



Paint Analysis

Test No. 23-5451 Summary Report

Each sample set consisted of one item containing a known paint sample and two items containing questioned paint chips. Participants were requested to compare the items and report their findings. Data were returned from 67 participants and are compiled in 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 three items consisting of automotive paint samples. Item 1 was a known paint sample representative of the damaged area of the suspect's vehicle. Items 2 and 3 consisted of questioned paint chips recovered from the victim's clothing and on the ground near the victim. Participants were requested to examine the questioned paint chips and determine if either could have originated from the damaged area of the suspect's vehicle.

The paint samples in Item 1 were prepared from a different multi-layer automotive paint panel from that of Items 2 and 3. The test panel was described by the supplier as a grey-coated aluminum coil substrate panel. The panel used for Item 1 was made with the same primer and color basecoat, but contained a different clear coat than the panel used for Items 2 and 3.

SAMPLE PREPARATION: The panels used for this test were inspected for defects, and the areas containing defects were not used.

ITEM 1 (KNOWN): For the known Item 1, the paint panel was cut into approximately 1/2" x 1/2" wide pieces. One piece was deposited and folded into a glassine bag, then placed into a pre-labeled envelope and sealed.

ITEMS 2 AND 3 (ELIMINATION): For the questioned Items 2 and 3, the designated paint panel was cut into approximately 1/4" x 1/4" wide pieces. For each item, two pieces were deposited and folded into a glassine bag, then placed into their respective pre-labeled envelopes, 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: All predistribution laboratories reported the expected responses and used the following combined list of procedures: Stereomicroscopy, Polarized Light Microscopy, FTIR, SEM/EDX, and Stereoscope UV Light Source.

Summary Comments

This test was designed to allow participants to assess their proficiency in the examination, comparison, and interpretation of multi-layered automotive paint samples. 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 aluminum substrate panels. Item 1 came from a different automotive paint panel with the same primer and color basecoat but contained a different clearcoat than the panel used for both Items 2 and 3 (Refer to Manufacturer's Information for preparation details).

Of the 67 participants that reported examination results, 66 (99%) participants eliminated both Items 2 and 3 as having originated from the same source as the Item 1 known paint sample. The remaining participant identified both Items 2 and 3 as having originated from the Item 1 known paint sample.

The most commonly reported examination procedures included: Stereomicroscopy (96%) and FTIR (97%).

Examination Results

Could the questioned paint chips recovered from the clothing of the victim (Item 2) and/or on the ground near the victim (Item 3) have originated from the damaged area of the suspect's vehicle as represented by Item 1?

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
28AP89	No	No	ENUU2U	No	No
2NFLD6	No	No	EXJZYE	No	No
3WM8UR	No	No	EY7YR4	No	No
4CC864	No	No	FB4WHN	No	No
7N2QWE	No	No	FF9T2N	No	No
8496U3	No	No	FGQCYM	No	No
8H9774	No	No	FQRW2F	No	No
8JK7K7	No	No	HA6YDU	No	No
8QJUX4	No	No	HBEZYT	No	No
9QFZ3H	No	No	HBVRVB	No	No
9RCFB9	No	No	HMR9XD	No	No
A4YUK9	Yes	Yes	JL7LMF	No	No
AK6Y7Y	No	No	JU6GYF	No	No
ATZAPN	No	No	JWN76Q	No	No
B4GZKY	No	No	L7LDQN	No	No
BJ8K4K	No	No	LCFKHP	No	No
BLVUF7	No	No	LJUXDM	No	No
BNMF2P	No	No	MFAXK6	No	No
BYJLVN	No	No	MUPNAE	No	No
CJPQ3A	No	No	NH9V4W	No	No
CLREBR	No	No	P3ETH7	No	No
CNHQJQ	No	No	QRBT66	No	No
CWUEBQ	No	No	RQTN2K	No	No
D3VDWZ	No	No	T2TLKD	No	No
DCKAAF	No	No	T3JCGW	No	No
DHQ32Q	No	No	TTXGRC	No	No
E9HTAQ	No	No	UJKJ94	No	No
EKAG6Q	No	No	ULAQT2	No	No

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
UZCPT	No	No			
VJJEK3	No	No			
WKCL46	No	No			
WPJFWF	No	No			
XHZCPD	No	No			
XT2UZF	No	No			
Y4RHFT	No	No			
YQPE9Z	No	No			
ZGXQYW	No	No			
ZJNKRD	No	No			
ZM6JR7	No	No			

Examination Response Summary		Participants: 67	
<p><i>Could the questioned paint chips recovered from the clothing of the victim (Item 2) and/or on the ground near the victim (Item 3) have originated from the damaged area of the suspect's vehicle as represented by Item 1?</i></p>			
		Item 2	Item 3
Responses	Yes	1 (1.5%)	1 (1.5%)
	No	66 (98.5%)	66 (98.5%)
	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
28AP89	✓				✓					
2NFLD6	✓		✓	✓			✓			
3WM8UR	✓		✓	✓					✓	
4CC864	✓	✓	✓		✓	✓		✓		
7N2QWE	✓		✓		✓					
8496U3	✓	✓			✓					
8H9774	✓				✓					
8JK7K7	✓	✓	✓		✓					
8QJUX4	✓				✓					
9QFZ3H	✓	✓			✓					
9RCFB9	✓	✓			✓				✓	
A4YUK9	✓									
AK6Y7Y	✓				✓					
ATZAPN	✓		✓		✓					
B4GZKY	✓				✓					
BJ8K4K	✓				✓					
BLVUF7	✓				✓	✓				
BNMF2P	✓				✓				✓	
BYJLVN	✓				✓					
CJPQ3A	✓				✓					Brightfield light microscopy
CLREBR	✓	✓			✓				✓	
CNHQJQ	✓				✓					
CWUEBQ	✓	✓			✓					
D3VDWZ					✓	✓				
DCKAAF	✓	✓	✓		✓				✓	
DHQ32Q	✓				✓	✓				

