Collaborative Testing Services, Inc
FORENSIC TESTING PROGRAM

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Paint Analysis
Test No. 25-5451 Summary Report

Each participant received a sample pack that contained two known paint chip samples and one set of questioned paint chips, which they were asked to examine using their existing protocols. Data were returned from 62 participants and are compiled into the following tables:

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 pack contained known paint chip sample(s) and questioned paint chip sample(s). Participants were asked to examine the questioned paint chip sample(s) and determine if it could have originated from the known paint chip(s).

SAMPLE PREPARATION: The substrate panels used for this test were inspected for defects, and the areas containing defects were not used. Association items were selected at the same time and within close spatial proximity to one another prior to item packaging and maintained together as association batches during sample pack assembly.

KNOWN ITEMS: One paint chip sample, approximately ½" x ½" in size, was selected and deposited into a glassine bag and then placed into a pre-labeled item envelope and sealed.

QUESTIONED ITEMS: Two paint chip samplings, approximately ¼" x ¼" in size, were selected and deposited into a glassine bag and then placed into a pre-labeled item envelope and sealed.

SAMPLE PACK ASSEMBLY: All items were placed into a pre-labeled sample pack envelope and sealed. This process was repeated until all of the sample packs 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, Fluorescence, FTIR, SEM/EDX, Microspectrophotometry, Comparison Microscopy, and UV.

Item	Known/ Questioned	Association/ Elimination	Automotive Substrate	Primer	Color	Clear Coat
1	Known	Elimination	Grey-Coated Aluminum Coil Panel	U28AW032B	E211BW077Q (Opulent Blue)	E10CG500D
2	Known	Association	Grey-Coated Aluminum Coil Panel	U28AW032B	E211BW077Q (Opulent Blue)	R10CG392D
3	Questioned	Association	Grey-Coated Aluminum Coil Panel	U28AW032B	E211BW077Q (Opulent Blue)	R10CG392D

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. Participants were supplied with two known paint chip samples and one set of questioned paint chips. Items 2 and 3 were prepared from the same source of automotive paint panel. Item 1 was prepared from a different source of automotive paint panel. Refer to the Manufacturer's Information for preparation details.

Among the 62 responding participants, 59 (95%) associated Item 3 as having originated from the Item 2 known paint sample and eliminated it as having originated from the Item 1 known paint sample. Of the remaining three participants, two participants either eliminated or reported inconclusive for Item 3 as having originated from either the Item 1 or Item 2 known paint samples, while one participant identified Item 3 as having originated from the Item 1 known paint sample and eliminated Item 3 as having originated from the Item 2 known paint sample.

The most commonly reported examination procedures included: FTIR (100%), Stereomicroscopy (98%), and SEM/EDX (68%).

CTS noted 12 participants (19%) reported a fifth layer of primer on the four-layered manufactured automotive paint panel within the Conclusions and Additional Comments sections. CTS reached out to the manufacturer who stated that the gray coil coating can turn off-white when applied to the aluminum panel.

Examination Results

Could the questioned paint chips recovered from the crime scene (Item 3) have originated from the damaged area of either of the two suspect vehicles as represented by Items 1 and 2?

TABLE 1

	Item 3			Item 3	
WebCode	Item 1	Item 2	WebCode	Item 1	Item 2
24VKRG	No	Yes	FNWG4K	No	Yes
266P4K	No	Yes	FZPXTK	No	Yes
2GLCBZ	No	Yes	GJXKUJ	No	Yes
2U8REZ	No	Yes	GMWVR6	No	Yes
33J6XG	No	Yes	HHFTKY	No	Yes
38QTCH	No	Yes	HR3RAJ	No	Yes
466A7D	No	Yes	J7HC7H	No	Yes
4P3XBE	No	Yes	JQNJLG	No	Yes
6T6ZZF	No	Yes	LENVKX	No	Yes
7FCXVT	No	Yes	LHM7FX	No	Yes
7V6QFU	No	Yes	LNDGQW	No	Yes
7ZXTLF	No	Yes	LP8ALE	No	Yes
8Q74BP	No	Yes	LZ8XFW	No	Yes
9KVZTA	Yes	No	N6WW6C	No	No
9UMFFT	No	Yes	N9W8ZC	No	Yes
A43PGR	No	Yes	NUT4DW	No	Yes
A6ZXPB	No	Yes	PCPNPB	No	Yes
BJFHMA	No	Yes	PJQZNT	No	Yes
BTNRE9	No	Yes	PKH2RW	No	Yes
CG7UKP	No	Yes	PR23AU	No	Yes
CHXTYM	No	Yes	PR7J8T	No	Yes
CPY6W6	No	Yes	T6EWQN	No	Yes
CZ3ZDP	No	Yes	T78PL8	No	Yes
DTRYEJ	No	Yes	TBZRRT	Inc	Inc
ENXRN3	No	Yes	TQUGMP	No	Yes

TABLE 1

WebCode	Item 3 Item 1	Item 3 Item 2	WebCode	Item 3 Item 1	Item 3 Item 2
U9D8MN	No	Yes			
UD7CD8	No	Yes			
VC8NCM	No	Yes			
VG4A4Q	No	Yes			
VWXYYM	No	Yes			
W3DZUP	No	Yes			
WBBUP3	No	Yes			
WHT4FK	No	Yes			
WLEMLP	No	Yes			
X9H2UJ	No	Yes			
XZPQH4	No	Yes			
Z7LLVK	No	Yes			

Examination Response Summary **Participants: 62**

Could the questioned paint chips recovered from the crime scene (Item 3) have originated from the damaged area of either of the two suspect vehicles as represented by Items 1 and 2?

	Item 1	Item 2
Yes:	**1** *(1.6%)*	**59** *(95.2%)*
No:	**60** *(96.8%)*	**2** *(3.2%)*
Inc:	**1** *(1.6%)*	**1** *(1.6%)*

Examination Procedures

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
24VKRG	✓				✓				✓	
266P4K	✓				✓					
2GLCBZ	✓	✓		✓	✓				✓	
2U8REZ	✓				✓				✓	UV light source
33J6XG	✓			✓	✓					
38QTCH	✓				✓					
466A7D	✓				✓		✓		✓	
4P3XBE	✓				✓			✓	✓	
6T6ZZF	✓	✓	✓		✓					Raman, XRD
7FCXVT	✓		✓	✓	✓				✓	
7V6QFU	✓	✓	✓	✓	✓		✓			
7ZXTLF	✓				✓					
8Q74BP	✓	✓		✓	✓				✓	
9KVZTA	✓	✓	✓		✓		✓		✓	RAMAN
9UMFFT	✓	✓	✓		✓		✓		✓	
A43PGR	✓				✓		✓		✓	Pyrolysis GC/MS
A6ZXPB	✓				✓					comparison microscope
BJFHMA			✓	✓	✓			✓		
BTNRE9	✓				✓			✓	✓	
CG7UKP	✓		✓		✓	✓			✓	
CHXTYM	✓				✓				✓	
CPY6W6	✓				✓			✓		
CZ3ZDP	✓				✓		✓		✓	Pyrolysis GC/MS

