



Paint Analysis

Test No. 24-5451 Summary Report

Each sample set contained a known paint sample and two sets of questioned paint chips. Participants were asked to examine these items using their existing protocols. Data were returned from 69 participants 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 contained one piece of painted poplar wood (Item 1) and two sets of questioned painted poplar wood pieces (Items 2 and 3). Participants were asked to examine the questioned samples and determine if either could have originated from the known paint sample.

SAMPLE PREPARATION: The poplar wood planks used for this test were inspected for defects, and the areas containing defects were not used. Each paint layer was set to dry before the next was applied. Once dried, all wood planks were then separately cut into individual 1" x 2.5" pieces.

ITEMS 1 and 3 (ASSOCIATION): For the known Item 1, one 1" x 2.5" painted wood piece was deposited into a glassine bag and then placed into a pre-labeled envelope and sealed. For the questioned Item 3, one painted wood piece was scored into approximately ¼" x ¼" wide pieces, two ¼" x ¼" pieces were deposited into a glassine bag, and then placed into a pre-labeled envelope and sealed. Items 1 and 3 painted wood pieces were taken within a four-inch spatial proximity and kept together as matching batches.

ITEM 2 (ELIMINATION): For the questioned Item 2, one painted wood piece was scored into approximately ¼" x ¼" wide pieces, two ¼" x ¼" pieces were deposited into a glassine bag, and then placed into a pre-labeled envelope and sealed.

SAMPLE SET ASSEMBLY: For each sample set, Items 1, 2, and 3 were placed into a pre-labeled envelope and sealed. This process was repeated until all of the sample sets were prepared.

VERIFICATION: Predistribution results were consistent with each other and the manufacturer's preparation information. The following procedures were used to examine the items: Stereomicroscopy, Polarized Light Microscopy, High Power Microscopy, FTIR, SEM/EDX, XRS/XRF, Pyrolysis GC/MS, and Solubility/Chemical.

Item	Substrate	Primer	Color Coat
1	Poplar Wood	Behr® Acrylic-Alkyd water-based	Behr Premium Plus® Interior Eggshell - Blue
2	Poplar Wood	Behr® Acrylic-Alkyd water-based	Glidden® Premium Interior Eggshell - Blue
3	Poplar Wood	Behr® Acrylic-Alkyd water-based	Behr Premium Plus® Interior Eggshell - Blue

Summary Comments

This test was designed to allow participants to assess their proficiency in the examination, comparison, and interpretation of multi-layered architectural paint samples. Each sample set contained one known paint sample (Item 1) and two sets of questioned paint chips (Items 2 and 3), which were cut from painted poplar wood plank substrates. Items 1 and 3 originated from the same poplar wood plank. Item 2 originated from a second poplar wood plank prepared with a different color coat. Refer to the Manufacturer's Information for preparation details.

All 69 reporting participants eliminated Item 2 and identified Item 3 as having originated from the Item 1 known paint sample.

The most commonly reported examination procedures included: Stereomicroscopy (100%), FTIR (99%), and SEM/EDX (61%).

Examination Results

Could either of the questioned paint chips recovered from the suspect (Item 2 and Item 3) have originated from the damaged area of the entrance door (Item 1)?

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
2VXH4A	No	Yes	EWEHCC	No	Yes
2WMZVA	No	Yes	EWYXRE	No	Yes
3CYKG9	No	Yes	F6RQDE	No	Yes
3FBLBQ	No	Yes	GJCEEP	No	Yes
3FUPJQ	No	Yes	GUNVU9	No	Yes
3FYVD9	No	Yes	GZW6EN	No	Yes
3KAX8Q	No	Yes	HQPMFQ	No	Yes
4AWJ9T	No	Yes	J4BG8B	No	Yes
4D7JQ8	No	Yes	KGTTWP	No	Yes
4PVCBN	No	Yes	KLJ47N	No	Yes
62RLL4	No	Yes	KRQN28	No	Yes
7TBLE7	No	Yes	LA7ZKP	No	Yes
7YEP3J	No	Yes	LH4VHN	No	Yes
92RAZH	No	Yes	LMBJVP	No	Yes
AWDQH2	No	Yes	NJLWDM	No	Yes
AWZ9NV	No	Yes	NXKRJ2	No	Yes
BAFKMJ	No	Yes	P7UL4L	No	Yes
BFREU2	No	Yes	QH4LDK	No	Yes
BMP73V	No	Yes	QUCJ62	No	Yes
BXQKWF	No	Yes	R2YEYH	No	Yes
CF2YQF	No	Yes	RPDJ9G	No	Yes
CGYBGG	No	Yes	T4DKKH	No	Yes
CTQVTE	No	Yes	TKXCKH	No	Yes
D8N9VG	No	Yes	U47XJV	No	Yes
DW9LJU	No	Yes	U7BJ9G	No	Yes
E2UPZC	No	Yes	UPU78B	No	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
V7W34F	No	Yes			
V9WMGD	No	Yes			
VDB6YV	No	Yes			
VE7RHE	No	Yes			
VH8P3E	No	Yes			
VWMXTA	No	Yes			
WLYFLV	No	Yes			
WRBATD	No	Yes			
X33ATV	No	Yes			
XCCM2C	No	Yes			
XGLZLV	No	Yes			
XMBKPC	No	Yes			
YCA7ED	No	Yes			
YPCYJV	No	Yes			
YXM26V	No	Yes			
YY42ED	No	Yes			
ZKKX89	No	Yes			

Examination Response Summary			Participants: 69
<i>Could either of the questioned paint chips recovered from the suspect (Item 2 and Item 3) have originated from the damaged area of the entrance door (Item 1)?</i>			
	<u>Item 2</u>	<u>Item 3</u>	
Yes:	0 (0%)	69 (100%)	
No:	69 (100%)	0 (0%)	
Inc:	0 (0%)	0 (0%)	

Examination Procedures

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
2VXH4A	✓	✓			✓	✓	✓			
2WMZVA	✓				✓					
3CYKG9	✓		✓		✓	✓		✓		
3FBLBQ	✓				✓					
3FUPJQ	✓				✓					
3FYVD9	✓		✓		✓	✓			✓	
3KAX8Q	✓	✓	✓		✓				✓	
4AWJ9T	✓				✓		✓	✓		
4D7JQ8	✓				✓	✓			✓	
4PVCBN	✓				✓		✓			
62RLL4	✓				✓				✓	
7TBLE7	✓				✓					
7YEP3J	✓				✓		✓			RAMAN
92RAZH	✓				✓				✓	
AWDQH2	✓	✓	✓		✓					Raman 514nm, 633nm, 785nm
AWZ9NV	✓		✓	✓	✓		✓			
BAFKMJ	✓				✓	✓				
BFREU2	✓	✓	✓		✓	✓		✓		
BMP73V	✓				✓				✓	
BXQKWF	✓	✓			✓					

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
CF2YQF	✓		✓	✓						
CGYBGG	✓	✓	✓		✓		✓	✓		
CTQVTE	✓	✓			✓	✓		✓		Pyrolysis GC/MS
D8N9VG	✓	✓	✓		✓		✓	✓		
DW9LJU	✓	✓		✓	✓				✓	
E2UPZC	✓				✓			✓		
EWEHCC	✓			✓	✓					
EWYXRE	✓	✓	✓		✓					
F6RQDE	✓			✓	✓		✓			
GJCEEP	✓			✓	✓				✓	
GUNVU9	✓			✓	✓	✓			✓	
GZW6EN	✓				✓				✓	
HQPMFQ	✓				✓		✓	✓		Pyrolysis GC/MS
J4BG8B	✓	✓	✓		✓		✓	✓		
KGTTWP	✓		✓		✓	✓			✓	
KLJ47N	✓	✓		✓	✓				✓	
KRQN28	✓				✓				✓	
LA7ZKP	✓	✓	✓		✓		✓	✓		
LH4VHN	✓	✓		✓	✓				✓	
LMBJVP	✓				✓					
NJLWDM	✓				✓					UV