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
E9HTAQ	✓				✓		✓			
EKAG6Q	✓	✓	✓		✓					
ENUU2U	✓				✓					
EXJZYE	✓	✓			✓					
EY7YR4	✓			✓	✓				✓	
FB4WHN	✓	✓			✓					
FF9T2N	✓				✓				✓	
FGQCYM	✓				✓					
FQRW2F	✓	✓		✓	✓	✓			✓	
HA6YDU	✓				✓					
HBEZYT	✓				✓					
HBVRVB	✓				✓					
HMR9XD	✓	✓			✓	✓		✓		Pyrolysis GC/MS
JL7LMF	✓		✓		✓					
JU6GYF	✓				✓					
JWN76Q	✓				✓				✓	
L7LDQN	✓				✓					Raman 532, 638, 785
LCFKHP	✓			✓	✓				✓	
LJUXDM	✓				✓					
MFAXK6	✓				✓			✓		
MUPNAE	✓	✓			✓					
NH9V4W	✓	✓			✓					
P3ETH7	✓	✓			✓				✓	
QRBT66	✓	✓			✓					
RQTN2K	✓				✓					
T2TLKD				✓	✓					
T3JCGW	✓		✓		✓					

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
TTXGRC	✓				✓			✓		
UJKJ94	✓				✓			✓		
ULAQT2	✓	✓					✓			
UZCPTE	✓				✓					
VJJEK3	✓		✓		✓					
WKCL46	✓	✓			✓					
WPJFWF	✓				✓					
XHZCPD	✓	✓	✓		✓	✓	✓			Raman (785nm, 633nm), XRD
XT2UZF					✓					
Y4RHFT	✓				✓				✓	
YQPE9Z	✓				✓				✓	
ZGXQYW	✓	✓	✓		✓	✓				
ZJNKRD	✓				✓					Visual
ZM6JR7	✓				✓				✓	

Response Summary										Total Participants: 67
	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	Microspectrophotometry	XRF/XRS	SEM/EDX	
Participants	64	20	11	7	65	3	5	5	18	
Percent	96%	30%	16%	10%	97%	4%	7%	7%	27%	

Conclusions

TABLE 3

WebCode	Conclusions
28AP89	The known paint sample representative of the damaged area of the suspect vehicle's front bumper (Item 1), the questioned paint chips recovered from the victim's clothing (Item 2) and the questioned paint chips recovered on the ground near the victim (Item 3) show the same layers with red and white layer. All layers of three samples were analyzed by stereomicroscopy and Fourier transform-infrared-spectroscopy. As a result, the questioned paint samples such as Item 2 and 3 could not have originated from the damaged area of suspect vehicle's front bumper (Item 1).
2NFLD6	The questioned paint chips recovered from the victim's clothing (Item 2) and the known paint sample (Item 1) were inconsistent on chemical composition and could not have the same source. The questioned paint chips recovered on the ground near the victim (Item 3) and the known paint sample (Item 1) were inconsistent on chemical composition and could not have the same source.
3WM8UR	Item # 1 is a suitable standard for comparison. The red paint in Item# 2 could not have originated from the same source as Item# 1, the damaged front bumper. The red paint in Item# 3 could not have originated from the same source as Item# 1, the damaged front bumper.
4CC864	The morphological examinations and the chemical analyses carried out in the laboratory on the known paint sample from the damaged vehicle and the recovered paint chips from the clothing of the victim and the ground near the victim highlight (show) a significant difference between the clear coat from the known paint sample collected from the damaged area of the suspect vehicle and the clearcoat from the recovered paint chips from the clothing of the victim and on the ground around the victim. The chemical similarities of the other layer paint systems lead us to believe that the victim was probably hit by this type and/or model of vehicle but not the damaged and sampled one.
7N2QWE	I have considered the following propositions to evaluate my findings: 1. Questioned paint chips recovered from the victim's clothing and/or ground near victim originated from the damaged area of the vehicle's front bumper. 2. Questioned paint chips recovered from the victim's clothing and/or ground near victim are unrelated and present due to chance. Given the above, I consider the findings to be more probable if the second proposition is true in regard to the paint chips recovered from the victim's clothing and the ground near victim are unrelated and present due to chance. Therefore, it is my opinion that the recovered paint chips from both the victim's clothing (item 2) and the ground near victim (item 3) can be excluded from having originated from the damaged area of the vehicle's front bumper based on differences observed in the analysis.
8496U3	One of the two submitted exhibits from both items 2 and 3 were examined microscopically and found to be consistent in layer structure with item 1 (4 layers). One of the two submitted exhibits from both items 2 and 3 and the submitted exhibit from item 1 were analyzed using polarized light microscopy, visible microscopy and fourier transform infrared spectroscopy (FTIR). The FTIR results reveal discriminating differences between the top layer (clear) of items 2 and 3 and item 1. Additional FTIR analysis was performed on the top (clear) layer of the remaining exhibits from items 2 and 3 and compared to the top (clear) layer of item 1. The FTIR results reveal discriminating differences between the top layer (clear) of items 2 and 3 and item 1. Thus, neither item 2 nor item 3 could have originated from item 1 as received.
8H9774	The known paint sample from the vehicle's front bumper (item 1) consisted of a clear top coat, a red second coat, a light grey third coat and a dark grey fourth coat. The paint chips recovered from the victims clothing (item 2) consisted of a clear top coat, a red second coat, a