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
DTRYEJ	✓	✓		✓	✓				✓	
ENXRN3	✓	✓	✓		✓		✓		✓	
FNWG4K	✓				✓		✓		✓	
FZPXTK	✓				✓					
GJXKUJ	✓	✓	✓		✓		✓		✓	
GMWVR6	✓				✓				✓	PyGC/MS
HHFTKY	✓		✓		✓				✓	
HR3RAJ	✓	✓	✓	✓	✓		✓			
J7HC7H	✓	✓			✓		✓		✓	
JQNJLG	✓				✓		✓		✓	
LENVKX	✓				✓				✓	
LHM7FX	✓				✓				✓	
LNDGQW	✓	✓			✓					
LP8ALE	✓	✓		✓	✓	✓			✓	
LZ8XFW	✓	✓		✓	✓				✓	
N6WW6C	✓			✓	✓				✓	
N9W8ZC	✓				✓				✓	
NUT4DW	✓				✓					
PCPNPB	✓	✓	✓	✓	✓		✓		✓	Raman
PJQZNT	✓	✓		✓	✓	✓			✓	
PKH2RW	✓				✓					
PR23AU	✓	✓			✓	✓			✓	Pyrolysis GC/MS
PR7J8T	✓			✓	✓					
T6EWQN	✓	✓			✓				✓	RS (514, 633, 785 nm)

TABLE 2

WebCode	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility / Chemical	Microspectrophotometry	XRF / XRS	SEM / EDX	Other
T78PL8	✓				✓				✓	UV (long wave and short)
TBZRRT	✓				✓	✓				DXR Raman, Comparison Microscope
TQUGMP	✓				✓				✓	Raman Spectroscopy
U9D8MN	✓				✓				✓	
UD7CD8	✓	✓	✓		✓	✓			✓	
VC8NCM	✓				✓	✓			✓	
VG4A4Q	✓				✓			✓		
VWXYYM	✓	✓	✓		✓		✓		✓	Raman spectroscopy, LA-ICP-MS
W3DZUP	✓	✓	✓		✓		✓		✓	
WBBUP3	✓				✓				✓	
WHT4FK	✓	✓	✓		✓		✓		✓	
WLEMLP	✓		✓		✓					
X9H2UJ	✓	✓	✓		✓		✓		✓	
XZPQH4	✓	✓	✓		✓		✓	✓		Microscopic Exam: Comparison Transmitted and Reflected Light Microscopy
Z7LLVK	✓				✓					

Response Summary **Participants: 62**

	Stereomicroscope	Polarized Light	Fluorescence	Pyrolysis GC	FTIR	Solubility/ Chemical	Microspectrophotometry	XRF/XRS	SEM/EDX
Total	61	24	19	14	62	7	18	6	42
Percent	*98%*	*39%*	*31%*	*23%*	*100%*	*11%*	*29%*	*10%*	*68%*

Conclusions

TABLE 3

WebCode	Conclusions
24VKRG	The known paint reference from the first vehicle (Item #1) has the following layer structure: 1 – Clear Coat 2 – Blue Base Coat with Decorative Flakes 3 – Light Grey Primer 4 – Dark Grey E-Coat The known paint reference from the second vehicle (Item #2) has the following layer structure: 1 – Clear Coat 2 – Blue Base Coat with Decorative Flakes 3 – Light Grey Primer 4 – Dark Grey E-Coat The unknown paint chips recovered from the scene (Item #3) have the following layer structure: 1 – Clear Coat 2 – Blue Base Coat with Decorative Flakes 3 – Light Grey Primer 4 – Dark Grey E-Coat One of the paint chips from the scene (Item #3) was analyzed and compared to the known reference sample from the second vehicle (Item #2). Based on the examinations conducted, the layers comprising the analyzed paint chip from Item #3 are comparable in color, texture, relative thickness, and chemical composition to the corresponding layers of Item #2. Accordingly, the analyzed paint chip from Item #3 and Item #2 originated from the same vehicle or from different vehicles painted in the same manner (Type III Association). This level of association was reached because vehicles produced at the same manufacturing plant as the source of Item #2, which were painted with the same color code and same paint formulations, would also be indistinguishable from the source of the analyzed paint chip from Item #3. The paint from the scene (Item #3) does not compare to the known reference paint sample from the first vehicle (Item #1). No further analysis at this time. [Participant submitted data in a format that could not be reproduced in this report.]
266P4K	Questioned paint chips recovered from the crime scene (Item 3) and paint sample recovered from the damaged area of the second suspect vehicle (Item 2) have the common characteristics features.
2GLCBZ	Item 1 - Item 1 (known) was compared to item 3 (questioned). A significant difference was seen during FTIR analysis. Item 1 is ELIMINATED as being a source of item 3. Item 2 - Item 2 (known) was compared to item 3 (questioned). Based on physical properties (layers, layer sequence), microscopic properties and chemical properties (FTIR, PyGC/MS, and SEM/EDS), no significant differences were seen between the two items in all testing. Item 2 could have been the source of the paint chip in item 3.
2U8REZ	Items 1-3 were examined with a combination of the following techniques: stereoscopically (LED and UV light sources) and instrumentally using Fourier Transform Infrared Spectrometry and Scanning Electron Microscopy/Energy Dispersive Spectroscopy. Items 1 (known sample from first suspect vehicle) and 3 (questioned chips from scene) were not consistent with respect to examined chemical properties. Items 2 (known sample from second suspect vehicle) and 3 (questioned chips from scene) were consistent with respect to physical appearance, number of layers present and chemical composition of layers present. Therefore, items 1B and 1C may share a common source of origin. No statistical or numerical probabilities can be applied to the conclusions of this report.
33J6XG	Based on the analyses performed, the following conclusions are drawn: 1. Item 3 may originate from the same source as Item 2 2. Item 3 does not derive from Item 1
38QTCH	Item 3 was determined to be excluded as originating from Item 1. The number of layers were consistent and the thickness of the layers did slightly differ, but Item 3 could not be excluded as originating on microscopy alone because the samples received may have varied throughout the source. Item 3 was excluded as originating from Item 1 based on the differing IRs of the blue layers (topcoats). Item 3 could not be excluded as originating from Item 2 using microscopy or IR. Items 2 and 3 both had four layers (from top) greenish-gray, dark gray, light gray, and blue, and similar coating thickness for each layer. Items 2&3 also had similar IRs for the topcoat and primer, therefore Item 3 could not be excluded as originating from Item 2.
466A7D	Based on the analyses conducted, no exclusionary differences in stereomicroscopic properties,

