the knot of the trash bag, Item #3, are physically and chemically consistent with the paint chip of the known paint sample from the damaged dining room wall, Item #1. Therefore, the paint chips from Item #3 could have originated from the same source as the paint chips in Item #1.</p>
Z9HKYH	<p>The questioned paint chips, Item 3, may come from the damaged area of the dining room wall as represented by Item 1. The questioned paint chip, Item 2, was not originated from the damaged area of the dining room wall as represented by Item 1.</p>
ZP8ZT7	<p>The orange layer of Item 2 has a different color and chemical composition than the orange layer of Item 1. The chips from Item 1 and Item 2 did not come from the same source. Two chips of orange paint were found in Item 3. The examined chip from Item 3 is similar in color, layer structure, and chemical composition with the sample from Item 1. It is possible that the examined chips from Items 1 and 3 could have come from the same source.</p>

Additional Comments

TABLE 4

WebCode	Additional Comments
3E8FVL	Intermittent low levels of Iron were noted in the top (orange) layer of the control sample, that were not noted in the recovered sample. As the semi-quantitative level was less than 1 %, this was not considered significant.
7F2Y8V	Q1 = item 2 Q2a & Q2b = item 3 I suggest not using a cardboard substrate in the future. The white coat was absorbed by the cardboard, and when a cross section was taken, it almost appeared to have a third layer.
8QGF6K	"Item 1" to "Item 3" were each found to consist of two layers of paint - an outermost orange layer and an inner white layer. The orange layer of "Item 2" was found to be different from the orange layer of "Item 1" in terms of colour and chemical composition. The orange layers of "Item 1" and "Item 3" were found to be similar in terms of colour and chemical composition. The white layers of "Item 1" to "Item 3" were found to be similar in terms of colour and chemical composition.
AD89PY	The paints in Items 1 and 3 are similar in color, appearance, layer sequence and chemical composition. The paints in Items 1 and 2 are dissimilar in appearance & chemical composition.
BLTPME	An association scale would normally be included in the report.
D3RQ8Q	Substrate looked like paper, not like drywall.
K4KRN2	Chemical Analysis performed includes: Fourier Transform Infrared Spectroscopy, Microspectrophotometry, and Scanning Electron Microscopy.
K78KCP	Also included in the laboratory report would be the interpretation of the type association statements (Type I through V). Since there's not enough space to copy all the statements used by our laboratory, just the type of association used in the conclusion of the case will be copied below. Type III Association: An association in which items are consistent in all measured physical properties and/or chemical composition and, therefore, could have originated from the same source. Because other items have been manufactured that would also be indistinguishable from the submitted evidence, an individual source cannot be determined.
KMWNYK	Some differences were noted between the two pieces provided as Item #3.
NNV6JK	If there is a difference between items 1 and 3 it should be observed by a technique which aims at the pigments. That technique could be SEM-EDX.
Q2CRR9	Images were captured with a Canon G12 digital camera. Images are stored within the laboratory. Images were captured with a Diagnostics Instruments, Inc. SPOT Insight digital camera. Images are stored within the laboratory. A stereomicroscope was utilized in the general examination of evidence. A polarized light microscope is used to examine the optical properties of particulate matter, fibers, and other trace evidence. A comparison microscope with transmitted light and polarized light capabilities is used to compare the physical and optical characteristics of trace evidence materials side-by-side in the same optical field up to 600 times magnification. A Perkin Elmer Spectrum 100 infrared spectrometer (FTIR) with Spotlight 200 microscope accessory is used to analyze the chemical characteristics of materials. A CRAIC Technologies QDI 2010 microspectrophotometer (MSP) is used to measure the relative intensities of visible and UV light that is transmitted, reflected, or fluoresced by a sample. A variable extent of agreement or disagreement can exist between questioned samples and known standards upon comparison. Accordingly, the following terms are the reported results utilized to describe the degree of association or dissociation. Indistinguishable: The questioned sample is the same distinct type of material as the known standard based upon observed and measured physical properties and/or chemical composition. In other words, one could not discern a questioned sample if it were to be mixed with an indistinguishable known standard with respect to the analysis performed. Similar: The questioned sample is the same distinct type of material as