TABLE 3

WebCode	Conclusions
	light grey third coat and a dark grey fourth coat. The chemical composition of the clear top coat from the paint chips recovered from the victims clothing (item 2) was found to be different to the clear top coat of the paint from the vehicle's front bumper (item 1) and therefore could not have originated from that source. The paint chips recovered from the ground near the victim (item 3) consisted of a clear top coat, a red second coat, a light grey third coat and a dark grey fourth coat. The chemical composition of the clear top coat from the paint chips recovered from the ground near the victim (item 3) was found to be different to the clear top coat of the paint from the vehicle's front bumper (item 1) and therefore could not have originated from that source.
8JK7K7	The questioned paint chips recovered from the victim's clothing (Item 2) could NOT have originated from the damaged area of the suspect vehicle's front bumper (Item 1), because of the differences in their physical properties and chemical compositions. The questioned paint chips recovered on the ground near the victim (Item 3) could NOT have originated from the damaged area of the suspect vehicle's front bumper (Item 1), because of the differences in their physical properties and chemical compositions.
8QJUX4	Through a physical study and chemical analysis performed on the submitted evidence, it was determined that: Items 1, 2 and 3 do not present physical matching and are made up of four layers, one clear, one red, one light cream and the other dark gray, which are consistent in color, texture and sequence. Items 1 and 2 do not have a similar chemical composition (Infrared Spectra, FTIR) so they do not come from the same origin. Items 1 and 3 do not have a similar chemical composition (Infrared Spectra, FTIR) so they do not come from the same origin. Item 1 was used as reference sample.
9QFZ3H	The following methodologies were used in the examination of this case: visual examination, microscopy, and FTIR. KNOWN STANDARD: Examination of Lab Item #1 revealed the presence of a red paint chip with the following layer structure: clear, red, light gray, and dark gray on a metal substrate. QUESTIONED SAMPLES: Examination of Lab Items #2 and 3 revealed the presence of red paint chips with the following layer structure: clear, red, light gray, and dark gray on a metal substrate. The red paint chips recovered from the victim's clothing (Lab Item #2) and the ground near the victim (Lab Item #3) are not consistent with the red paint chip collected from the damaged area of the suspect vehicle's front bumper (Lab Item #1). Therefore, the red paint chips from Lab Items #2 and 3 could not have originated from the same source as the red paint chip from Lab Item #1.
9RCFB9	The known paint sample Item 1 and the questioned paint samples Items 2 and 3 were each found to comprise 4 layers. The top to the bottom layers of each item were colourless, red, light grey and dark grey in colour respectively. The chemical composition of the colourless top layer of Item 1 were found to differ from those of the colourless top layer of the Items 2 and 3, suggesting that Items 2 and 3 did not originate from the same source as Item 1.
A4YUK9	Questioned Items #2 and #3 and submitted known reference Item #1 are characterized with the similar morphological characteristic features: color, color tone, color layer succession and structure.
AK6Y7Y	Each item has four layers; the first is clear, the second is red, the third is gray and fourth is dark gray. Item 2 and 3 are different from Item 1 by FT-IR analysis of the clear coat.
ATZAPN	Based on the particles examined, the multilayered red paint particles in Items 2 and 3 could not be associated with the Item 1 multilayered red paint due to differences in chemical composition (Exclusion/Elimination).
B4GZKY	Physical examinations indicate that Items 1, 2 and 3 are indistinguishable from one another. However, chemical examinations revealed differences between Items 2 and 3 in relation to Item 1. Therefore, Items 2 and 3 did not originate from the vehicle represented by Item 1 nor

TABLE 3

WebCode	Conclusions
	<p>from another vehicle painted in the same manner (Elimination). 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/Fracture Match – 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 could be reached. Elimination – The items exhibit exclusionary differences that demonstrate they did not originate from the same source.</p>
BJ8K4K	<p>1. Exhibit 1 (known paint standard from the damaged area of the suspect vehicle's front bumper), Exhibit 2 (questioned paint chips recovered from the victim's clothing), and Exhibit 3 (questioned paint chips recovered from the ground near the victim) were submitted for comparative examinations. Exhibits 1, 2, and 3 each consist of multi-layered paint chip(s) on an apparent metal substrate. The following layer structure was observed in each Exhibit: a. Layer 1: colorless clearcoat. b. Layer 2: medium red basecoat. c. Layer 3: light grey primer. d. Layer 4: dark grey primer. 2. Comparative examinations of Exhibits 2 and 3 (questioned paint samples) with Exhibit 1 (known paint standard) disclosed them to be inconsistent with respect to the organic composition of their layer 1 clearcoats. As a result of these findings, the questioned paint chips in Exhibits 2 and 3 could not have originated from the damaged bumper as represented by Exhibit 1.</p>
BLVUF7	<p>The paint from the damaged area of the victim's vehicle (Item 1) consisted of: clear topcoat; red base-coat; pale grey undercoat; dark grey primer. The paints recovered from the victim's clothing (Item 2) and from the ground, near the victim (Item 3), also consisted of: clear topcoat; red base-coat; pale grey undercoat; dark grey primer. However, the clear topcoat of the paints recovered from the victim's clothing and from the ground, near the victim, were different in chemical composition to that of the paint from the damaged area of the victim's vehicle. In addition, although the colours and pigment of these base-coats (Items 1, 2 & 3) were indistinguishable, there were reproducible differences between the chemical composition of the red base-coat of the paint from the damaged area of the victim's vehicle and that of the paints recovered from the victim's clothing and from the ground, near the victim. Consequently, the paints recovered from the victim's clothing (Item 2) and from the ground, near the victim (Item 3), could not have originated from the damaged area of the suspect's vehicle (Item 1). However, it is considered that the recovered paints (Items 2 & 3) could have originated from the same vehicle.</p>

TABLE 3

WebCode	Conclusions
BNMF2P	Item 2 (paint chips recoverd from the victim's clothing) and Item 3 (paint chips recovered on the ground near the victim) are diffrent components from Item 1. Therefore, Item 2 and Item 3 did not originate from Item 1.
BYJLVN	The questioned paint chips marked "Item 2" and "Item 3", recovered from the victim's clothing and on the ground near the victim respectively, did not originate from the same source as the known paint sample marked "Item 1", representative of the damaged area of the front bumper of the suspect's vehicle.
CJPQ3A	<p>CONCLUSIONS: The questioned paint identified as recovered from the victim's clothing and the ground near the victim (Items 2 and 3) did not originate from the area of the vehicle represented by Item 1. RESULTS: Questioned paint identified as recovered from the victim's clothing and the ground near the victim (Items 2 and 3) was examined for the purpose of determining whether or not it is like that on the suspect vehicle's front bumper (Item 1). The paint standard from the suspect vehicle's front bumper (Item 1) has the following layer structure: 1. Colorless acrylic-urethane enamel clearcoat. 2. Medium red basecoat. 3. Light grey polyester-urethane enamel primer. 4. Dark grey polyester-melamine enamel primer. This paint exhibits characteristics typical of an automotive finish and was used for comparison with the questioned paint (Items 2 and 3). The questioned paint identified as recovered from the victim's clothing and the ground near the victim (Items 2 and 3) has the following layer structure: 1. Colorless acrylic-melamine-urethane enamel clearcoat. 2. Medium red basecoat. 3. Light grey polyester-urethane enamel primer. 4. Dark grey polyester-melamine enamel primer. Examination and comparison of the questioned paint (Items 2 and 3) with Item 1 revealed they are dissimilar with respect to binder type and characteristics of layer 1. It is therefore concluded that the questioned paint identified as recovered from the victim's clothing and the ground near the victim (Items 2 and 3) did not originate from the area of the vehicle represented by Item 1. However, it should be noted that it is not uncommon for vehicles to have different paint systems on different body panels of the same vehicle or even different areas of the same body panel. Considering the striking correspondence of the characteristics exhibited by the bottom three layers of paint in Items 1-3, it is requested that additional standard samples be taken from every damaged panel/area on the suspect vehicle and submitted to the laboratory for further comparisons with the paint fragments identified as recovered from the victim's clothing and the ground near the victim (Items 2 and 3).</p> <p>METHODS OF ANALYSIS: Examinations were performed visually, by stereo microscopy, brightfield light microscopy, and Fourier transform infrared microspectroscopy.</p>
CLREBR	Both Item 2 and 3 could not have originated from Item 1.
CNHQJQ	Items #01.01 through #01.03: Examination (microscopic) disclosed paint particles with the following layer structure: 1) clear topcoat. 2) Red non-metallic color coat. 3) Light grey primer. 4) Grey primer. Microscopic and Instrumental (MICRO-FTIR) analysis of the questioned paint, #01.02 and #01.03, and the known paint, #01.01, revealed that they are consistent with respect to color, texture and layer structure. But dissimilar with respect to chemical type of layer 1. Therefore, the questioned paint from #01.02 and #01.03 could not have come from the source represented by the known paint #01.01.
CWUEBQ	Findings: Item #2 & #3 : Description: Questioned paint: Finding: Different chemical composition from clearcoat Item #1. Conclusion: Source Exclusion 1. 1. The evidence exhibits fundamentally different characteristics than the known reference and could not have come from the same source Remarks: The evidence is being returned to your department. Digital images are being retained at [Laboratory]. Analytical Detail: These findings were determined using visual examination techniques, microscopical examination techniques (stereomicroscope, PLM, comparison microscopes) and instrumental analyses (FTIR).