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
NXKRJ2	✓	✓	✓		✓					RAMAN
P7UL4L	✓	✓		✓	✓		✓	✓	✓	
QH4LDK	✓				✓	✓			✓	
QUCJ62	✓	✓			✓				✓	
R2YEYH	✓	✓	✓	✓	✓		✓		✓	Raman
RPDJ9G	✓				✓	✓				
T4DKKH	✓	✓			✓		✓		✓	
TKXCKH	✓			✓	✓					
U47XJV	✓				✓				✓	Raman spectroscopy
U7BJ9G	✓				✓					
UPU78B	✓				✓					
V7W34F	✓		✓		✓	✓			✓	
V9WMGD	✓				✓				✓	Raman; PyGC/MS
VDB6YV	✓	✓		✓	✓				✓	
VE7RHE	✓	✓			✓				✓	Alternate Light Source
VH8P3E	✓	✓			✓					
VWMXTA	✓				✓		✓		✓	
WLYFLV	✓				✓					
WRBATD	✓				✓			✓		
X33ATV	✓									Laser Induced Breakdown Spectroscopy (LIBS) and Projectina Comparison Microscope

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
XCCM2C	✓				✓			✓		
XGLZLV	✓	✓			✓			✓		
XMBKPC	✓	✓	✓		✓	✓		✓		
YCA7ED	✓				✓					
YPCYJV	✓				✓	✓		✓		
YXM26V	✓				✓			✓		
YY42ED	✓				✓	✓				High power microscopy
ZKKX89	✓		✓		✓	✓		✓		

Response Summary										Participants: 69
	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	Microspectrophotometry	XRF/XRS	SEM/EDX	
Total	69	23	16	15	68	11	15	6	42	
Percent	100%	33%	23%	22%	99%	16%	22%	9%	61%	

Conclusions

TABLE 3

WebCode	Conclusions
2VXH4A	Item 2 did not originate from the same source as Item 1. Item 3 originated from the same source as Item 1 or a source with similar characteristics.
2WMZVA	Item 3 and Item 1 match based on FTIR analysis, and therefore could have been originated from the same source.
3CYKG9	The following methodologies were used in the examination of this case: visual examination, microscopy, solubility and chemical tests, fluorescence, FTIR, and SEM-EDX. The known paint sample representative of the damaged area of the entrance door, Item 1, revealed the presence of a piece of wood painted light blue with the following layer structure: Light blue, White. The questioned paint chips recovered from the suspect, Item 2, revealed the presence of two small pieces of wood painted light blue with the following layer structure: Light blue, White. The questioned paint chips recovered from the suspect, Item 3, revealed the presence of two small pieces of wood painted light blue with the following layer structure: Light blue, White. The light blue paint recovered from the suspect, Item 2, was not consistent with the light blue paint from the damaged area of the entrance door, Item 1. Therefore, the light blue paint from Item 2 did not originate from the same source as the light blue paint from Item 1. The light blue paint recovered from the suspect, Item 3, was consistent in color and composition with the light blue paint from the damaged area of the entrance door, Item 1. Therefore, the light blue paint from Item 3 could have originated from the same source as the light blue paint from Item 1.
3FBLBQ	Item 2 The spectrum produced by the blue topcoat from Item 2 did not match the spectrum of the blue topcoat from Item 1. there was a change in both the resin and the pigmentation. Item 3 Both the topcoat and the primer spectra were consistent with the topcoat and the primer spectra produced by Item 1.
3FUPJQ	All of three items are wood chips covered by sky-blue color paint. Sky-blue paint from Item 3 showed similar IR spectral features with Item 1, but Item 2 was not. Therefore, only Item 3 would be originated from Item 1.
3FYVD9	The following methodologies were used in the examination of this case: visual examination, microscopy, solubility and chemical tests, fluorescence, FTIR, and SEM-EDX. KNOWN STANDARDS: Examination of Item 1 revealed the presence of one rectangular piece of wood with blue paint on one side. The blue paint had the following layer structure: blue, white. QUESTIONED SAMPLES: Examination of Item 2 revealed the presence of blue paint chips with the following layer structure: blue, white. Each paint chip was on a wood substrate. The questioned paint chips recovered from the suspect (Item 2), were not consistent with the known paint sample representative of the damaged area of the entrance door (Item 1). Therefore, the paint in Item 2 did not originate from the same source as the paint in Item 1. Examination of Item 3 revealed the presence of blue paint chips with the following layer structure: blue, white. Each paint chip was on a wood substrate. The questioned paint chips recovered from the suspect (Item 3) were physically and chemically consistent with the known paint sample representative of the damaged area of the entrance door (Item 1). Therefore, the paint from Item 3 could have originated from the same source as the paint in Item 1.
3KAX8Q	The paint from questioned paint chips, item 2, could not have originated from the damaged area of the entrance door, item 1. The paint from questioned paint chips, item 3, could have originated from the damaged area of the entrance door, item 1.
4AWJ9T	One of the Q1 questioned paint samples (designated as Q1a) was instrumentally analyzed and compared to the known paint K1. Questioned paint Q1a and the known paint K1 are

TABLE 3

WebCode	Conclusions
	<p>consistent with respect to their color, texture and layer structure; however, Q1a and K1 are different with respect to chemical type for layer 1. It is the opinion of the undersigned that questioned paint Q1a could not have originated from the same source as represented by the known paint K1 submitted. One of the Q2 questioned paint samples (designated as Q2a) was instrumentally analyzed and compared to the known paint K1. Questioned paint Q2a and the known paint K1 are consistent and no exclusionary differences were observed with respect to their color, texture, layer structure, chemical type, and elemental composition. It is the opinion of the undersigned that questioned paint Q2a could have originated from the same source as represented by the known submitted exemplar K1 or from another source exhibiting all of the same analyzed characteristics. The remaining paint samples from Q1 and Q2 were designated as Q1b and Q2b. No further analysis was performed on these paint samples.</p>
4D7JQ8	<p>The following methodologies were used in the examination of this case: visual examination, microscopy, solubility and chemical tests, FTIR, and SEM-EDX. Examination of Lab Item #1 revealed the presence of one large textured blue paint chip with the following layer structure: blue and white on a wood substrate. Examination of Lab Items #2 and #3 each revealed the presence of two small textured blue paint chips with the following layer structure: blue and white on a wood substrate. The paint chips recovered from the suspect (Item #3) were physically and chemically consistent with the paint from the damaged area of the entrance door (Item #1). Therefore, the paint from Item #3 could have originated from the same source as the paint from Item #1. The paint chips recovered from the suspect (Item #2) were not consistent with the paint from the damaged area of the entrance door (Item #1). Therefore, the paint from Item #2 did not originate from the same source as the paint from Item #1.</p>
4PVCBN	<p>Item 1 (known paint sample representative of the damaged area of the entrance door): This paint chip consists of 2 paint layers, light blue and white on a wooden substrate. Item 2 (questioned paint chips recovered from the suspect): These paint chips consist of 2 paint layers, light blue and white on a wooden substrate. No visible differences could be determined visually comparing each layer with the paint chip of sample 1. Item 3 (questioned paint chips recovered from the suspect): These paint chips consist of 2 paint layers, light blue and white on a wooden substrate. No visible differences could be determined visually comparing each layer with the paint chip of sample 1. The color of all light blue samples is RAL 5024 pastel blue, there is no difference in the color. The paint chips in question recovered from the suspect (Item 3) could probably have originated from the same source as the damaged area of the entrance door represented by Item 1. The paint chips in question recovered from the suspect (Item 2) could definitely not have originated from the same source as the damaged area of the entrance door represented by Item 1.</p>
62RLL4	<p>Items 1, 2, and 3 are two layer architectural paint consisting of a blue color coat and a white primer. The blue paint chips from Item 3 are similar in color, physical characteristics, and chemistry to the known paint sample from Item 1. The blue paint from Item 3 could share the same source of paint as Item 1 or any other blue paint source that is similar in color, physical characteristics, and chemistry. Item 2 is not similar in physical characteristics or chemistry to the known paint sample from Item 1. Item 2 could not have come from the same source of paint as Item 1. Items 1, 2, and 3 were examined visually and using stereomicroscopy, Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy – Energy Dispersive Spectroscopy (SEM-EDS). Samples collected and analyzed during examination and analysis of the items in this case were returned to and retained with the original item (carbon tabs).</p>
7TBLE7	<p>Item 1 and Item 2 have no common origin. Item 1 and Item 3 may have a common origin.</p>
7YEP3J	<p>All three items of this test have been analysed to answer the police question. The Item 1 contains a known paint sample representative of the damaged area of the local business</p>