TABLE 4

WebCode	Additional Comments
	the known standard based upon a limited analysis. Alternatively, one or more variations existed between the questioned sample and the known standard due to the factors such as sample heterogeneity, contamination of the sample(s), or having a sample of insufficient size to adequately assess homogeneity of the entity from which it was derived. The reason(s) for limited analysis and/or explanation(s) for minor variations are specified in the report. Inconclusive: Situations when an inconclusive result may be reached include but are not limited to: an inadequate standard, samples do not exhibit sufficient distinguishing characteristics or a significant time lapse between standard collection and when the sample was deposited. The reason(s) for an inconclusive comparison result are specified in the report. Dissimilar: One or more characteristics suitable for comparison do not correspond with the standard.
Q6H867	This proficiency was used as a training tool on FTIR microscopy and fluorescence spectroscopy.
QLLK23	Remarks 1. The term 'source' refers to the specific area of the wall from which the paint was taken.
QTL63X	The chemical composition of both (Item 3) and (item 1) are similar, the physical properties of both items are also similar. The chemical composition and physical properties of (Item 2) are different from those of (Item 1).
TKFC6L	The paint chips of Item 3 could have come from the Item 1.
WQERUK	Dissimilarities were observed in the orange layer paint. White layers were similar for Items 1, 2, and 3.
WVQRW4	The conclusion scale is in our reports.
XFCW3T	Remark:1. The term "source" refers to the specific damaged area of the dining room wall from which the control paint sample, Item 1, was obtained. Commentary regarding Test No. 14-545 - Not part of the report: The substrate was not drywall. Instructions should have indicated "please ignore the cardboard substrate". Confusing and inaccurate! Alternatively, the paint in the samples could have been applied to actual pieces of drywall.
XG7M98	Glad to see paint used that varies from the norm that our lab sees; color, binder-filler.
XJTD76	An interpretation scale follows the page for the benefit of interested readers/subject matter experts. [Participant included an Interpretation Scale that cannot be reproduced here].
XQRVPN	FTIR - Differences observed in the orange layer between items 1 and 2. No differences observed in either the orange or white layers of items 1 and 3. Analysis of item 2 white layer deemed unnecessary due to the differences observed in the orange layers between items 1 and 2. SEM/EDX - imaging - item 2 orange layer contained small cylindrical, cage like structures thought to be diatoms (predominantly silicate – diatomaceous earth - Al and Ti known contaminants from clay particles often associated with diatomaceous earth). These structures were present only in orange layer of item 2, not present in item 1 or item 3. PyGC/MS - minor differences in organic polymer component of item 2. Significant peaks (repeatable) observed at approx. 13.4 (chloroaniline) and 17.1 mins (ester). These compounds were only detected in item 2 (unable to determine which layer as sample was analysed as conglomerate), not detected in item 1 or item 3.

Appendix: Data Sheet

Collaborative Testing Services ~ Forensic Testing Program

Test No. 14-545: Paint Analysis

DATA MUST BE RECEIVED BY June 02, 2014 TO BE INCLUDED IN THE REPORT

Participant Code:

WebCode:

Accreditation Release Statement

CTS submits external proficiency test data directly to ASCLD/LAB and ANSI-ASQ NAB/FQS. Please select one of the following statements to ensure your data is handled appropriately.

- This participant's data is intended for submission to ASCLD/LAB and/or ANSI-ASQ NAB/FQS. (Accreditation Release section on the last page must be completed and submitted.)
- This participant's data is NOT intended for submission to ASCLD/LAB or ANSI-ASQ NAB/FQS.

New Online Data Entry Feature!

Visit www.cts-portal.com to enter your proficiency test results online. If you have any questions please do not hesitate to contact CTS.