TABLE 3

WebCode	Conclusions
	chemical composition (by FTIR), elemental composition (by Scanning Electron Microscopy-Energy Dispersive Spectroscopy), or color (by visible MSP) were observed between items 3 and 2. Therefore, the questioned paint (item 3) could have originated from the same source as represented by the known paint (item 2) or from another source of paint exhibiting all of the same analyzed/measured characteristics. Based on the analysis conducted, exclusionary differences were observed between items 3 and 1 with respect to the chemical composition of their clear coats. The questioned paint (item 3) could not have originated from the same source as represented by the known paint (item 1).
4P3XBE	Results of Examination 1. Layer Structure Determination a. Microscopic examination of questioned paint Q1 (Item #3) disclosed the following layer structure: i. Q1 - Clear coat (layer 1) / dark blue coat with decorative flakes (layer 2) / white primer (layer 3) / gray primer (layer 4) / thin light-yellow primer (layer 5) / silver-colored metal substrate b. Microscopic examination of known paints K1 (Item #1) and K2 (Item #2) disclosed the following layer structures: i. K1 - Clear coat (layer 1) / dark blue coat with decorative flakes (layer 2) / white primer (layer 3) / gray primer (layer 4) / thin light-yellow primer (layer 5) / blue metal substrate ii. K2 - Clear coat (layer 1) / dark blue coat with decorative flakes (layer 2) / white primer (layer 3) / gray primer (layer 4) / thin light-yellow primer (layer 5) / silver-colored metal substrate 2. Comparison Results a. One of the particles comprising questioned paint Q1 was designated Q1a and was analyzed instrumentally. b. Layer 1 (clear coat) of questioned paint Q1a and layer 1 (clear coat) of the known paint K1 are different with respect to chemical type. c. Questioned paint Q1 and known paint K2 are consistent and no exclusionary differences were observed with respect to their color, texture, layer structure, chemical type, and elemental composition. d. The remaining particle from questioned paint Q1 was designated Q1b. No further analysis was performed on this particle, therefore no conclusions can be made at this time. Interpretation of Results 1. It is the opinion of the undersigned that questioned paint Q1a could have originated from the same source as represented by the known submitted exemplar K2 or from another source exhibiting all of the same analyzed characteristics. 2. 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. 3. Questioned paint Q1b was not fully compared to known paints K1 and K2. Therefore, no conclusions can be made at this time.
6T6ZZF	Item 1 could be distinguished from item 3 on the basis of our examination procedures. It is therefore not possible that the paint fragment (item 1) originates from the crime scene. The paint layers of item 2 could not be distinguished from the paint layers from the crime scene (item 3) using the examination procedures carried out. Therefore, item 2 could have originiated from the crime scene (item 3).
7FCXVT	In my opinion: i. Item 3 (questioned paint sample recovered from the crime scene) could not have originated from Item 1 (known paint sample representative of the damaged area of the first suspect vehicle) based on the different chemical composition of the clear layers. ii. The findings provide strong support for the proposition that Item 3 (questioned paint sample recovered from the crime scene) originated from Item 2 (known paint sample representative of the damaged area of the second suspect vehicle). This evaluation is based on my understanding of the relevant circumstances as described above. If this assumption or any of the information is incomplete or incorrect, I will have to re-evaluate my findings.
7V6QFU	Item 1 and Item 2 were used for comparison purposes. The questioned paint chips (Item 3) are similar in visual color to the known paint from the first and second suspect vehicle (Item 1 and Item 2). One of these questioned paint chips was selected for further analysis and is similar in layer sequence, fluorescence, color, paint type, and paint composition to the known paint from the second suspect vehicle (Item 2). It is my opinion that the questioned paint could have come from the second vehicle or any other vehicle with similar paint characteristics. The questioned

TABLE 3

WebCode	Conclusions
	paint chip was dissimilar in paint type to the known paint from the first suspect vehicle (Item 1). It is my opinion that the questioned paint chip did not originate from the sampled area of the first suspect vehicle. No analysis was performed on the remaining paint chips.
7ZXTLF	Item 3 and Item 2 match based on FTIR analysis, and therefore could have been originated from the same source.
8Q74BP	1. The following items were submitted to the laboratory as proficiency test samples from Collaborative Testing Services (CTS): a. Exhibit 1, CTS Item 1: Known paint sample representative of the damaged area of the first suspect vehicle. b. Exhibit 2, CTS Item 2: Known paint sample representative of the damaged area of the second suspect vehicle. c. Exhibit 3, CTS Item 3: Questioned paint chips recovered from the crime scene. 2. Exhibits 1, 2, and 3 each consist of four layers of paint on an apparent metal substrate and are consistent with an automotive paint application: a. Layer 1: colorless clearcoat b. Layer 2: dark blue basecoat with effect pigment c. Layer 3: light grey primer d. Layer 4: medium-dark grey primer 3. Comparative examinations of Exhibit 2 (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 second suspect vehicle as represented by Exhibit 2, or another source of automotive 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. 4. Comparative examinations of Exhibit 1 (known paint sample) with Exhibit 3 (questioned paint sample) disclosed them to be inconsistent in their chemical compositions. As a result of these findings, Exhibit 3 could not have originated from the first suspect vehicle as represented by Exhibit 1.
9KVZTA	The physical characteristics, chemical composition and color of the paint layer of item 1 are consistent with the results obtained for item 3.
9UMFFT	The vehicle as represented by the paint in Item 1 is excluded as the source of the questioned paint in Item 3. The paint samples in Items 2 and 3 are similar in all examined characteristics. The vehicle as represented by the paint in Item 2 could be the source of the paint in Item 3.
A43PGR	The metallic blue paint in Item 3 was indistinguishable from the metallic blue paint in Item 2 in color, polymer type, texture, layer structure, and elemental composition (Type 3 Association). This means that the questioned paint chips recovered from the crime scene could have come from the damaged area of the second suspect vehicle. The metallic blue paint in Item 3 was different from the metallic blue paint in Item 1 (Elimination). This means that the questioned paint chips recovered from the crime scene did not come from the damaged area of the first suspect vehicle. Trace Interpretation Scale Type 1 Association: Physical match — 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 measure 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