TABLE 3

WebCode	Conclusions
	<p>entrance door. We observe two layers on this paint chip (a blue solid basecoat on top of a white primer). The Item 2 and Item 3 contain paint chips recovered from a suspect. We observe two layers on each of these paint chips (a blue solid basecoat on top of a white primer). Our observations and analysis show that - The IR spectrum of the Item 2 blue basecoat is different from the IR spectrum of the - Item 1 blue basecoat; - By three analytical techniques prescribed by our method (IR, RAMAN, XRF), there are no significant difference between spectra of the Item 3 layers and spectra of the Item 1 layers. Hence, the paint chips contained in Item 2 and Item 1 have different origins. Whereas, it is likely that the paint chips contained in Item 3 and Item 1 have a common origin. The results of our observations and analysis show that - The paint chip recovered from the suspect (Item 2) doesn't come from the damaged area of the local business entrance door (Item 1); - The paint chip recovered from the suspect (Item3) is likely to come from the damaged area of the entrance (Item 1).</p>
92RAZH	<p>The known paint sample (Item 1) as well as the questioned paint samples (Item 2 and Item 3) show a light blue top paint layer and a white paint layer. All samples cannot be differentiated by means of microscopy, but the blue layer of Item 2 can be differentiated by means of infrared spectroscopy. Regarding to the methods used, the questioned paint chips from the suspect (Item 3) could have originated from the damaged area of the entrance door (Item 1).</p>
AWDQH2	<p>the white colors of items 1, 2 and 3 could not be distinguished from each other using microscopy, FT-IR, resp. Raman. - the blue color of Item 2 can be distinguished from the blue colors of Item 1 and Item 3 based on microscopy (structure of the surface, UV fluorescence) and the infrared spectra. - the blue colors of items1 and Item3 could not be distinguished from each other using microscopy (esp. structure of the surface, UV fluorescence), FT-IR, resp. Raman Because Item1 is a representative of the damaged area of the entrance door, - the paint chip Item2 (recovered from the suspect) cannot have originated from the damaged area of the entrance door (Item1) - the paint chip Item3 (recovered from the suspect) could have originated from the damaged area of the entrance door (Item1)</p>
AWZ9NV	<p>I have considered the following propositions to evaluate my findings: 1. Paint samples recovered from an alleged suspect originated from the damaged area of the entrance door. 2. Paint samples recovered from an alleged suspect originated from another source and were present due to chance. In relation to questioned Item 3, I consider the findings to be more probable if the first proposition is true, that is, Item 3 originated from the damaged area of the entrance door rather than the second that the paint chips were present by chance. In relation to questioned Item 2, I consider the findings to be more probable if the second proposition is true, that is, Item 1 originated from an unrelated source and is present due to chance. Based on the results, it is my opinion that the findings provide moderately strong support for the proposition that Item 3 originated from Item 1. Item 2 could not have originated from Item 1 based on different chemical compositions.</p>
BAFKMJ	<p>Item 3 could be originated from Item 1, while Item 2 is significantly distinguished from Item 1</p>
BFREU2	<p>Items 1, 2, and 3 are two layered paint samples with a blue topcoat and white basecoat. Item 3 is similar in layer structure, color, and chemical composition to Item 1. Therefore, Item 3 could have originated from the same source as Item 1. Item 2 is not similar in chemical composition to Item 1. Therefore, Items 1 and 2 could have not originated from the same source.</p>
BMP73V	<p>Item 1 - Known paint sample representative of the damaged area of the entrance door - contained a section of wood (approximately 7cm by 3cm) painted blue. Item 2 - Questioned paint chips recovered from the suspect - contained two small sections of wood (approximately 0.5cm by 0.5cm) painted blue. Item 3 - Questioned paint chips recovered from the suspect - contained two small sections of wood (approximately 0.5cm by 0.5cm) painted blue. The blue</p>

TABLE 3

WebCode	Conclusions
	<p>Painted wood from the entrance door (item 1) was found to have two paint layers, comprised of a blue top layer and a white second layer. The questioned paint chips from the suspect (item 2) were found to have two paint layers, comprised of a blue top layer and a white second layer. The blue top layer was found to have a different chemical composition to the blue top layer from the entrance door (item 1). Therefore these two paint samples could not share a common origin. The questioned paint chips from the suspect (item 3) were found to have two paint layers, comprised of a blue top layer and a white second layer. In relation to layer sequence, colour, chemical composition and elemental composition the two paint layers from the questioned paint chips (item 3) were found to be indistinguishable from the paint from the entrance door (item 1). Therefore these two paint samples may share a common origin.</p>
BXQKWF	<p>All of the submitted paint from items 1, 2, and 3 was visually examined. The paint from Item 1 was examined and compared to 1 exhibit from item 2 and 1 exhibit from item 3 using polarized light microscopy, visible microscopy and fourier transform infrared spectroscopy (FTIR). The examined paint from items 1, 2, and 3 were found to each consist of 2 layers: blue and white. The 2 layers of items 3 and item 1 are consistent in appearance, microscopic and chemical properties. Thus, item 3 could have originated from item 1 as represented by the examined samples in items 1 and 3 or another paint source exhibiting the same analyzed characteristics. There are discriminating differences in the physical properties and the FTIR results of the blue layer of item 2 and item 1. Thus, item 2 could not have originated from item 1 as analyzed. No further analysis was performed on the remaining samples from items 2 and 3. Therefore, no conclusion can be reached on these samples.</p>
CF2YQF	<p>The paint chips in Item 1 and 3 were consistent in colors and chemical compositions. Based upon the results, it was concluded that the paint chips in Item 1 and 3 could have originated from the same source.</p>
CGYBGG	<p>Information: The submitted questioned paint chips, reportedly recovered from a suspect (Items 2 and 3) were examined and compared to known paint, reportedly representative of a damaged area of a door (Item 1). All three items had a layering structure of light blue over white. Samples of each layer on each item were analyzed using a combination of the following methods: polarized light microscopy, fluorescence, infrared spectroscopy, microspectrophotometry, and scanning electron microscopy-energy dispersive spectroscopy. Results: The analyzed samples of Item 3 and Item 1 layers were similar in all examinations performed. Item 3 originated either from the damaged area of the door as represented by Item 1 or from another indistinguishable source (Level 3 - Association). The analyzed samples of Item 2 and Item 1 light blue layers were dissimilar in chemistry. Item 2 did not originate from the damaged area of the door as represented by Item 1 (Elimination). Additional Information: The analyzed samples of the white layer of Items 1, 2, and 3 were similar in all examinations performed. Please submit additional samples of the door paint for comparison to Item 2.</p>
CTQVTE	<p>The paint in Item 2 is similar in color and layer sequence but dissimilar in chemical composition to 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. The paint in Item 3 is similar in color, layer sequence, 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.</p>
D8N9VG	<p>Examinations: Visual examination, stereomicroscopy, fluorescence microscopy, polarized light microscopy, infrared spectroscopy, scanning electron microscopy - energy dispersive spectroscopy, microspectrophotometry Information: Questioned paint samples recovered from a suspect (Items 2 and 3) were examined and compared to known paint reportedly collected from the damaged area of an entrance door (Item 1) to determine if either questioned paint sample could have originated from the door. The layering structure of each submitted paint sample was blue paint over white paint. Results: Items 1 and 2 differed in the chemistry of the</p>