Scenario:

Police are investigating the homicide of a 32-year-old female. The victim's body was found in a trash bag on the side of the road. Orange paint chips were found in the knot of the trash bag as well as a large questioned chip tangled in the victim's hair near a possible blunt force trauma wound. The police investigation so far has led to a 45-year-old male suspect whose neighbor insists that he saw a woman resembling the victim enter the suspect's house on the night she was reported missing. A warranted search of the house revealed that the suspect's dining room appears to be the same color as the paint chips found on the victim, and a damaged area of the wall was discovered behind a painting. A known paint sample has been collected from the damaged area of the dining room wall. Police are requesting you to examine the recovered paint chips and determine if they could have originated from the damaged area of the suspect's dining room wall.

Please Note:

- Samples contained within each individual item are representative of a single source.
- The purpose of this test is the examination of the paint; please ignore the drywall substrate.

CTS will not reproduce Interpretation Scales, Scale of Conclusions or Terminology Keys in the final report, please do not submit with the participant's data sheet.

Items Submitted (Sample Pack P1):

- Item 1: Known paint sample representative of the damaged dining room wall.
- Item 2: Large questioned paint chip recovered from the victim's hair.
- Item 3: Questioned paint chips recovered from the knot of the trash bag.

1.) Could the questioned paint chips from either of the two sources (Items 2 or 3) have originated from the damaged area of the dining room wall as represented by Item 1?

- Item 2:** Yes No Inconclusive
- Item 3:** Yes No Inconclusive

Please return all pages of this data sheet.

Page 1 of 3

Participant Code:

WebCode:

2.) Indicate the procedure(s) used to examine the submitted items:

Microscopic Examinations:

- | | | |
|---|--|---|
| <input type="checkbox"/> Stereomicroscope | <input type="checkbox"/> Polarized Light | <input type="checkbox"/> Fluorescence |
| <input type="checkbox"/> Pyrolysis GC | <input type="checkbox"/> FTIR | <input type="checkbox"/> Solubility/Chemical |
| <input type="checkbox"/> XRS/XRF | <input type="checkbox"/> SEM/EDX | <input type="checkbox"/> Microspectrophotometry |
| <input type="checkbox"/> Other (specify): _____ | | |

3.) What would be the wording of the Conclusions in your report?

4.) Additional Comments

Return Instructions: Data must be received via online data entry, fax (please include a cover sheet), or mail by *June 02, 2014* to be included in the report.

QUESTIONS?

TEL: +1-571-434-1925 (8 am - 4:30 pm EST)
EMAIL: forensics@cts-interlab.com
www.ctsforensics.com

Participant Code:

ONLINE DATA ENTRY: www.cts-portal.com
FAX: +1-571-434-1937
or Toll-Free: 1-866-FAX-2CTS (329-2287)
MAIL: Collaborative Testing Services, Inc.
P.O. Box 650820
Sterling, VA 20165-0820 USA

Please return all pages of this data sheet.

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RELEASE OF DATA TO ACCREDITATION BODIES

The following Accreditation Releases will apply only to:

Participant Code:

WebCode:

for Test No. **14-545: Paint Analysis**

This release page must be completed and received by **June 2, 2014** to have this participant's submitted data included in the reports forwarded to the respective Accreditation Bodies.

ASCLD/LAB RELEASE

If your lab has been accredited by ASCLD/LAB and you are submitting this data as part of their external proficiency test requirements, have the laboratory's designated individual complete the following.

The information below must be completed in its entirety for the results to be submitted to ASCLD/LAB.

ASCLD/LAB Legacy Certificate No. _____ ASCLD/LAB International Certificate No. _____

Signature _____ Date _____

Laboratory Name _____

Location (City/State) _____

ANSI-ASQ NAB/FQS RELEASE

If your laboratory maintains its accreditation through ANSI-ASQ NAB/FQS, please complete the following form in its entirety to have your results forwarded.

ANSI-ASQ NAB/FQS Certificate No. _____

Signature and Title: _____ Date _____

Laboratory Name _____

Location (City/State) _____

Accreditation Release

Return Instructions

Please submit the completed Accreditation Release at the same time as your full data sheet. See Data Sheet Return Instructions on the previous page.

*Questions? Contact us 8 am-4:30 pm EST
Telephone: +1-571-434-1925
email: forensics@cts-interlab.com*

Please return all pages of this data sheet.

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