TABLE 3

WebCode	Conclusions
D3VDWZ	On analysis, I found the questioned paint chips recovered from the victim's clothing (Item 2) and questioned paint chips recovered on the ground near the victim (Item 3) were not similar with the known paint sample representative of the damaged area of the suspect vehicle's front bumper (Item 1).
DCKAAF	The Exhibit 1 paint chip consisted of a four-layered automotive paint on a metal substrate. The layer structure was a clearcoat top layer followed by a red colored layer, a light gray primer layer and a dark gray primer layer. The Exhibit 2 and 3 paint chips were analyzed and compared to the Exhibit 1 paint chip. The paint chip in Exhibit 1, though visibly similar in physical appearance (color and layer structure), is different in chemical and elemental composition from the Exhibit 2 and Exhibit 3 paint chips. Therefore, the paint chips in Exhibits 2 and 3 did not come from the same source as the Exhibit 1 paint (Exclusion). Different areas on the same vehicle may have different paint systems. Further comparisons can be performed if additional known samples are submitted.
DHQ32Q	Item 2 and Item 3 could not have originated from Item 1, as represented by the submitted samples.
E9HTAQ	It was determined utilizing stereomicroscopic, Fourier Transform Infrared Spectroscopy and X-Ray Fluorescence Spectroscopy that the questioned red paint from item 2 and item 3 exhibit dissimilar characteristics with the known red paint from 1. Therefore the known paint can be eliminated as being the source of the questioned paint.
EKAG6Q	Information: Samples of each layer of the submitted questioned red paint chips (Items 2 and 3) were visually and microscopically compared to samples of each layer of the submitted known red paint (Item 1) using polarized light microscopy, fluorescence, and infrared spectroscopy. All three items had layers of clear/matte red/light gray/dark gray. Results: Respective red, light gray, and dark gray layers of all three items were similar in chemistry. However, the clear layers of Items 2 and 3 were dissimilar in chemistry to the clear layer of Item 1; therefore, the questioned paint chips did not originate from the source as represented by the known paint (Elimination). Additional Remarks: Because the clear layer of the questioned paint chips was the only layer that was dissimilar in chemistry, it is possible that the difference could be attributed to a spot fix on the sampled vehicle/vehicle part. Please submit additional known paint samples from near the damaged area of the vehicle/vehicle part for comparison to the questioned paint.
ENUU2U	After the study of the 3 items, we can say that: Items 2 and 3 may have a common origin. Item 1 has a different origin than items 2 and 3.
EXJZYE	1. Exhibit 1 (known paint from the damaged area of the suspect vehicle's front bumper), Exhibit 2 (questioned paint from the victim's clothing), and Exhibit 3 (questioned paint from the ground near the victim) each consist of a multi-layered automotive paint sample with the following layer structure: Layer 1: Colorless clearcoat. Layer 2: Medium red basecoat. Layer 3: Light grey primer. Layer 4: Dark grey primer. 2. Comparative examinations of Exhibit 2 (questioned paint from the victim's clothing) and Exhibit 3 (questioned paint from the ground near the victim) with Exhibit 1 (known paint from the damaged area of the suspect vehicle's front bumper) disclosed them to be inconsistent in their organic compositions of the clearcoat layer. As a result of these findings, Exhibit 2 and Exhibit 3 could not have originated from Exhibit 1.
EY7YR4	I formed the opinion based on the techniques used, that the questioned paint chips recovered from the victim's clothing (item 2) had a different chemical composition as the known paint sample (item 1) from the vehicle's front bumper and could not have originated from it. I also formed the opinion based on the techniques used, that the questioned paint chips recovered from the ground near the victim (item 3) had a different chemical composition as the known paint sample (item 1) from the vehicle's front bumper and could not have originated from it.