TABLE 3

WebCode	Conclusions
	blue layer of paint. In the opinion of the examiner, Item 2 did not originate from the door as represented by Item 1. (Elimination) Each paint layer of Item 3 corresponded to the respective paint layer of Item 1 in all examinations performed. In the opinion of the examiner, the questioned paint of Item 3 originated either from the door as represented by Item 1 or from another paint source with indistinguishable properties. (Level 3 - Association)
DW9LJU	1. Exhibit 2 (questioned paint from the suspect) and Exhibit 3 (questioned paint from the suspect) were submitted for examination and comparison with Exhibit 1 (known paint from the damaged area of the door). Exhibit 1 consists of a light blue finish coat over a white primer, typical of architectural paint. 2. Comparative examinations of Exhibit 3 with Exhibit 1 disclosed them to be consistent in their physical characteristics, organic compositions, and elemental compositions. As a result of these findings, Exhibit 3 could have originated from Exhibit 1, or another source with the same characteristics. A paint association is not a means of positive identification and the number of possible sources for a specific paint is unknown. 3. Comparative examinations of Exhibit 2 with Exhibit 1 disclosed them to be inconsistent in the chemical composition of layer 1. As a result of these findings, Exhibit 2 could not have originated from Exhibit 1.
E2UPZC	Item 1, identified as paint from the door frame, is a blue top coat over a white base coat. The blue top coat is composed of an acrylate material with inorganic inclusion materials including sodium aluminum silicates, potassium aluminum silicates, and likely titania. The white base coat is composed of a styrene/acrylic copolymer and inorganic inclusion materials including calcium carbonate, sodium aluminum silicates, potassium aluminum silicates, and likely titania. Item 2 from the suspect also features a blue top coat over a white base coat. However, the blue top coat is composed of a poly(vinyl acetate) with additional unsaturated hydrocarbon such as ethylene with inorganic inclusion materials including aluminum silicates and likely titania. The white base coat is composed of a styrene/acrylic copolymer and inorganic inclusion materials including calcium carbonate, sodium aluminum silicates, potassium aluminum silicates, and likely titania. The blue top coat organic material is inconsistent with the blue top coat organic material from the door frame. Therefore, Item 1 is excluded as a possible source of Item 2. Item 2 cannot have originated from the damaged door frame. Item 3 from the suspect also features a blue top coat over a white base coat. The blue top coat is composed of an acrylate material with inorganic inclusion materials including sodium aluminum silicates, potassium aluminum silicates, and likely titania. The white base coat is composed of a styrene/acrylic copolymer and inorganic inclusion materials including calcium carbonate, sodium aluminum silicates, potassium aluminum silicates, and likely titania. While the distribution and composition of inclusions vary between Item 3 and Item 1, they are grossly similar, and given the heterogeneity expected for the distribution of such inclusions, the inclusions alone cannot be used as grounds for exclusion or Item 1 as a possible source for Item 3. The organic materials for both the blue top coat and the white base coat of Item 3 are consistent with the corresponding layers of Item 1. Therefore, Item 1 cannot be excluded as a possible source for item 3. Item 3 may have originated from the damaged door frame.
EWEHCC	The questioned paint chips recovered from the suspect (item 3) and the known paint sample representative of the damaged area of the victim's entrance door (item 1) were consistent on color, layering and chemical composition and could have originated from the same source. The questioned paint chip recovered from the suspect (item 2) and the known paint sample (item 1) were inconsistent on chemical composition. The item 2 could not have originated from the same source as represented by the item 1.
EWYXRE	When comparing item 1 and item 2, different reactions were found in the fluorescence; no differences were found during the other optical exams. When comparing item 1 and item 3, it was found that the surfaces are rather uneven; no differences could be detected during all

TABLE 3

WebCode	Conclusions
	performed examinations. Based on these findings, item 2 can be distinguished from item 1, item 3 cannot be distinguished from item 1.
F6RQDE	All item are consisted with blue-top and white-bottom layer. FT-IR shows that white layers of each item are same. Microspectrophotometry shows blue layers of each item are same. FT-IR and Pyrolysis GC-MS shows that blue layers from item 1 and item 3 are same. But blue layer of item 1 and item 2 are different.
GJCEEP	I formed the opinion based on the techniques used, that the paint chips recovered from the suspect (item 3) had the same appearance, chemical composition and elemental composition as the control paint (item 1) recovered from the damaged entrance door and could have originated from it. I also formed the opinion based on the techniques used, that the paint chips recovered from the suspect (item 2) had a different appearance and chemical composition as the control paint (item 1) recovered from the damaged entrance door and could not have originated from it.
GUNVU9	The paint in Item 2 is similar in color and layer sequence to the paint in Item 1 and dissimilar in chemical composition to the paint in Item 1. 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, layer sequence and chemical composition to the paint in Item 1. The paint in Item 3 could have originated from the same source as the paint in Item 1.
GZW6EN	Examination of the known paint sample representative of the damage area of the entrance door (Item 1) Item 1 comprised a paint sample with the layer sequence: blue topcoat/white undercoat. The blue layer comprised an acrylic-type paint. The inorganic elemental composition of the blue layer principally comprised titanium, silicon, aluminium, sodium and potassium. The white layer comprised a styrene-modified acrylic-type paint. The inorganic elemental composition of the white layer principally comprised titanium, calcium, silicon, aluminium, potassium and sodium. Examination of the questioned paint chips recovered from the suspect (Item 2) Item 2 comprised a paint sample with the layer sequence: blue topcoat/white undercoat. The blue layer comprised a polyvinyl acetate-type paint containing kaolinite. The inorganic elemental composition of the blue layer principally comprised titanium, silicon, and aluminium. The composition of the blue top from Item 2 did not correspond with that of Item 1. Therefore, the results do not support the proposition that the paint recovered from the suspect (Item 2) originated from the damaged area of the victim's entrance door. Examination of the questioned paint chips recovered the suspect (Item 3) Item 3 comprised a paint sample with the layer sequence: blue topcoat/white undercoat. The layer sequence, appearance and composition of Item 3 corresponded with Item 1. Therefore, these results support the proposition that the paint recovered from the suspect (Item 3) originated from the damaged area of the entrance door (Item 1).
HQPMFQ	Light blue paint in Item 3 was indistinguishable from light blue paint in Item 1 in color, type, layer structure, and elemental composition (Type 2 Association). This means that the questioned paint chips recovered from the suspect could have originated from the damaged area of the entrance door. Light blue paint in Item 2 was different from light blue paint in Item 1 (Elimination). This means that the questioned paint chips recovered from the suspect did not originate from the damaged area of the entrance door. Trace Interpretation Scale Type 1 Association: Physical Fit—The compared items exhibit physical features that demonstrate they were once part of the same object. Type 2 Association: Association with Distinctive characteristics—Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. The items further share distinctive characteristics that would not be typically encountered in the relevant population. Type 3 Association: Association with Conventional characteristics—Items are consistent in all measured and observed physical