TABLE 3

WebCode	Conclusions
	comparative value. or (2) 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, and/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.
A6ZXPB	The comparison between the exemplar blue metallic paint chip in item 2 and the unknown blue metallic paint chip (A) in item 3 revealed similar class characteristics including physical and chemical properties. The source of the exemplar blue metallic paint chip in item 2 is included as a possible source of the unknown blue metallic paint chip (A) in item 3. The comparison between the exemplar blue metallic paint chip in item 1 and the unknown blue metallic paint chip (A) in item 3 revealed dissimilar class characteristics including chemical properties. The source of the exemplar blue metallic paint chip in item 1 is excluded as a possible source of the unknown blue metallic paint chip (A) in item 3. For another exemplar paint sample to be considered as a possible source of the unknown paint chips in item 3, they must share the same color, layer sequence, and chemical properties.
BJFHMA	The Questioned paint chips recovered from the crime scene (Item 3) could have originated from the damaged area of the second suspect vehicle (Item 2), because of the similarities of their physical properties and chemical compositions. The Questioned paint chips recovered from the crime scene (Item 3) could NOT have originated from the damaged area of the first suspect vehicle (Item 1), because of the differences of their physical properties and chemical compositions.
BTNRE9	RESULTS OF EXAMINATION 1. Observations a. Examination of Laboratory items #1, 2, and 3 disclosed that all four particles appear to be the same shade of blue when viewed from the top. 2. Layer Structure Determination a. Microscopic examination of questioned paint QA and known paints K1 and K2 disclosed the following layer structure: Top clearcoat (layer 1) Blue colorcoat with decorative flakes (layer 2) Light colored grey primer (layer 3) Grey primer (layer 4) Light colored yellow primer (layer 5) Metal substrate b. Metal substrates of QA, QB, and K2 are silver colored. Metal substrate of K1 is blue. c. Full analysis of QB was not conducted, therefore no conclusions can be made at this time. 3. Instrumental Analysis and Comparison Result a. Questioned paint QA and the known paint K1 are different with respect to chemical type and elemental compositions of their top clearcoats. b. Questioned paint QA and known paint K2 are consistent and no exclusionary differences were observed with respect to their color, texture, layer structure, chemical type, and elemental composition. INTERPRETATION OF RESULTS 1. It is the opinion of the undersigned that questioned paint QA could not have originated from the same source as represented by the known paint K1 submitted. 2. It is the opinion of the undersigned that questioned paint QA could have originated from the same source as represented by the known submitted exemplar K2 or from another source exhibiting all of the same analyzed characteristics. [Participant submitted data in a format that could not be reproduced in this report.]
CG7UKP	RESULTS AND INTERPRETATIONS: Multilayered blue paint samples with decorative flake in Items 2 and 3 were consistent in colors, textures, types, layer sequence, and chemical compositions. Based on the samples examined, it was concluded that the paints in Items 2 and 3 originated from either the same source or different sources painted in the same manner (Level III - Association with Discriminating Characteristics). This type of conclusion was reached because other vehicles produced at the same manufacturing plant and painted with the same type of paint system would also be indistinguishable. It should be noted that the techniques used in this comparative analysis can typically distinguish paint systems from different assembly

TABLE 3

WebCode	Conclusions
	plants. Based on the samples examined, the multilayered blue paint samples with decorative flake in Items 1 and 3 could not be associated due to differences in chemical composition (Exclusion/Elimination).
CHXTYM	Item 3 corresponded in layer sequence, appearance and composition to Item 2, but differed in composition to layers in Item 1. This indicates that the paint chip recovered from the crime scene (Item 3) could have originated from the same source as the paint sample taken from the damaged area of the second suspect vehicle (Item 2), and could not have originated from the same source as the paint sample taken from the damaged area of the first suspect vehicle (Item 1). The frequency of vehicles with paint systems indistinguishable from Item 2 is unknown.
CPY6W6	According to the analytical results received, the paint chips in question (Item3) may have originated from the damaged area of the vehicle 2 (Item 2). However, no match to the paint from the damaged area of vehicle 1 (Item1) was be found.
CZ3ZDP	Metallic blue paint in Item 3 was indistinguishable from metallic blue paint in Item 2 in color, type, layer structure, texture, and elemental composition (Type 3 Association: Association with Conventional characteristics). This means that the questioned paint chips recovered from the crime scene could have originated from the second suspect vehicle. Item 3 was different from Item 1 (Elimination). This means that the questioned paint chips recovered from the crime scene did not originate from the first suspect vehicle.
DTRYEJ	1. Comparative examinations of Exhibit 2 (known paint from the second suspect vehicle) with Exhibit 3 (questioned paint from the crime scene) 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 2, 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. 2. Comparative examinations of Exhibit 1 (known paint from the first suspect vehicle) with Exhibit 3 (questioned paint from the crime scene) disclosed them to be inconsistent in their organic compositions. As a result of these findings, Exhibit 3 could not have originated from Exhibit 1.
ENXRN3	The clear top coat, color coat, and primer layers of the selected paint chip from item 3 are similar in color, microscopical characteristics, elemental composition, and IR spectra to the clear top coat, color coat, and primer layers of item 2. Additionally, the clear top coat from item 3 is similar in UV-Vis spectra to the clear top coat from item 2. Therefore, the questioned paint chip could have originated from the damaged area of the second suspect vehicle or any other paint source with similar class characteristics. The clear top coat of the selected paint chip from item 3 has different IR and UV-Vis spectra than the IR and UV-Vis spectra of the clear top coat of item 1; therefore, the questioned paint chip did not originate from the damaged area of the first suspect vehicle.
FNWG4K	All 3 exhibits consisted of 4-layers on a metal substrate, Clear (L1), Metallic Blue (L2), Light Grey (L3), Dark Grey (L4). The respective layers were compared analytically by FTIR, UV-Visible micro-spectrophotometry and SEMEDS. With respect to the comparison between Item 1 and Item 3, the clear layer (L1) was different between the Item 1 and Item 3. Therefore, in my opinion, the results provide an elimination with respect to a comparison between Item 1 and Item 3. The exhibits were dissimilar in physical properties and/or chemical composition, proving that they did not originate from the same source. With respect to the comparison between Item 2 and Item 3, the respective layers were indistinguishable in relation to the testing performed. Therefore, in my opinion, the results provide a level 3 association with respect to a comparison between Item 2 and Item 3. A level 3 association is an association in which exhibits are consistent in observed and measured physical properties and/or chemical composition and, therefore, could have originated from the same source. Because other exhibits have been manufactured that would also be indistinguishable from the submitted