TABLE 3

WebCode	Conclusions
FB4WHN	<p>Examinations: Visual examination, stereomicroscopy, polarized light microscopy, infrared spectroscopy (IR). Information: The known four-layer paint sample (Item 1) was submitted for comparison to questioned four-layer paint samples (Items 2 and 3). The paint layer structure of each item consisted of clear over red over light gray over dark gray over a metal substrate. Results: The questioned paint in Items 2 and 3 corresponded in visual appearance and layer structure to the known paint in Item 1. Samples of the three lower layers of Items 2 and 3 corresponded in chemistry by IR to samples of the three lower layers of Item 1; however, the clear layer chemistries differed. Therefore, it is the opinion of the examiner that the questioned paint in Items 2 and 3 did not originate from the source represented by the known paint sample in Item 1. Additional Remarks: The questioned paint items (Items 2 and 3) are suitable for further comparisons or examinations: If known red paint from other damaged panels of the same vehicle or known red paint from another vehicle is submitted, further comparisons may be conducted. A database search to determine the possible year/make/model of the source vehicle of the questioned paint items may be conducted upon request. Please contact the undersigned regarding the possibilities of additional paint examinations.</p>
FF9T2N	<p>Examinations: Visual examination, stereomicroscopy, infrared spectroscopy, scanning electron microscopy - energy dispersive spectroscopy. Information: Questioned paint samples recovered from clothing (Item 2) and from the ground (Item 3) were examined and compared to known paint collected from a vehicle bumper (Item 1) to determine if either questioned paint sample could have originated from the vehicle bumper. Results: Each submitted paint sample consisted of four layers of paint (clear over red over light gray over dark gray) on a metal substrate. The clear layer of paint from Items 2 and 3 differed in chemistry from the clear layer of paint from Item 1. In the opinion of the examiner, Items 2 and 3 did not originate from the vehicle part represented by Item 1. (Elimination)</p>
FGQCYM	<p>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 consistent with respect to their color, texture and layer structure; however, Q1a and K2 are different with respect to chemical type for layer 1. 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 with respect to their color, texture and layer structure; however, Q2a and K2 are different with respect to chemical type for layer 1. The remaining particles from Q1 and Q2 were designated as Q1b and Q2b. No further analysis was performed on these particles. It is the opinion of the undersigned that questioned paints Q1 and Q2 could not have originated from the same source as represented by the known paint K1 submitted.</p>
FQRW2F	<p>Item 1. Four layer clearcoat/nonreflective dark red/light gray/dark gray automotive paint on a silver metallic substrate was observed and used for comparison to the paint in Items 2 and 3. Item 2. Four layer clearcoat/nonreflective dark red/light gray/dark gray automotive paint on a silver metallic substrate was observed and was similar in color and layer sequence but dissimilar in 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. Item 3. Four layer clearcoat/nonreflective dark red/light gray/dark gray automotive paint on a silver metallic substrate was observed and was similar in color and layer sequence but dissimilar in chemical composition to the paint in Item 1. Therefore, the paint in Item 3 did not originate from the same source as the paint in item 1.</p>
HA6YDU	<p>Comparative examination of the paint chips from samples Item 1 and Item 2 found chemical differences in the paint layers. Item 2 could not have originated from Item 1. Comparative examination of the paint chips from samples Item 1 and Item 3 found chemical differences in the paint layers. Item 3 could not have originated from Item 1.</p>

TABLE 3

WebCode	Conclusions
HBEZYT	we have no scientific evidence to conclude that both items 2 and 3 could have been originated from the same source as item 1
HBVRVB	The four-layer paint sampled from Item 1 (Known from suspect bumper) and Item 2 (Questioned paint from victim's clothing) were found to be dissimilar in chemical composition (FTIR). The damaged area of the of the suspect vehicle's front bumper is not the source of the paint chips recovered from the victim's clothing. The four-layer paint sampled from Item 1 (Known from suspect bumper) and Item 3 (Questioned paint from ground near victim) were found to be dissimilar in chemical composition (FTIR). The damaged area of the suspect vehicle's front bumper is not the source of the paint chips recovered from the ground near the victim.
HMR9XD	Item 1 was used as a comparison to Items 1 and 2. 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 and layer sequence but dissimilar in chemical composition to the paint in Item 1; therefore, the paint in Item 3 could not have originated from the same source as the paint in Item 1.
JL7LMF	The red paint chips from the questioned paint chips recovered from the victim's clothing (Item 2) were not consistent with the red paint chip from the known paint sample representative of the damaged area of the suspect vehicle's front bumper (Item 1). Therefore, the red paint chips from the questioned paint chips recovered from the victim's clothing (Item 2) did not originate from the same source as the red paint chip from the known paint sample representative of the damaged area of the suspect vehicle's front bumper (Item 1). The red paint chips from the questioned paint chips recovered on the ground near the victim (Item 3) were not consistent with the red paint chips from the known paint sample representative of the damaged area of the suspect vehicle's front bumper (Item 1). Therefore, the red paint chips from the questioned paint chips recovered on the ground near the victim (Item 3) did not originate from the same source as the red paint chips from the known paint sample representative of the damaged area of the suspect vehicle's front bumper (Item 1).
JU6GYF	The paint chips of all three samples consist of four layers: clear coat, a red solid coat, a white primer surfacer and a grey first primer. The paint chips from the clothing of the victim and from the ground near the victim show similar IR-spectra in all four layers. The IR-spectra from all four layers of sample 1 are different from the other layers.No evidence was found, that the questioned paint chips from the victims clothing and the ground near the victim originated from the damaged area of the suspect's vehicle.
JWN76Q	The known paint sample (Item 1) as well as the questioned paint samples (Item 2 and Item 3) show the same paint layers: clearcoat, red basecoat, a white layer and a grey layer. All layers of all samples were analyzed by microscopy, light microscopy, infrared spectroscopy and SEM/EDX. Item 2 (the sample from the victim's clothing) and Item 3 (the sample from the ground near the victim) can be differentiated from Item 1. The clearcoat of Item 1 is different. The questioned paint samples Item 2 and Item 3 could not have originated from the damaged area of the suspect vehicle's front bumper (Item 1).
L7LDQN	Items 1, 2 and 3 have the same visual appearance. They all have 4 layers: transparent, red, light grey/white and grey. Using our instrumental method (FTIR) we did observe difference in IR spectrum of the transparent layers for Item 1 and Item 2, as well for Item 1 and Item 3. Item 1 has different chemistry composition of upper transparent layer as both Item 2 and Item 3. Paint chip from victim's clothing (Item 2) and paint chip found on the ground near the victim (Item 3) do not have the origin in car paint of a red sedan (Item 1)