TABLE 3

WebCode	Conclusions
	<p>properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. Because other items have been manufactured or are naturally occurring that would also be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Association with limited characteristics and/or examination (1) Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. This type of evidence may be commonly encountered in the environment or may have limited comparative value. Or (2) The comparison between items may be categorized as a Type 4 Association if the association is limited by the inability to perform a complete analysis or if minor variations are observed in the examination results. Inconclusive—No conclusion could be reached regarding an association or an elimination between the items. Elimination—Items exhibit differences in one or more of the following: physical properties, chemical composition, or microscopic characteristics and therefore did not originate from the same source. Non-Association—The items were different in physical properties, chemical composition, and/or microscopic characteristics, indicating that the items did not originate from the same source. However, these differences were insufficient for a definitive elimination.</p>
J4BG8B	<p>Examinations: Visual examination, stereomicroscopy, polarized light microscopy, fluorescence microscopy, infrared spectroscopy (IR), microspectrophotometry, scanning electron microscopy - energy dispersive spectroscopy (SEM-EDS) Information: The known two-layer paint sample (Item 1) was submitted for comparison to questioned two-layer paint samples (Items 2 and 3). Each item had a paint layer sequence of light blue over white. Results: The light blue layers of Item 2 and Item 1 differed in chemistry by IR. The questioned paint in Item 2 did not originate from the source represented by the known paint sample in Item 1 (Elimination/Non-association). Each layer of the sampled questioned paint in Item 3 corresponded to the respective layer of the sampled known paint in Item 1 in all tests performed. The questioned paint in Item 3 originated either from the entrance door of the local business as represented by Item 1 or from another paint source with indistinguishable properties (Level 3 - Association). Because other surfaces or items may have been painted with paint that would also be indistinguishable from the submitted evidence, an individual source cannot be determined.</p>
KGTTPW	<p>The following methodologies were used in the examination of this case: visual examination, microscopy, solubility and chemical tests, fluorescence, FTIR, and SEM-EDX. Examination of Items #2 and #3 (questioned paint chips recovered from the suspect) each revealed the presence of two small pieces of wood painted blue on one side. The blue paint the following layer structure: blue and white. Examination of Item #1 (known paint sample representative of the damaged area of the entrance door) revealed the presence of one piece of wood painted blue on one side. The blue paint had the following layer structure: blue and white. The blue paint recovered from the suspects, Items #2 and #3, was compared to the blue paint from the known paint sample representative of the damaged area of the entrance door, Item #1. The blue paint in Item #2 is not consistent with the blue paint in Item #1; therefore, the blue paint in Item #2 did not originate from the same source as the blue paint in Item #1. The blue paint in Item #3 is physically and chemically consistent with the blue paint in Item #1; therefore, the blue paint in Item #3 could have originated from the same source as the blue paint in Item #1.</p>
KLJ47N	<p>1. Exhibit 1 (known paint sample representative of the damaged area of the entrance door), Exhibit 2 (questioned paint chips recovered from the suspect), and Exhibit 3 (questioned paint chips recovered from the suspect) each consist of dual-layered paint samples on an apparent wood substrate. The following layer structure was observed in each Exhibit: a. Layer 1: light</p>

TABLE 3

WebCode	Conclusions
	<p>blue topcoat b. Layer 2: white primer 2. Comparative examinations of Exhibit 1 (known paint sample) with Exhibit 3 (questioned paint sample) disclosed them to be consistent in their physical characteristics, organic compositions, and elemental compositions. As a result of these findings, Exhibit 3 could have originated from the entrance door as represented by Exhibit 1, or another source of paint with the same characteristics. A paint association is not a means of positive identification and the number of possible sources for a specific paint is unknown. 3. Comparative examinations of Exhibit 1 (known paint sample) with Exhibit 2 (questioned paint sample) disclosed them to be inconsistent in their chemical compositions. As a result of these findings, Exhibit 2 could not have originated from the entrance door as represented by Exhibit 1.</p>
KRQN28	<p>The questioned paint chips recovered from the suspect (Item 2) may not have originated from the damaged area of the entrance door (Item 1). The questioned paint chips recovered from the suspect (Item 3) may have originated from the damaged area of the entrance door (Item 1)</p>
LA7ZKP	<p>Item 1 is a two-layer paint sample with a blue top coat and a white primer layer on a wood-like substrate. Item 2 is a two-layer paint sample with a blue top coat and a white primer layer on a wood-like substrate. The item 2 top coat has a different chemical composition than the item 1 top coat; therefore, item 2 could not have originated from item 1. The item 2 primer layer is similar in microscopic characteristics and chemical composition to the item 1 primer layer. Item 3 is a two-layer paint chip with a blue top coat and a white primer layer on a wood-like substrate. The item 3 top coat and primer layer are similar in microscopic characteristics and chemical composition to the top coat and primer layer of item 1; therefore, item 3 could have originated from item 1 or another paint source with the same class characteristics</p>
LH4VHN	<p>The entrance door (as represented by item 1) was eliminated as a possible source of the paint chips recovered from the suspect (item 2). The entrance door (as represented by item 1) could not be eliminated as a possible source of the paint chips recovered from the suspect (item 3). As such, the paint chips recovered from the suspect (item 3) either came from the entrance door or from another source of paint that is indistinguishable from item 1 in color, layer sequence, microscopic appearance, and chemical composition. Other sources of indistinguishable paint would include other items painted with the same manufacturer's formulation and color.</p>
LMBJVP	<p>The two-layer paint (medium blue over white primer) sampled from Item 1 (Known from door) and Item 2 (Questioned from suspect) were found to be dissimilar in chemical composition (FTIR). The damaged area of the door is not the source of this questioned paint sample recovered from the suspect. The two-layer paint (medium blue over white primer) sampled from Item 1 (Known from door) and Item 3 (Questioned from suspect) were found to be similar in chemical composition (FTIR). The damaged area of the door cannot be excluded as a possible source of this questioned paint sample recovered from the suspect.</p>
NJLWDM	<p>Items 1-3 were analyzed visually with UV and white light and analyzed instrumentally by Fourier Transform Infrared Spectrometry (FTIR). Due to differences in fluorescence under UV light and differences in the chemical makeup of the top layer, Item 2 was excluded as sharing a common source with Item 1. Items 1 and 3 were both two-layer paint systems with similar visual and chemical properties. Items 1 and 3 could share a common source of origin. Questioned Item 3 could also have originated from additional sources that are indistinguishable in all assessed examinations and analyses. No statistical or numerical probabilities can be applied to the conclusions of this report.</p>
NXKRJ2	<p>After analyzing the three pieces of evidence, we conclude that item 2 has a different chemical composition with respect to item 1 and item 3.</p>