TABLE 3

WebCode	Conclusions
	evidence, an individual source cannot be determined.
FZPXTK	The five-layer paint sampled from Item 1 (Known from first vehicle) and Item 3 (Questioned from scene) were found to be dissimilar in chemical composition (FTIR). The damaged area of the first suspect vehicle is not the source of the paint chips recovered from the crime scene. The five-layer paint sampled from Item 2 (Known from second vehicle) and Item 3 (Questioned from scene) were found to be similar in chemical composition (FTIR). The damaged area of the second suspect vehicle cannot be excluded as a possible source of the paint chips recovered from the crime scene.
GJXKUJ	Item 1 is not similar in chemical composition to Item 3. Therefore, Item 1 could have not originated from the same source as Item 1. Item 2 is similar in layer structure, color, and chemical composition to Item 3. Therefore, Item 3 could have originated from the same source as Item 2.
GMWVR6	Physical examinations indicate that Items 1, 2 and 3 are indistinguishable from one another in that each consists of a four-layer automotive paint system on a primed metal substrate. The layer structure is as follows: clear coat / blue metallic color coat / light gray primer / medium gray electro-coat primer. However, the Item 3 clear coat layer differs in chemical composition from the Item 1 clear coat. Therefore, Item 3 did not originate from the same source as Item 1 (Elimination). Further, Items 2 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 2 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 could be reached. Elimination – The items exhibit exclusionary differences that demonstrate they did not originate from the same source.
HHFTKY	The physical and chemical properties of Items #1 and #2 were compared to Item #3. It is concluded that the known paint recovered from the damaged area of the first suspect vehicle (Item 1) could not have been the source of the questioned paint chip recovered from the crime scene (Item 3). It is further concluded that the known paint recovered from the damaged area

TABLE 3

WebCode	Conclusions
	of the second vehicle (Item 2) can not be eliminated as being the source of the questioned paint chip recovered from the crime scene (Item 3).
HR3RAJ	Item 1: This item was used for comparison purposes. Item 2: This item was used for comparison purposes. Item 3: This item contains two questioned paint chips that are similar in visual color to the known paint from the suspect vehicles (01-01-AA and 01-02-AA). One of these questioned paint chips was selected for further analysis and is similar in layer sequence, but different in fluorescence and paint type from the known paint from the first suspect vehicle (01-01-AA). It is my opinion that the questioned paint did not come from this vehicle (Category 5). This same questioned paint chip is similar in layer sequence, fluorescence, color, paint type, and paint composition to the known paint from the second suspect vehicle (01-02-AA). It is my opinion that the questioned paint could have come from the second suspect vehicle or any other vehicle with similar paint characteristics (Category 2B). No analysis was performed on the remaining paint chip.
J7HC7H	Item 3 did not originate from Item 1 based on the submitted sample. Item 3 originated from Item 2 or another source with similar characteristics.
JQNJLG	The paint sample from the crime scene, Item 3, consisted of two multilayered paint samples with a clear top layer, metallic blue 2nd layer, light grey 3rd layer, dark grey 4th layer and an off-white 5th layer on a metal substrate. The paint samples from the damaged areas of both the first and second, suspect vehicles, Items 1 and 2 respectively, both consisted of multilayered paint samples with a clear top layer, metallic blue 2nd layer, light grey 3rd layer, dark grey 4th layer and an off-white 5th layer on a metal substrate. The paint sample from the crime scene, Item 3, could not be distinguished from the paint sample from the damaged area of the second vehicle, Item 2, with respect to layer sequence and the colour, appearance and chemical and elemental compositions of the respective paint layers . Therefore, it is my opinion that the paint chips recovered from the crime scene, Item 3, could have originated from the damaged area of the second vehicle, Item 2. The polymer formulations of the clear top layer and metallic blue 2nd layer of the paint sample from the crime scene, Item 3, were distinguishable from the corresponding layers of the paint sample from the damaged area of the first vehicle, Item 1. Therefore, it is my opinion that the paint sample from the crime scene, Item 3, did not originated from the same source as the paint sample from the first vehicle, Item 1.
LENVKX	The questioned paint chips recovered from the crime scene (Item 3) may not have originated from the damaged area of the suspect vehicle represented by Item 1. The questioned paint chips recovered from the crime scene (Item 3) may have originated from the damaged area of the suspect vehicle represented by Item 2.
LHM7FX	Questioned sample 3 was consistent with known Sample 2 in color, structure and appearance of layers, and in polymer composition and elemental content of corresponding layers. Sample 2 represents a possible source for Sample 3. Sample 3 was not consistent with Sample 1. Sample 1 does not represent a possible source for Sample 3.
LNDGQW	The paint from items 1 and 2 was examined and compared to the paint from 1 of the 2 exhibits from item 3 using visible microscopy, polarized light microscopy, and fourier transform infrared spectroscopy (FTIR). The examined exhibits from items 1, 2, and 3 each consist of 5 layers. The FTIR results reveal differences between the clear layers of items 1 and 3. Thus, item 3 could not have originated from the same source as item 1 as represented by the examined samples in items 1 and 3. The 5 layers of item 3 and item 2 are consistent in appearance, microscopic, and chemical properties. Thus, item 3 could have originated from the same source as item 2 as represented by the examined samples in items 2 and 3 or another paint source exhibiting the same analyzed characteristics and layer structure. No analysis was performed on the remaining exhibit from item 3. Therefore, no conclusions can be reached on

TABLE 3

WebCode	Conclusions
	that sample. Because paint is mass produced, it is not possible to state that item 3 originated from a particular source to the exclusion of all other materials that exhibit the same visual, microscopic, and chemical properties.
LP8ALE	CONCLUSIONS: The questioned paint recovered from the crime scene (item 3) is the same distinct type of paint as the known paint on the second suspect vehicle (item 2) and originated either from that source or another source of automotive paint having the same distinct characteristics. The questioned paint recovered from the crime scene (item 3) did not originate from the area/panel of the first suspect vehicle represented by item 1. RESULTS: Questioned paint identified as recovered from the crime scene (item 3) was examined for the purpose of determining whether or not it is like that on the suspect vehicles (items 1 and 2). The paint standard from the second suspect vehicle (item 2) has the following layer structure: 1. Colorless acrylic-urethane-melamine enamel clearcoat 2. Medium blue basecoat with effect pigment 3. Light grey polyester-melamine enamel primer 4. Dark grey polyester-melamine enamel primer 5. Off-white polyester-urethane enamel primer 6. Metal substrate This paint exhibits characteristics typical of an original automotive finish and was used for comparison with questioned paint recovered from the crime scene (item 3). Examination and comparison of the questioned paint (item 3) with item 2 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 crime scene (item 3) is the same distinct type of paint as that on the second suspect vehicle (item 2) and originated either from that vehicle, or from another source of automotive paint having the same distinct characteristics. The paint standard from the first suspect vehicle (item 1) has the following layer structure: 1. Colorless acrylic-urethane enamel clearcoat 2. Medium blue basecoat with effect pigment 3. Light grey polyester-melamine enamel primer 4. Dark grey polyester-melamine enamel primer 5. Off-white polyester-urethane enamel primer 6. Metal substrate This paint exhibits characteristics typical of an original automotive finish and was used for comparison with questioned paint recovered from the crime scene (item 3). Examination and comparison of the questioned paint (item 3) with item 1 revealed they are dissimilar with respect to binder characteristics of layers 1 and 2. It is therefore concluded that the questioned paint recovered from the crime scene (item 3) did not originate from the area/panel of the vehicle 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.
LZ8XFW	The blue metallic paint chips in Item# 1-3 are similar in color and layer sequence but dissimilar in chemical composition to the paint chip in Item# 1-1, therefore the paint chips in Item# 1-3 could not have originated from the same source as the paint in Item# 1-1. The blue metallic paint chips in Item# 1-3 are similar in color, layer sequence, and chemical composition to the paint chip in Item# 1-2, therefore the paint chips in Item# 1-3 could have originated from the same source as the paint in Item# 1-2.
N6WW6C	I formed the opinion based on the technique used that the questioned paint chips (item 3) recovered from the crime scene were chemically different to the known paint sample representative of the damaged area of the first suspect vehicle (item 1) and could not have originated from it. I also formed the opinion based on the techniques used that the questioned paint chips (item 3) recovered from the crime scene had a different layer sequence to the known paint sample representative of the damaged area of the second suspect vehicle (item 2) and could not have originated from it.
N9W8ZC	The paint from the damaged area of the first suspect vehicle (item 1), damaged area of the second suspect vehicle (item 2) and questioned paint chips recovered from the crime scene (item 3) each consisted of multi-layered metallic blue paint. The multi-layered paint from each