TABLE 3

WebCode	Conclusions
LCFKHP	<p>Examination of the known paint sample representative of the damaged area of the front bumper of the suspect vehicle (Item 1): Item 1 comprised a paint sample with the layer sequence: clear/red/light grey/dark grey. The clear layer was identified as a polyurethane-modified acrylic type paint. The bulk elemental composition of the clear layer principally comprised carbon with the elements silicon and aluminium. The red layer was identified as a paint containing polyurethane and melamine. The bulk elemental composition of the red layer contained the elements chlorine, silicon, magnesium, sulfur and titanium. The light grey layer was identified as an isophthalic alkyd type paint. The bulk elemental composition of the light grey layer contained the elements titanium, sulfur, silicon, aluminium and barium. The dark grey layer was identified as a melamine-modified isophthalic alkyd type paint. The bulk elemental composition of the dark grey layer contained the elements titanium, silicon, aluminium and iron. Examination of the questioned paint chips recovered from the victim's clothing (Item 2): Item 2 comprised a paint sample with the layer sequence: clear/red/light grey/dark grey. The clear layer was identified as a styrene, melamine and polyurethane-modified acrylic type paint. The composition of the clear layer 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 victim's clothing (Item 2) originated from the front bumper of the suspect vehicle. Examination of the questioned paint chips recovered from the ground near the victim (Item 3): Item 3 comprised a paint sample with the layer sequence: clear/red/light grey/dark grey. The clear layer was identified as a styrene, melamine and polyurethane-modified acrylic type paint. The composition of the clear layer from Item 3 did not correspond with that of Item 1. Therefore, the results do not support the proposition that the paint recovered from the ground near the victim (Item 3) originated from the front bumper of the suspect vehicle.</p>
LJUXDM	<p>Item 1, Item 2, and Item 3 composed with clearcoat and red color paint. Clearcoat from Item 2 and Item 3 showed similar FT-IR spectrums. However, FT-IR spectrum of the Item 1 was not matched to those of Item 2 and Item 3.</p>
MFAXK6	<p>The paint sample from Item 1 has a different clear coat than the paint chips from Items 2 and 3. The paint sample from Item 1 did not come from the same source as the paint chips from Items 2 and 3.</p>
MUPNAE	<p>Items: #2 & #3 . Description: Questioned paint chips Finding: Same color, texture, layer structure and microscopic characteristics as Item #1. Different chemical composition of the clearcoat layer than Item #1. The remaining layers all have the same chemical composition as the corresponding layers of Item #1. Conclusion: Source Exclusion - The evidence exhibits fundamentally different characteristics than the known reference and could not have come from the same source. Remarks: The paint chips in Items #1 - #3 all consisted of the following layer structure: Clearcoat, Red Basecoat, Light Gray Primer Surfacer, Dark Gray Primer E-Coat. The evidence and digital images are being retained at [Laboratory]. Analytical Detail: These findings were determined using microscopical examination techniques (stereomicroscope and PLM comparison microscope) and instrumental analyses (FTIR).</p>
NH9V4W	<p>These exhibits were examined and compared in an attempt to determine whether or not there is evidence of an association between the questioned paint chips and the known paint sample. Examinations of Exhibit 1, the known paint sample from the damaged area of the suspect vehicle's front bumper, revealed the presence of a paint chip having the following layer structure: 1. Clear colorless acrylic-urethane topcoat 2. Medium red finishcoat 3. Light gray primer 4. Dark gray primer This layer structure is typical of an automotive paint layer system. Exhibits 2 and 3, recovered from the victim's clothing and from the ground near the victim, were examined and each was found to contain two paint chips having the following layer structure: 1. Clear colorless acrylic-melamine-styrene-urethane topcoat 2. Medium red</p>

TABLE 3

WebCode	Conclusions
	finishcoat 3. Light gray primer 4. Dark gray primer This layer structure is typical of an original finish automotive paint layer system. Microscopic examinations and comparisons of the questioned paint chips in Exhibits 2 and 3 with the Exhibit 1 known paint sample from the suspect vehicle revealed they are like one another with respect to their layer colors and layer sequences. However, these microscopic comparisons also revealed differences between them with respect to their relative layer thicknesses and instrumental comparisons revealed exclusionary differences with respect to their Layer 1 binder types. It is therefore concluded that the questioned paint chips recovered from the victim's clothing and from the ground near the victim could not have originated from the damaged area of the suspect vehicle's front bumper as it is represented by Exhibit 1.
P3ETH7	The red automotive paint sample labeled "questioned paint chips recovered from the victim's clothing", (item 2), displays differences in chemical composition as compared to the red automotive paint sample labeled "known paint sample representative of the damaged area of the suspect vehicle's front bumper", (item 1). Elimination. The red automotive paint sample labeled "questioned paint chips recovered on the ground near the victim", (item 3), displays differences in chemical composition as compared to the red automotive paint sample labeled "known paint sample representative of the damaged area of the suspect vehicle's front bumper", (item 1). Elimination.
QRBT66	Item 1 exhibits differences in chemical composition from items 2 and 3. Items 2 and 3 did not originate from the suspect's vehicle as represented by item 1.
RQTN2K	Results: 1. Exhibit 1 consisted of one red paint chip having the paint layer sequence: clear/medium red/light grey/dark grey. 2. Exhibits 2 and 3 each consisted of two red paint chips having the paint layer sequence: clear/medium red/light grey/dark grey. The clear paint layers in Exhibits 2 and 3 were physically and chemically different from the corresponding paint layer in Exhibit 1. The medium red paint layers in Exhibits 2 and 3 were physically indistinguishable, but chemically different, from the corresponding paint layer in Exhibit 1. The light grey and dark grey paint layers in Exhibits 2 and 3 were physically and chemically indistinguishable from the corresponding paint layers in Exhibit 1. Conclusions: The paint in Exhibits 2 and 3 did not originate from the source of Exhibit 1.
T2TLKD	Paint chips recovered from the clothing of the victim (Item 2) and/or on the ground near the victim (Item 3) have not originated from the damaged area of the suspect's vehicle as represented by Item 1.
T3JCGW	The following methodologies were used in the examination of this case: visual examination, fluorescence, and FTIR. Examination of Items #2 and #3 each revealed the presence of two pieces of silver-colored metal with red paint on one side. The red paint had the following layer structure: Clear, Red, Light Gray, and Dark Gray. Examination of Item #1 revealed the presence of a piece of silver-colored metal with red paint on one side. The red paint had the following layer structure: Clear, Red, Light Gray, and Dark Gray. The red paint from Item #2 was not consistent with the red paint from Item #1. Therefore, the red paint from Item #2 did not originate from the same source as the red paint from Item #1. The red paint from Item #3 was not consistent with the red paint from Item #1. Therefore, the red paint from Item #3 did not originate from the same source as the red paint from Item #1.
TTXGRC	The questioned paint chips recovered from the clothing of the victim (Item 2) could not be originated from the damaged area of the suspect's vehicle as represented by Item 1. The questioned paint chips recovered on the ground near the victim (Item 3) could not be originated from the damaged area of the suspect's vehicle as represented by Item 1.
UJKJ94	Microscopic and instrumental analysis and comparison of the questioned paint chips in Item 2 and Item 3 with the known paint sample in Item 1 revealed them to be inconsistent with respect