TABLE 3

WebCode	Conclusions
P7UL4L	Exhibits 2 and 3 (questioned paint recovered from the suspect) both contained a two-layer paint system (blue and white). The known sample from the damaged area of the entrance door (Exhibit 1) also contained a two-layer paint system (blue and white). Exhibits 2 and 3 were compared to Exhibit 1 with the following results: The paint chips in Exhibit 3 corresponded in color and layer structure (cornflower blue, white), chemical composition, and elemental composition to the known paint in Exhibit 1. Therefore, the Exhibit 3 paint could have come from the same source as Exhibit 1 or another source with the same characteristics (Type III Inclusion). This type of conclusion was reached because paints are mass-produced, and other paints manufactured to the same specifications as Exhibit 3 would also be indistinguishable from this paint. The techniques utilized in this comparative analysis can typically distinguish most paint products. The paint chips in Exhibit 2 displayed a different chemical composition in the blue paint layer when compared to Exhibit 1; therefore, the paint in Exhibit 2 did not come from the same source as the paint in Exhibit 1 (Exclusion). See the Appendix of this report for further context regarding the conclusions listed above. [See Table 4 Additional Comments for referenced Appendix.]
QH4LDK	Known paint (Item 1), reportedly from the entrance door was found to be consistent with the questioned paint (Item 3) reportedly from the suspect with respect to color, layer sequence, chemical and physical properties, and composition. Based upon these observations, it is the opinion of this analyst that the known paint (Item 1) and the questioned paint (Item 3) could have come from the same source or any source exhibiting the same analyzed characteristics. The known paint (Item 1) was found to be inconsistent with the questioned paint (Item 2) with respect to chemical and physical properties and composition.
QUCJ62	Item 3 could have originated from Item 1.
R2YEYH	The questioned paint sample (Items 001-2) recovered from the suspect was distinguishable from the known paint sample (Item 001-1) representative of the damaged area of the local business entrance door. Therefore, the questioned paint sample (Items 001-2) did not come from the damaged area of the known paint sample (Item 001-1) representative of the damaged area of the local business entrance door. The questioned paint sample (Items 001-3) recovered from the suspect was indistinguishable from the known paint sample (Item 001-1) representative of the damaged area of the local business entrance door. Therefore, the questioned paint sample (Items 001-3) could have come from the damaged area of the local business entrance door (Item 001-1) or from another source of paint with the same physical and chemical properties.
RPDJ9G	Questioned paint chips recovered from the suspect (Item 2) are different from the known paint sample (Item 1) recovered from the damaged area of the entrance door. Questioned paint chips recovered from the suspect (Item 3) are similar to the known paint sample (Item 1) recovered from the damaged area of the entrance door.
T4DKKH	The samples were examined using stereomicroscopy, Infrared Spectroscopy (FTIR), UV-VIS Microspectrophotometry (MSP), and Scanning Electron Microscopy- Energy Dispersive X-ray Spectrometry (SEM-EDS). All paint samples consisted of a blue topcoat and a white primer. The questioned sample from Item #3 was consistent in color, layering, chemical composition, and elemental composition with the known paint from Item #1 and could have originated from the same source (Level III association). The blue topcoat layer of the questioned sample from Item #2 was inconsistent in chemical composition with the known paint 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

TABLE 3

WebCode	Conclusions
	<p>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 the 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 heterogeneity, contamination of the sample(s), or having a sample of insufficient size to adequately assess the 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.</p>
TKXCKH	<p>The Questioned paint chips recovered from the suspect (Item 3) could have originated from the damaged area of the entrance door (Item 1), because of the similarities of their physical properties and chemical compositions. Questioned paint chips recovered from the suspect (Item 2) could NOT have originated from the damaged area of the entrance door (Item 1), because of the differences of their physical properties and chemical compositions.</p>
U47XJV	<p>The questioned paint chips recovered from the suspect, marked "Item 3", could have originated from the same source as the known paint sample representative of the damaged area of the entrance door, marked "Item 1", or another source of paint with similar characteristics. The questioned paint chips recovered from the suspect, marked "Item 2", did not originate from the same source as the known paint sample representative of the damaged area of the entrance door, marked "Item 1".</p>
U7BJ9G	<p>RESULTS 1. Exhibit 1 contained a block of wood painted on one surface with the paint layer sequence: medium blue / white. 2. Exhibit 2 contained two wood shavings, each painted on one surface with the paint layer sequence: medium blue / white. The medium blue paint layer was physically and chemically different from the medium blue paint layer in Exhibit 1. The white paint layer was physically and chemically indistinguishable from the white paint layer in Exhibit 1. 3. Exhibit 3 contained two wood shavings, each painted on one surface with the paint layer sequence: medium blue / white. These paint layers were physically and chemically indistinguishable from the corresponding paint layers in Exhibit 1. CONCLUSIONS 1. The paint in Exhibit 2 did not originate from the source of Exhibit 1. 2. The paint in Exhibit 3 originated either from the source of Exhibit 1, or from another source of painted wood having indistinguishable physical and chemical properties.</p>
UPU78B	<p>The sample of paint from the damaged area of the entrance door (item 1) consisted of a layer of blue paint on a layer of white paint. Both samples of paint recovered from the suspect (items 2 and 3) consisted of a layer of blue paint on a layer of white paint. The corresponding blue and white layers of paint were compared by their visual appearances and chemical compositions. The chemical compositions were determined using FTIR (Fourier transform infrared spectroscopy). Using these techniques, I could not exclude one sample of paint</p>

TABLE 3

WebCode	Conclusions
	<p>recovered from the suspect (item 3) as coming from the damaged area of the entrance door (item 1). Therefore, this sample of paint recovered from the suspect could have come from the entrance door or from another source of this type of two-layered blue and white paint. The blue layer in the other sample of paint recovered from the suspect (item 2) had a different chemical composition to the blue layer of paint in the sample from the damaged area of the entrance door (item 1). Therefore, this sample of paint recovered from the suspect (item 2) has not come from the sampled area of damage on the entrance door.</p>
V7W34F	<p>The two-layered light blue paints in Items 1 and 3 were consistent in colors, textures, types, layer sequence, and chemical compositions. Based on the particles examined, it was concluded that the paints in Items 1 and 3 originated from either the same source or different sources painted in the same manner (Level II – Association with Highly Discriminating Characteristics). This type of conclusion was reached because Items 1 and 3 both exhibit architectural paint systems with two layers of varying colors and chemistries. The layer structure of architectural paint is dictated by a number of factors (color choice, price, desired properties, etc.) that are unlikely, though not impossible, to be reproduced in another viable source of paint. It should be noted that the techniques used in this comparative analysis can typically distinguish architectural paint systems/layers with differing colors and/or chemistries. Based on the particles examined, the light blue paint in Items 1 and 2 could not be associated due to differences in fluorescence (Exclusion/Elimination).</p>
V9WMGD	<p>Physical examinations indicate that Items 1, 2 and 3 are indistinguishable from one another in that each consists of a two layer architectural paint system: blue color coat over a white primer. However, the Item 2 blue paint layer differs in chemical composition from the Item 1 blue paint layer. Therefore, Item 2 did not originate from the same source as Item 1 (Elimination). Further, Items 1 and 3 were determined to contain no exclusionary differences in layer structure, layer colors, or layer composition. Therefore Item 3 originated from the painted substrate represented by Item 1 or from another substrate painted in the same manner (Type III Association). This conclusion was reached because other substrates painted with the same materials applied in the same manner would also be indistinguishable. The following categories and their descriptions are meant to provide context to the conclusions reached in this report. Every category may not be applicable in every case nor for every material. Type I Association: Physical Fit – The items exhibit physical features that demonstrate they were once part of the same object. Associations of Evidence with Class Characteristics: Class characteristics are physical and/or chemical properties that place an item within a particular group of items. Associations of evidence with class characteristics can have varying degrees of significance. In general, the smaller the size of the group relative to the relevant population, the more significant the association. A class association cannot definitively establish that the items came from the same source. Type II: Association with Highly Discriminating Characteristics – An association in which items could not be differentiated. Therefore, the possibility that the items came from the same source cannot be eliminated. Additionally, the items share unusual characteristics that would not be expected to be encountered in the relevant population. Type III: Association with Discriminating Characteristics – An association in which items could not be differentiated. Therefore, the possibility that the items came from the same source cannot be eliminated. Other items have been manufactured that would also be indistinguishable from the submitted items and could be encountered in the relevant population. Type IV: Association with Limitations – An association in which items could not be differentiated. Therefore, the possibility that the items came from the same source cannot be eliminated. As compared to the categories above, this type of association has decreased evidential value. For example, the items are more commonly encountered in the relevant population, a complete analysis was not performed due to limited characteristics or a limited analytical scheme, or minor variations were observed in the data. Inconclusive – No conclusion</p>