TABLE 3

WebCode	Conclusions
	of these items consisted of a clear top coat, metallic blue second coat, light grey third coat, grey fourth coat and a very thin dull yellow fifth coat on a metal substrate. The clear top coat from the first suspect vehicle (item 1) was found to have a different chemical composition to the clear top coat from the paint chips from the crime scene (item 3). Therefore the paint chips from the crime scene could not have originated from the first suspect vehicle. In relation to colour, chemical composition and elemental composition the top four paint layers from the suspect vehicle (item 2) were found to be indistinguishable from the corresponding layers of the paint chips from the crime scene (item 3). Therefore these two paint samples may share a common origin. Note: the thin dull yellow fifth coat from these items was too thin to obtain a sample for analysis.
NUT4DW	Comparative examination of the paint layers from Item 1 (Sample ID [Number]) and Item 3 (Sample ID [number]) by FTIR and optical microscopy found differences in the physical and chemical composition of the surface layer of each sample. Item 1 and Item 3 do not have a common origin. Comparative examination of the paint layers from Item 2 (Sample ID [number]) and Item 3 (Sample ID [number]) by FTIR and optical microscopy found that the physical and chemical compositions of the outer blue and inner white layer of each sample were comparable. Item 3 and Item 2 have a common origin.
PCPNPB	The questioned paint sample (Item 001-3) recovered from the crime scene was distinguishable from the known paint sample (Item 001-1) representative of the damaged area of the first suspect vehicle. Therefore, the questioned paint sample (Items 001-3) did not come from the sampled area of the known paint sample (Item 001-1) representative of the damaged area of the first suspect vehicle. The questioned paint sample (Item 001-3) recovered from the crime scene was indistinguishable from the known paint sample (Item 001-2) representative of the damaged area of the second suspect vehicle. Therefore, the questioned paint sample (Items 001-3) could have come from the damaged area of the second suspect vehicle (Item 001-2) or from another source of paint with the same physical and chemical properties.
PJQZNT	The paint in Item 3 is similar in color, layer sequence and chemical composition to the paint in Item 2. Therefore, the paint in Item 3 could have originated from the same source as the paint in Item 2. The paint in Item 3 is dissimilar in chemical composition to the paint in Item 1 and did not originate from the same source as Item1.
PKH2RW	Items 02 and 03, are composed by 3 layers, being all equal in disposition and composition, so they may have a common origin. Items 01 and 03, are composed by 3 layers, being all equal in disposition, but just primer layers has the same composition, so they may NO have a common origin.
PR23AU	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. The paint in Item 3 is similar in color, layer sequence, and chemical composition to the paint in Item 2; therefore, the paint in Item 3 could have originated from the same source as the paint in Item 2.
PR7J8T	The paint from item-3 (questioned paint chips recovered from the crime scene) and item-2 (known paint sample representative of the damaged area of the second suspect vehicle) were consistent on color, layering and chemical composition and could have originated from the same source (second suspect vehicle). The paint from item-3 (questioned paint chips recovered from the crime scene) and item-1 (known paint sample representative of the damaged area of the first suspect vehicle) were consistent on color and layering, but were inconsistent on chemical composition and therefore could not have originated from the same source (first suspect vehicle).
T6EWQN	Questioned paint chips recovered from the crime scene (Item 3) could have orginated from the damaged area of the second suspect vehicle (Item 2). Questioned paint chips recovered from

TABLE 3

WebCode	Conclusions
	the crime scene (Item 3) could not have orginated from the damaged area of the first suspect vehicle (Item1).
T78PL8	Item 1, Item 2 and Item 3 are each composed of a 5-layer automotive paint system. The top layer is a clear coat followed by a blue color coat, a white primer, a gray primer followed by a light yellow e-coat. The questioned paint chips recovered from the crime scene (Item 3) are visually similar in color, layer structure, chemistry and elemental composition in comparison to the known paint sample representative of the damaged area of the second suspect's vehicle (Item 2). The paint from Item 3 could have originated from Item 2 or any other paint source similar in color, layer structure, chemistry and elemental composition. The questioned paint chips recovered from the crime scene (Item 3) are visually similar in color and layer structure, but different in chemistry and elemental composition in comparison to the known paint sample representative of the damaged area of the first suspect's vehicle (Item 1). The paint from Item 3 could not have originated from the same paint source as Item 1.
TBZRRT	The forensic examination of all items has been completed, and the findings are summarized in the following points. 1. Microscopic examination of cross-section, revealed a significant similarities between all three items (1, 2 &3) i.e. layers number, sequence, thickness, color, texture and could not found any variation in over-spray or any irregularity. 2. Identification of each layer carried out by utilizing DXR Raman, only the pigment were identified as "copper phthalocyanine" in all items. DXR Raman was in-active for the remaining layers. so no conclusion has been made. 3. Elemental analysis conducted using ICP-MS indicated a difference between Item 3 and both Item 1 and Item 2. 4. No conclusion could be drawn due to the FTIR microscope being out of order.
TQUGMP	The questioned paint chips recovered from the crime scene, marked "Item 3", could have originated from the same source as the known paint representative of the damage area of the second suspect vehicle, marked "Item 2", or another source of paint with similar characteristics. The questioned paint chips recovered from the crime scene, marked "Item 3", did not originate from the same source as the known paint representative of the damage area of the second suspect vehicle, marked "Item 1".
U9D8MN	The known paint samples (Item 1 and Item 2) as well as the questioned paint sample (Item 3) show the same paint layers: clearcoat, blue effect layer, beige layer, grey layer and a yellow layer. All layers of all samples were analyzed by microscopy, light microscopy, infrared spectroscopy and SEM/EDX. All samples cannot be differentiated by means of microscopy and SEM/EDX, but the clearcoat and the blue effect layer of Item 1 can be differentiated by means of infrared spectroscopy. Regarding to the methods used, the questioned paint chips from the crime scene (Item 3) could have originated from the damaged area of the second suspect vehicle (Item 2).
UD7CD8	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 Item #3 revealed the presence of two small pieces of metal painted blue reflective on one side. The blue reflective paint had the following layer structure: clear, blue reflective, light gray, and dark gray. Examination of Item #1 and Item #2 each revealed the presence of one small piece of metal painted blue reflective on one side. The blue reflective paint had the following layer structure: clear, blue reflective, light gray, and dark gray. The blue reflective paint from Item #3 is not consistent with the blue reflective paint in Item #1; therefore, the blue reflective paint in Item #3 did not originate from the same source as the blue reflective paint in Item #1. The blue reflective paint from Item #3 is physically and chemically consistent with the blue reflective paint in Item #2; therefore, the blue reflective paint in Item #3 could have originated from the same source as the blue reflective paint in Item #2.
VC8NCM	On analysis, I found: i) The questioned paint chips recovered from the crime scene (Item 3) to