TABLE 3

WebCode	Conclusions
	to clear coat binder composition. Therefore, Item 2 and Item 3 did not originate from the source represented by the known paint sample in Item 1. It should be noted that some vehicles may be painted with different paint systems on different panels of the same vehicle. Upon submission of additional paint samples, further analysis may be performed.
ULAQT2	Exhibit 1 (known paint sample from suspect's front bumper) disclosed the presence of a red paint chip. Exhibit 2 (questioned paint from victim's clothing) and Exhibit 3 (questioned paint from the ground near victim) also disclosed the presence of red paint chips. Comparative examinations of the red paint chips in Exhibits 2 and 3 disclosed different microscopical characteristics and elemental compositions than the known red paint chip in Exhibit 1. Therefore, the paint chips in Exhibits 2 and 3 did not come from the known sample as represented by Exhibit 1 (Exclusion).
UZCPTE	The questioned paint chips (item 2 and item 3) and the known paint sample (item 1) are different from one another.
VJJEK3	The item 2 is not consistent with item 1. The item 3 is not consistent with item 1.
WKCL46	Results of Examination 1. Layer Structure Determination a. Examination of Laboratory items #1, 2A, 2B, 3A, and 3B disclosed that all five particles have the following layer structure: top clearcoat (layer 1) red colorcoat (layer 2) light colored grey primer (layer 3) dark grey primer (layer 4) silver colored metal substrate 2. Instrumental Analysis and Comparison: Result: a. Questioned paint (Laboratory items 2A and 2B) and the known paint (Laboratory item 1) are different with respect to chemical composition of top clearcoat. b. Questioned paint (Laboratory items 3A and 3B) and the known paint (Laboratory item 1) are different with respect to chemical composition of top clearcoat. Interpretation of Results: 1. It is the opinion of the undersigned that questioned paint (Laboratory items 2A and 2B) could not have originated from the same source as represented by the known paint (Laboratory item 1) submitted. 2. It is the opinion of the undersigned that questioned paint (Laboratory items 3A and 3B) could not have originated from the same source as represented by the known paint (Laboratory item 1) submitted. 3. It is not uncommon for vehicles to have different paint systems on different panels of the same vehicle. The known paint submitted may not be representative of all paint on the vehicle.
WPJFWF	The clear topcoats of Item No. 2 and Item No. 3 did not match Item No. 1.
XHZCPD	With the collected paint chips and our analysis, we can exclude, that the paint chips recovered from the victim's clothing (Item2) and from the ground near the victim (Item3) could have originated from the damaged area of the suspect vehicle's front bumper (Item1). The paint chips recovered on the ground near the victim (Item3) can originate from the same area of a vehicle as the paint chips recovered from the victim's clothing (Item2).
XT2UZF	Three painted metal coupons were inspected and were all found to have a clearcoat layer, a bright-red base coat and an off-white primer layer. The clearcoat layers were analyzed using Fourier transform infrared spectroscopy (FTIR) with an attenuated total reflectance (ATR) sampling accessory. The spectrum of the clearcoat on Item #1, best matching an acrylic-urethane resin, did not match either of the clearcoat spectra from Item #2 or Item #3. The clearcoat spectra from Items #2 and #3 matched each other and were consistent with an acrylic-melamine resin. Testing of additional layers was deemed unnecessary to conclude that Items #2 and #3 could not have originated from Item #1.
Y4RHFT	The paint evidence in Item 2 (paint chips from clothing) and Item 3 (paint chips from ground) are red, four-layer, automotive paints that are similar in layer color and layer sequence but differ in the paint chemistry of the top clear layer when compared to the red, four-layer, automotive paint evidence in Item 1 (known paint from vehicle bumper). The paint in Item 2

TABLE 3

WebCode	Conclusions
	and Item 3 could not have originated from the same source of paint as Item 1. Items 1, 2 and 3 were examined visually and using stereomicroscopy, Fourier transformed infrared spectroscopy (FTIR), and scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDS).
YQPE9Z	The three samples are visually similar to one another with a similar sequence of layering (clear colorless layer, red layer, and gray layer). Compositionally Item 1 does not appear to be a likely source for Items 2 and 3. The clear colorless layer of Item 1 has a different chemical composition (acrylic urethane) from Items 2 and 3 (styrene modified acrylic/melamine). The elemental profile of the red layer is different (no nitrogen is detected in the red layer of Item 1). Item 1 is not a likely source for either Item 2 or Item 3.
ZGXQYW	The top layer of paint from the questioned paint chips (Item 2 and Item 3) is dissimilar in paint type to the top layer of paint from the damaged area of the suspect vehicle's front bumper (Item 1). It is my opinion that these paint chips did not originate from the sampled area of the suspect vehicle. It should be noted that paint can vary based on the area it is sampled from.
ZJNKRD	Items 2 and 3 did not originate from the damaged area of the suspect vehicle's front bumper, Item 1 (see Additional Comments).
ZM6JR7	ITEMS: 1) a sealed manila envelope identified as "2023 CTS Forensic Testing Program Test No. 23- 5451: PAINT ANALYSIS" containing: 1-1) a chip of paint sealed in a small manila envelope identified as "Test No. 23-5451 Item 1". 1-2) a chip of paint sealed in a small manila envelope identified as "Test No. 23-5451 Item 2". 1-3) a chip of paint sealed in a small manila envelope identified as "Test No. 23-5451 Item 3". RESULTS: The paint chips in items #1-1, #1-2, and #1-3 were examined using stereomicroscopy, Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy-Energy Dispersive X-Ray Spectrometry (SEM-EDS). The known paint chip in item #1-1 consisted of three (3) layers in the following order: clear/red/gray. The questioned paint chip in item #1-2 consisted of three (3) layers in the following order: clear/red/gray. The questioned paint chip in item #1-3 consisted of three (3) layers in the following order: clear/red/gray. The questioned paint chip in item #1-2 was consistent in color, texture, layer sequence, and chemical composition of the red and gray layers when compared to the known paint chip, item #1-1; however, the questioned paint chip, item #1-2, was dissimilar in chemical composition of the clear layer when compared to the known paint chip, item #1-1. The questioned paint chip in item #1-3 was consistent in color, layer sequence, and chemical composition of the red and gray layers when compared to the known paint chip, item #1-1; however, the questioned paint chip, item #1-3, was dissimilar in texture and chemical composition of the clear layer when compared to the known paint chip, item #1-1. Further analysis could be performed if additional known red paint samples are submitted for comparison. OPINION: The questioned paint chip in item #1-2 was dissimilar to the known paint chip in item #1-1 and therefore didn't originate from the same source as the known paint chip, item #1-1. This is an Elimination. See Association Key below. The questioned paint chip in item #1-3 was dissimilar to the known paint chip in item #1-1 and therefore didn't originate from the same source as the known paint chip, item #1-1. This is an Elimination. See Association Key below. DISPOSITION OF EVIDENCE: The evidence is returned to the submitting/investigating agency upon completion of examination. [Association key not provided with report].