TABLE 3

WebCode	Conclusions
	could be reached. Elimination – The items exhibit exclusionary differences that demonstrate they did not originate from the same source.
VDB6YV	Item# 2 is dissimilar to Item# 1, therefore Item# 2 did not originate from the same location as the source of Item# 1. 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.
VE7RHE	ITEM 2 The questioned paint chip, Item 2, is different in chemical composition than the paint sample from the entrance door, Item 1. The entrance door is excluded as a possible source of the questioned paint chip. ITEM 3 The questioned paint chip, Item 3, is similar in chemical composition to the paint from the entrance door, Item 1. The questioned paint chip could have originated from the entrance door, or from another source of paint with a similar physical and chemical composition.
VH8P3E	Selected samples from the paint from the suspect (#2, #3) and the damaged door (#1) were visually, microscopically, and chemically examined. Examinations were performed using stereomicroscopy, polarized light microscopy, and infrared microspectroscopy. Sample 3A from paint from the suspect (#3) contains layers that are visually similar in color and layer structure as well as chemically similar to the sample from the damaged door (#1). The paint from 3A could have come from the paint on the damaged door (#1) or any other object with a similar paint system. Sample 2A from paint from the suspect (#2) contains layers that are visually similar in color and layer structure to the sample from the damaged door (#1); however the top blue layer is chemically different. The paint from 2A did not come from the paint on the damaged door.
VWMXTA	The paint sample from the 'damaged area of the entrance door' (Item 1) consisted of a piece of wood with a grey-blue topcoat and a white 2nd layer applied to one surface. The paint chips from 'recovered from the suspect' (Item 2 and Item 3) both consisted of small pieces of wood with a grey-blue topcoat and a white 2nd layer applied to the surface. The grey-blue topcoat and the white 2nd layer of the paint chips 'recovered from the suspect' (Item 3) were indistinguishable from the respective grey-blue topcoat and the white 2nd layer of the paint sample from the 'damaged area of the entrance door' (Item 1) with respect to their appearance, colour, chemical and elemental composition. In my opinion, this result provides moderate support for the contention that the paint chips 'recovered from the suspect' (Item 3) originated from the 'damaged area of the entrance door' (Item 1). The grey-blue topcoat of the paint chips 'recovered from the suspect' (Item 2) was distinguishable in chemical composition from the grey-blue topcoat of the paint sample from the 'damaged area of the entrance door' (Item 1). Therefore, in my opinion, the paint chips 'recovered from the suspect' (Item 2) did not originate from the 'damaged area of the entrance door' (Item 1).
WLYFLV	The source of the exemplar architectural blue paint sample in Item 1 is included as a possible source of the unknown architectural blue paint chips from Item 3. For another exemplar architectural paint sample to be included as a possible source of item 3, it would have to share the same class characteristics. The source of the exemplar architectural blue paint sample in Item 1 is excluded as a possible source of the unknown architectural blue paint chips from Item 2.
WRBATD	Item 1 consists of a piece of wood with a white primer and a blue architectural paint topcoat. Item 2 consists of 2 pieces of wood with a white primer and a blue architectural paint topcoat. Item 3 consists of 2 pieces of wood with a white primer and a blue architectural paint topcoat. Both the white paint and blue paint from Item 3 are similar in all examined characteristics to the white paint and the blue paint from Item 1. Thus, Item 1, or a similarly painted item, could be the source of Item 3. The blue paint of Item 2 is dissimilar to the blue paint of Item 1. Thus, Item 1 can not be the source of Item 2 as represented by the submitted samples.

TABLE 3

WebCode	Conclusions
X33ATV	The questioned paint chips in Item 3 was found to be similar to known paint sample in Item 1. The questioned paint chips in Item 2 was found not to be similar to known paint sample in Item 1. Therefore, item 3 (the recovered paint chip from the suspect) could have originated from the damaged area of the entrance door and hence, probable involvement of the suspect.
XCCM2C	The known paint sample and both questioned paint chips consisted of 2-layered paint structure, with a blue upper layer and a white lower layer on a wooden substrate. The questioned paint chips in item 3 were found to agree in colour and chemical composition with the corresponding layers of the known paint sample in item 1. This finding indicated that the questioned paint chips in items 3 could have originated from the damaged area of the entrance door from which the known paint sample item 1 was taken. The white lower layer of the questioned paint chips in item 2 were found to agree in colour and chemical composition with the white lower layer of the known paint sample in item 1. The blue upper layer of the questioned paint chips in item 2 were found to agree in colour but differ in chemical composition from the blue upper layer of the known paint sample in item 1. This finding indicated that the questioned paint chips in item 2 did not originate from the damaged area of the entrance door from which the known paint sample item 1 was taken.
XGLZLV	The physical and chemical properties of items 2 and 3 were compared to item 1. It is concluded that the paint chips recovered from the suspect (item 2) could not have originated from the damaged area of the entrance door (item 1). It is further concluded that the paint chips recovered from the suspect (item 3) cannot be eliminated from sharing a common source with the paint from the damaged area of the entrance door (item 1).
XMBKPC	<p>CONCLUSIONS: The questioned paint recovered from the subject (item 3) is the same distinct type of paint as the known paint on the damaged area of the entrance door (item 1) and originated either from that source or another source of architectural paint having the same distinct characteristics. The questioned paint recovered from the subject (item 2) did not originate from the damaged area of the entrance door represented by item 1. RESULTS: Question paint chips recovered from the subject (items 2 and 3) were examined for the purpose of determining whether or not there is any paint present like that on the damaged area of the entrance door (item 1). The paint standard from the damaged area of the entrance door (item 1) has the following layer structure: 1. Light blue acrylic latex enamel topcoat 2. White alkyd enamel undercoat This paint exhibits characteristics typical of an architectural finish and was used for comparison with questioned paint recovered from subject (items 2 and 3). Examination and comparison of the questioned paint (item 3) with item 1 revealed they are alike with respect to layer structure, layer colors, layer textures, microchemical reactivities, binder characteristics, and pigment characteristics. It is therefore concluded that the questioned paint recovered from the subject (item 3) is the same distinct type of paint as that on the damaged area of the entrance door (item 1) and either originated from that source or from another source of architectural paint having the same distinct characteristics. The questioned paint recovered from the subject (item 2) has the following layer structure: 1. Light blue polyvinyl acetate enamel topcoat 2. White alkyd enamel undercoat Examination and comparison of the questioned paint (item 2) with item 1 revealed they are dissimilar with respect to general binder types of layer 1. It is therefore concluded that the questioned paint recovered from the subject (item 2) did not originate from the damaged area of the entrance door represented by item 1. METHODS OF ANALYSIS: Examinations were performed visually, by stereo microscopy, brightfield/polarized light comparison microscopy, microchemical tests, Fourier transform infrared microspectroscopy, pyrolysis gas chromatography, and scanning electron microscopy/energy dispersive x-ray analysis.</p>
YCA7ED	Comparative examination of the paint layers from samples 241042 (Item 1) and 241043 (Item 2) by optical microscopy and FTIR found significant differences in the physical and chemical