TABLE 3

WebCode	Conclusions
	be similar to the known paint sample representative of the damaged area of the second suspect vehicle (Item 2). ii) The questioned paint chips recovered from the crime scene (Item 3) to be dissimilar to the known paint sample representative of the damaged area of the first suspect vehicle (Item 1). Based on the findings, I am of the opinion that: i) The questioned paint chips recovered from the crime scene (Item 3) and the known paint sample representative of the damaged area of the second suspect vehicle (Item 2) could have come from the same source. ii) The questioned paint chips recovered from the crime scene (Item 3) and the known paint sample representative of the damaged area of the first suspect vehicle (Item 1) did not come from the same source.
VG4A4Q	Physical and chemical examinations indicate that: item 1 differed in chemical composition from item 3. therefore, item 3 (questioned paint chips recovered from the crime scene) did not originated from item 1 (known paint sample representative of the damaged area of the first suspect vehicle). item 2 and item 3 are indistinguishable from one another. therfore, item 3 (questioned paint chips recovered from the crime scene) could have originated from item 2 (Known paint sample representative of the damaged area of the second suspect vehicle)
VWXYYM	1.) The questioned paint chips recovered from the crime scene (Item 3) couldn't have originated from the damaged area of the first suspect vehicle as represented by Item 1. 2.) The questioned paint chips recovered from the crime scene (Item 3) could have originated from the damaged area of the second suspect vehicle as represented by Item 2.
W3DZUP	The Interpretations &. Opinions stated below are based solely on the representative samples analyzed. Examination and comparison of representative layers in Items 2 and 3 were found to be similar in all measured physical, microscopic, chemical, elemental, and color properties. They could have come from the same source or any other source with the same properties. Examination and comparison of representative layers in Items 1 and 3 were found to be dissimilar in chemical properties. They could not have come from the same source.
WBBUP3	The questioned paint chips in item 3 and both known paint samples in items 1-2 consisted of 5-layered paint structure, with a colourless top layer, a metallic blue second layer, a pale grey third layer, a grey fourth layer and a pale yellow fifth layer on a metal substrate. The questioned paint chips in item 3 were found to agree in colour, layer sequence and chemical composition with the corresponding layers of the known paint sample in item 2, indicating that they had likely originated from the same source. The questioned paint chips in item 3 were found to agree in colour and layer sequence but the chemical composition of the colourless top layer and the metallic blue second layer were found to differ from the corresponding layers of the known paint sample in item 1, indicating that they did not originate from the same source.
WHT4FK	Information: The submitted questioned paint chips, reportedly recovered from a scene (Item 3), were examined and compared to known paint chips, reportedly collected from damaged areas of two separate vehicles (Items 1 and 2). All three items had a layering sequence of clear/metallic blue/light gray/dark gray. Samples of each layer of each item were analyzed using one or more 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 clear and metallic blue layers were dissimilar in chemistry. Item 3 did not originate from the damaged area of the vehicle as represented by Item 1 (Elimination). The analyzed samples of Item 3 and Item 2 were similar in all examinations performed. Item 3 originated either from the damaged area of the vehicle as represented by Item 2 or from another indistinguishable source (Level 3 - Association). Because other items have been painted in a manner that would also be indistinguishable from the submitted evidence, an individual source cannot be determined.
WLEMLP	The recovered paint sample Item 3, was found to show agreement in colour, layer structure,

TABLE 3

WebCode	Conclusions
	chemical properties and chemical composition to the suspect vehicle paint sample Item 2 such that in my opinion they could have had a common origin. The paint evidence provides moderate support that the recovered paint sample originated from this vehicle rather than from a different vehicle. The recovered paint sample Item 3, was found to show differences in chemical composition in the top two layers from the suspect vehicle paint sample Item 1, such that the recovered paint did not originate from this vehicle.
X9H2UJ	Examinations: Visual examination, stereomicroscopy, polarized light microscopy, fluorescence microscopy, infrared spectroscopy (IR), microspectrophotometry, scanning electron microscopy - energy dispersive spectroscopy (SEM-EDS) Information: Two known paint samples (Items 1 and 2) were submitted for comparison to a questioned paint sample (Item 3). Each item had a paint layer sequence of clear over metallic blue over white over gray. Results: The sampled clear layers of Item 3 and Item 1 differed in chemistry by IR. In the opinion of the examiner, the questioned paint in Item 3 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 2 in all tests performed. In the opinion of the examiner, the questioned paint in Item 3 originated either from the vehicle as represented by Item 2 or from another paint source with indistinguishable properties (Level 3 - Association). Because other vehicles or items may have been painted with paint that would also be indistinguishable from the submitted evidence, an individual source cannot be determined.
XZPQH4	The blue questioned automotive paint from the crime scene (Item 3) is disassociated from the known paint sample representative of the damaged area of the first suspect vehicle (Item 1) due to differences in elemental characteristics (μXRF) (Elimination). The blue questioned automotive paint from the crime scene (Item 3) is associated to the known paint sample representative of the damaged area of the second suspect vehicle (Item 2) upon comparison of chemical, elemental, optical, and physical properties and either originated from this vehicle or from another damaged automotive paint source with the same characteristics (Level III Association).
Z7LLVK	Results: 1. Exhibit 1 contained painted metal, having the paint layer sequence: clear / dark blue pearlescent / light grey / dark grey / light green – yellow. 2. Exhibit 2 contained painted metal, having the paint layer sequence: clear / dark blue pearlescent / light grey / dark grey / light green – yellow. 3. Exhibit 3 contained painted metal, having the paint layer sequence: clear / dark blue pearlescent / light grey / dark grey / light green – yellow. The clear, dark blue pearlescent, light grey, dark grey, and light green-yellow paint layers were physically indistinguishable from the corresponding paint layers in Exhibit 1. The clear and dark blue pearlescent paint layers were chemically different from the corresponding clear and dark blue pearlescent paint layers in Exhibit 1. The light grey, dark grey, and light green-yellow paint layers were chemically indistinguishable from the corresponding light grey, dark grey, and light green-yellow paint layers in Exhibit 1. The clear, dark blue pearlescent, light grey, dark grey, and light green-yellow paint layers were physically and chemically indistinguishable from the corresponding paint layers in Exhibit 2. Conclusions: 1. The paint in Exhibit 3 did not originate from the source of Exhibit 1. 2. The paint in Exhibit 3 originated either from the source of Exhibit 2, or from another source of paint having indistinguishable physical and chemical properties.