Additional Comments

TABLE 4

WebCode	Additional Comments
BJ8K4K	When CTS reports the results from automotive paint exams, they only reference three layers (L1 clearcoat, L2 basecoat, and L3 primer) added to the metal substrate. In every automotive test I have taken, there is always an additional L4 primer in close proximity to the metal substrate; it is dark grey and thin. Is this an intentional point of comparison? I see mixed results on whether labs report 3 or 4 layers on these automotive paint tests. In this specific test, that layer would not make sense for the scenario provided. The damaged vehicle part is a bumper, and this L4 primer has melamine in it (neither would the metal substrate, but that is always referenced in the instructions not to be analyzed). If this 4th layer is a primer that comes with the metal substrate itself, could this please be acknowledged? Thanks!
BLVUF7	SEM-EDS analysis was not carried out because exclusionary differences were detected between the known Item and the two recovered Items using FTIR. It is considered that the paint used to apply the red base-coat to the known sample (Item 1) is highly likely to be the same product as that used to apply the red base-coats to the recovered samples (Items 2 & 3). The reproducible differences detected between the base-coats of the known sample and the two recovered samples could be due to wet-on-wet migration of polyurethane binder of the clear topcoat of the known sample (Item 1) into the red base-coat. This absorption, in the case of the known sample, is probably a factor of the difference in composition of the binder of the clear lacquer used on the known sample as opposed to that used on the two recovered samples.
BYJLVN	The paint chips marked "Item 1", "Item 2" and "Item 3" were each found to consist of an outermost clear colourless layer, a second red layer, a third light grey layer and a fourth dark grey layer. The questioned paint chips marked "Item 2" and "Item 3" were found to be different from the known paint sample marked "Item 1" in terms of chemical composition.
CNHQJQ	Would request the submission of additional paint sample of other areas of the vehicle for future comparison.
EKAG6Q	An Association Scale would be included in the report with definitions to provide context to the opinion reached in this case. The following definition would be highlighted: Elimination (Non-association): The items were dissimilar in physical properties and/or chemical composition, indicating that they did not originate from the same source.
EXJZYE	Due to similarity of layers 2-4 between the questioned samples and the known, additional standards would be requested from other damaged areas of the suspect vehicle.
FB4WHN	An association scale would be included in the report.
FF9T2N	An Association Scale would be included in the report.
MUPNAE	Our reports are presented in a table format that does not translate well to the restrictions of the CTS form.
NH9V4W	Exhibits 1, 2, and 3 were examined macroscopically and by stereomicroscopy, brightfield/polarized light microscopy, and by Fourier transform infrared microspectroscopy. As per the test instructions, samples contained within each individual item were considered as representative of a single source, and the metal substrate was ignored.
WPJFWF	Although the topcoats were all urethane resins. the pigments of Items 2 and 3 did not match Item 1.
XHZCPD	Only the clearcoat-layer from Item 1 is different to the clearcoat-layer of Item 2 respectively

TABLE 4

WebCode	Additional Comments
	Item 3. The other three paint-layers of Item 1 are indistinguishable from the corresponding paint-layers of Item 2 respectively Item 3. Therefore in real cases we would ask for more paint from all damaged areas of the suspect's vehicle- the difference in the clearcoat-layer could be from a repair where only the clear coat has been recoated.
ZJNKRD	Paint applied to different areas on a motor vehicle may vary due to the function and substrate used for vehicle parts (e.g., bumpers and hoods) or the repair of painted areas. A determination of whether other painted areas on the suspect vehicle are possible sources of the paint from Items 2 and 3 requires consultation with laboratory personnel and submission of additional paint samples.
ZM6JR7	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. Alternatively, an association between items would be categorized as a Type IV if limited analysis was performed due to the characteristics or size of the specimen(s). 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 could be 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.

-End of Report-
(Appendix may follow)

Test No. 23-5451: Paint Analysis

DATA MUST BE SUBMITTED BY **April 24, 2023, 11:59 p.m. EDT** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: LHL92H

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 hit-and-run accident involving a pedestrian. When police arrived, an eyewitness gave a description of a red sedan. Police recovered paint chips from the victim's clothing and on the ground near the victim. Later that day, police located a suspect vehicle that resembled the color of the paint chips recovered at the scene and there appeared to be damage to the front bumper. A known paint sample has been collected from the damaged area of the suspect vehicle's front bumper. Police are requesting that you examine the recovered paint chips and determine if they could have originated from the damaged area of the suspect's vehicle.

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 metal substrate.

Items Submitted (Sample Pack P1):

Item 1: Known paint sample representative of the damaged area of the suspect vehicle's front bumper.

Item 2: Questioned paint chips recovered from the victim's clothing.

Item 3: Questioned paint chips recovered on the ground near the victim.

1.) Could the questioned paint chips recovered from the clothing of the victim (Item 2) and/or on the ground near the victim (Item 3) have originated from the damaged area of the suspect's vehicle as represented by 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"/> 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

Other (specify):

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 ASCLD/LAB, 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 ASCLD/LAB, ANAB, and/or A2LA. (Accreditation Release section below must be completed.)
- This participant's data is **not** intended for submission to ASCLD/LAB, 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.
(Include ASCLD/LAB Certificate here)

A2LA Certificate No.

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

Authorized Contact Person and Title

Laboratory Name

Location (City/State)