TABLE 3

WebCode	Conclusions
	composition of the surface layer of each sample. Item 1 and Item 2 do not have a common origin. Comparative examination of samples 241042 (Item 1) and 241044 (Item 3) by optical microscopy and FTIR found no significant differences in physical or chemical composition. The findings are consistent with Item 1 and Item 3 having a common origin.
YPCYJV	[No Conclusions Reported.]
YXM26V	[No Conclusions Reported.]
YY42ED	Items 1 and 3 are consistent in color, appearance, layer sequence, chemical composition, and pigment appearance and distribution. Therefore, the paint chips recovered from the suspect, Item 3, originated from the damaged area of the entrance door, as represented by Item 1, or another damaged object with paint having the same analyzed characteristics. The light blue layers of Items 1 and 2 are different in chemical composition. Therefore, the paint chips recovered from the suspect, Item 2, did not originate from the damaged area of the entrance door, as represented by Item 1.
ZKKX89	Items 1, 2, and 3 were examined by stereomicroscopy and infrared spectroscopy. Items 1 and 3 were additionally examined by microspectrophotometry, energy-dispersive X-ray spectroscopy/scanning electron microscopy, and pyrolysis gas chromatography/mass spectrometry. Medium-steel blue paint found in Item 3 was indistinguishable from the medium-steel blue paint found in Item 1 in color, type, texture, layer structure, and elemental composition (Type 2 Association). This means the multi-layer architectural paint recovered from the suspect in Item 3 could have come from the entrance door. Medium-steel blue paint found in Item 2 was different from the medium-steel blue paint found in Item 1 (Elimination). This means the paint recovered from the suspect in Item 2 did not come from the entrance door. Trace Interpretation Scale: Type 1 Association: Physical Fit—The compared items exhibit physical features that demonstrate they were once part of the same object. Type 2 Association: Association with Distinctive characteristics—Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. The items further share distinctive characteristics that would not be typically encountered in the relevant population. Type 3 Association: Association with Conventional characteristics—Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. Because other items have been manufactured or are naturally occurring that would also be indistinguishable from the submitted evidence, an individual source cannot be determined. Type 4 Association: Association with limited characteristics and/or examination (1) Items are consistent in all measured and observed physical properties, chemical composition and/or microscopic characteristics, and therefore could have originated from the same source. This type of evidence may be commonly encountered in the environment or may have limited comparative value. Or (2) The comparison between items may be categorized as a Type 4 Association if the association is limited by the inability to perform a complete analysis or if minor variations are observed in the examination results. Inconclusive—No conclusion could be reached regarding an association or an elimination between the items. Elimination—Items exhibit differences in one or more of the following: physical properties, chemical composition, or microscopic characteristics and therefore did not originate from the same source. Non-Association—The items were different in physical properties, chemical composition, and/or microscopic characteristics, indicating that the items did not originate from the same source. However, these differences were insufficient for a definitive elimination.

Additional Comments

TABLE 4

WebCode	Additional Comments
CGYBGG	An Association Scale would also be included to define the conclusions reached.
D8N9VG	An Association Scale for Trace Evidence would be included with the report.
J4BG8B	An Association Scale would be included in the report as well as a remark to submit additional relevant known paint sources for comparison to Item 2, if desired.
LMBJVP	My examinations and analyses do not focus on the detection of inorganic materials. Items 1 and 3 may vary in their inorganic content.
NXKRJ2	It is considered appropriate to continue with this type of test.
P7UL4L	APPENDIX: The following descriptions are meant to provide context to the opinions reached in this report. Not every type of conclusion may be applicable in every case or for every material type. Type I Inclusion: Source Identification – Source Identification is the highest degree of association between items. This association provides the strongest support that the items originated from the same source as opposed to different sources. Source Identification, which includes a physical fit, is reached when the items display physical features that correspond/re-align in a manner that is not expected to be replicated. Type II Inclusion: Inclusion with Highly Discriminating Characteristics – This is the highest degree of association that can be determined in the absence of a Source Identification. This type of association provides strong support that the items originated from the same source as opposed to different sources. The items correspond in all measured physical properties, chemical composition and/or microscopic characteristics and share highly discriminating characteristic(s) that would rarely be expected to occur in the relevant types of materials examined. Type III Inclusion: Inclusion with Discriminating Characteristics – This type of association provides support that the items originated from the same source as opposed to different sources. The items correspond in all measured physical properties, chemical composition and/or microscopic characteristics; however, other items have been manufactured or could occur in nature that would also be indistinguishable from the examined materials. Type IV Inclusion: Inclusion with Limitations – This type of association provides limited support that the items originated from the same source as opposed to different sources. Therefore, the possibility that the items came from the same source cannot be eliminated. As compared to the categories above, this type of association has decreased evidential value due to limiting factors such as the items are more commonly encountered, a limited analytical scheme was conducted, or minor variations were observed in the data. Inconclusive – No conclusion could be reached regarding an inclusion or an exclusion between the items. Exclusion with Limitations – This conclusion provides support that the items originated from different sources as opposed to the same source due to observed differences; however, an Exclusion conclusion was not reached due to limiting factors such as possible natural or manufactured source variations, damage or contamination that cannot be removed or avoided. Exclusion – The items display differences that support that the two items did not originate from the same source.
UPU78B	Elemental analysis by SEM-EDX was not performed due to the instrument being unavailable.
ZKKX89	MSP was used during the examination, but the results were not meaningful. I understand making the Q samples very general in description to avoid task-irrelevance and bias issues, but I would prefer a slight variation between the description of the two unknowns to make reporting results easier to differentiate.

-End of Report-
(Appendix may follow)

Test No. 24-5451: Paint Analysis

DATA MUST BE SUBMITTED BY **April 22, 2024, 11:59 p.m. EDT** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: Y8GD84

The Accreditation Release section can be accessed by using the "Continue to Final Submission" button above. This information can be entered at any time prior to submitting to CTS.

Scenario:

Police are investigating a breaking and entering case at a local business. The entrance door was vandalized and the paint damaged. A few hours later, police apprehended a suspect and recovered paint chips, which were similar to the entrance door. Police are requesting you to examine the recovered paint chips and determine if they could have originated from the damaged area of the entrance door.

Please Note:

-Samples contained within each individual item are representative of a single source.

-The purpose of this test is the examination of paint; please ignore the wood substrate.

Items Submitted (Sample Pack P1):

Item 1: Known paint sample representative of the damaged area of the entrance door.

Item 2: Questioned paint chips recovered from the suspect.

Item 3: Questioned paint chips recovered from the suspect.

1.) Could either of the questioned paint chips recovered from the suspect (Item 2 and Item 3) have originated from the damaged area of the entrance door (Item 1)?

	Yes	No	Inconclusive
Item 2:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Item 3:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

Please check all that apply.

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

Please note: Any additional formatting applied in the free form space below will not transfer to the Summary Report and may cause your information to be illegible. This includes additional spacing and returns that present your responses in lists and tabular formats.

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

4.) Additional Comments

RELEASE OF DATA TO ACCREDITATION BODIES

The Accreditation Release is accessed by pressing the "Continue to Final Submission" button online and can be completed at any time prior to submission to CTS.

CTS submits external proficiency test data directly to ANAB and/or A2LA. Please select one of the following statements to ensure your data is handled appropriately.

- This participant's data is intended for submission to ANAB and/or A2LA. (Accreditation Release section below must be completed.)
- This participant's data is not intended for submission to ANAB and/or A2LA.

Have the laboratory's designated individual complete the following steps **only if your laboratory is accredited in this testing/calibration discipline** by one or more of the following Accreditation Bodies.

Step 1: Provide the applicable Accreditation Certificate Number(s) for your laboratory.

ANAB Certificate No.

A2LA Certificate No.

Step 2: Complete the Laboratory Identifying Information in its entirety.

Authorized Contact Person and Title

Laboratory Name

Location (City/State)