Additional Comments

TABLE 4

WebCode	Additional Comments
38QTCH	The identified bands that had dissimilar intensities between Items 1 &&3 were the 1725, 1460, 1375 and 765 cm-1 bands. There were not dissimilar bands or band intensities between the the topcoat nor primer layers of Items 2 & 3.
7V6QFU	The bottom yellow-gray primer layer was challenging to sample. I would be curious to know if this was purposefully present.
8Q74BP	suggest making primer layers slightly thicker - difficult to remove from soft metal substrate. clarify if the protective coating on the metal is a part of the substrate and not a part of the exam.
9KVZTA	It is considered appropriate to continue with these tests.
ENXRN3	The statement: "The purpose of this test is the examination of paint; please ignore the grey-coated aluminum metal substrate" is confusing. Is the grey coating on the substrate also to be ignored or just the aluminum substrate only? Previous tests have instructed to ignore the metal substrate.
FZPXTK	My examinations and analyses do not focus on the detection of inorganic materials. The three paint samples may vary in their inorganic chemical content.
T6EWQN	Item 2 and Item 3 cannot be differentiated using the methods applied during the study which are indicate in the point two. Further verification of the common origin of the compared materials would require the use of additional methods (e.g., Py-GC/MS), which, however, are not available in our laboratory.
T78PL8	Item 1, Item 2 and Item 3 were examined visually and using stereomicroscopy, UV-fluorescence, Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy/energy dispersive X-Ray spectroscopy (SEM/EDS). Samples collected and/or analyzed during the examination and analysis of the items in this case (ex. glass slides) have been returned to and retained with the original item.
WHT4FK	An Association Scale would also be included in the report to define the conclusions reached.
X9H2UJ	An association scale would be included with the report.
XZPQH4	Level of Association: Level I Association: A physical fit; items physically fit and/or align one another by way of corresponding surface characteristics. The associated items were once joined together to form a single item. Level II Association: Items correspond in all tested properties and share atypical characteristic(s) that would not be expected to be readily available in the population of this evidence type. No exclusionary differences are detected. Level III Association: Items correspond in all tested properties and, therefore, could have originated from the same source. Other items have been manufactured and/or are naturally occurring that would also correspond to the submitted evidence. No exclusionary differences are detected. Level IV Association: Items correspond in tested properties and, therefore, could have originated from the same source. The items share typical characteristics expected to be readily available in the population of this evidence type. No exclusionary differences are detected. Alternatively, an association between items could be categorized as a Level IV Association if a limited analysis is performed. The extent of limited analysis varies and is specified in the report. Definitions: Physical Fit: Associated items physically fit and/or align one another by way of corresponding surface characteristics. The associated items were once joined together to form a single item. Associated: The questioned sample is the same distinct type of material as the known standard based upon detected properties. In other words, one

TABLE 4

WebCode	Additional Comments
	could not discern a questioned sample if it were to be mixed with an associated known standard. No exclusionary differences are detected. Disassociated: Exclusionary differences are detected upon comparison. Inconclusive: No conclusion could be reached regarding an association or an elimination. Elimination: The sample did not originate from the source represented by the known standard. Samples are disassociated from the standard due to detecting exclusionary differences upon comparison.

-End of Report-
(Appendix may follow)

Collaborative Testing Services ~ Forensic Testing Program

Test No. 25-5451: Paint Analysis

DATA MUST BE SUBMITTED BY **April 28, 2025, 11:59 p.m. EDT** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A WebCode: EF87GJ

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 homicide case. Paint chips were recovered from the crime scene and, later that same day, police located two damaged suspect vehicles that resembled the color of the paint chips recovered at the crime scene. Known paint samples have been collected from the damaged area of the two vehicles. Police are requesting that you examine the recovered paint chips and determine if they could have originated from the damaged area of either of the two suspect vehicles.

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 grey-coated aluminum metal substrate.

Items Submitted (Sample Pack P1):
Item 1: Known paint sample representative of the damaged area of the first suspect vehicle.
Item 2: Known paint sample representative of the damaged area of the second suspect vehicle.
Item 3: Questioned paint chips recovered from the crime scene.

1.) Could the questioned paint chips recovered from the crime scene (Item 3) have originated from the damaged area of either of the two suspect vehicles as represented by Items 1 and 2?

	Item 1		
	Yes	No	Inconclusive
Item 3:	○	○	○

	Item 2		
	Yes	No	Inconclusive
Item 3:	○	○	○

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

Please check all that apply.

Microscopic Exams:	☐ Stereomicroscope	☐ Polarized Light
	☐ Fluorescence	
☐ Pyrolysis GC	☐ FTIR	☐ Solubility/Chemical
☐ XRS/XRF	☐ SEM/EDX	☐ Microspectrophotometry

Other (specify):

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

Note: *Please use appropriate punctuation to indicate the end of sentences, sections, and statements in the free-form space below. Extra spacing and returns used for separation within your text will not transfer and may cause your information to be illegible in the Summary Report. The use of lists and tabular formats to deliver information is also cautioned against, as these do not transfer.*

4.) Additional Comments

Note: *Please use appropriate punctuation to indicate the end of sentences, sections, and statements in the free-form space below. Extra spacing and returns used for separation within your text will not transfer and may cause your information to be illegible in the Summary Report. The use of lists and tabular formats to deliver information is also cautioned against, as these do not transfer.*

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)