



GSR-Distance Determination Test No.18-5301/5 Summary Report

Each sample set contained one of the following: An evidence piece of clothing (Q1) for chemical processing for a GSR pattern and either photographs (18-5301) or online downloadable images (18-5305) of GSR patterns produced by test shots at known distances on untreated test fabric (K1a) and treated test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). Participants were requested to process the clothing sample and report the range of distances, along with their conclusions and comments. Data were returned from 142 participants and are compiled into the following tables:

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

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

Manufacturer's Information

Each sample set contained a piece of clothing evidence (Q1) for chemical processing and either photographs or digital images of known distance test GSR patterns on unprocessed test fabric (K1a) and test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). Participants were requested to process the clothing item and report the range of distances that the muzzle of the firearm could have been from the fabric (Q1) at the time of discharge.

SAMPLE PREPARATION: The firearm used to produce the distance standards and evidence item was a Smith & Wesson Model M&P 9mm semiautomatic handgun with a 4.25" barrel and the ammunition was Remington Model L9MM3BP 9mm 115 grain FMJ.

DISTANCE STANDARDS (K1a-c): The fabric used for the known distances was white cotton. The firearm was locked into a fixture and the white cotton fabric was placed at a predetermined distance from the firearm. This was done for each of the predetermined distances. First, the known GSR patterns were imaged. Each known pattern was then processed using the Modified Griess procedure. Immediately following processing, the film paper was imaged. Finally, the known patterns were processed with Sodium Rhodizonate reagents, and the fabric imaged immediately after processing.

QUESTIONED ITEM (Q1): Item Q1 consisted of one section of a white T-shirt material (60% Cotton, 40% Polyester blend knit). The firearm was locked into a fixture and the shirt was placed 20 inches away from the muzzle of the firearm. After firing, the article of clothing (Q1) was packaged between two pieces of chipboard and placed into an envelope. This process was repeated until all of the items were created.

SAMPLE SET ASSEMBLY: For the printed photos, the Q1, K1a, K1b, and K1c envelopes were placed into a pre-labeled sample pack envelope, sealed with evidence tape, and initialed "CTS." For the Digital Download version, the Q1 item was placed in a pre-labeled sample pack envelope and the K1a, K1b and K1c files were loaded onto the CTS Portal.

VERIFICATION: Two of the three predistribution laboratories reported a greater than/less than range that surrounded the expected distance. The remaining predistribution laboratory reported a range that was on the lower end of the expected response. After reviewing the known distance photos and the questioned sample, CTS determined it was acceptable to move forward with regular distribution.

Summary Comments

This test was designed to allow participants to assess their proficiency in muzzle to target distance determination using gunshot residue patterns. Each participant received an evidence piece of clothing (Q1) for chemical processing in addition to photographs of GSR patterns at known distances on untreated test fabric (K1a) and treated test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). The evidence piece of clothing (Q1) was prepared with the firearm locked into a fixture and the white T-shirt material (60% Cotton, 40% Polyester blend knit) was placed 20 inches away from the muzzle of the firearm. (Refer to the Manufacturer's Information for preparation details.)

In Table 1, 136 of the 142 responding participants (96%) reported a greater than distance between 9 and 21 inches. 137 of the 142 responding participants (96%) reported a less than distance between 18 and 27 inches. In the Summary of this table, CTS has grouped the responses provided by the participants based on their greater than/less than distance results and provided a tally of the ranges between responses as calculated by CTS.

For greater than/less than distances, a +/-2" allowance from the known shot distance (20") was used as the baseline. Any reported "greater than" values which were larger than 22" and reported "less than" values which were smaller than 18" were highlighted as inconsistent. CTS then analyzed the ranges of the reported values and determined the most common reported range, the mode, was 12". A 3" allowance was provided to the modal value to account for the distance between the known distance standard images. Any reported range larger than 15" was highlighted as inconsistent.

CTS is aware that laboratory reporting policies differ and there are varying acceptable ranges. It will therefore be at the discretion of the laboratory to further evaluate participant's results based on their own policies and procedures.

Distance Determination Results

What is the distance range that the muzzle of the firearm could have been from the shirt (Q1) at the time of discharge? Please report a numeral response (e.g. "6") from the supplied Distance Standards. If reporting "Contact", indicate with the numeral "0".

TABLE 1 (Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
27WTDQ- 5301	12	24	12	4TGGAE- 5301	18	27	9	8X2ZJY- 5301	18	24	6
2ABM8N- 5301	18	24	6	4ZZWNA- 5305	15	27	12	92FYCL- 5301	12		
2CZTNE- 5301	15	27	12	6GNE9X- 5301	12	24	12	9UVP9G- 5301	21	27	6
2NB9UL- 5305	15	27	12	6LV3MZ- 5301	15	24	9	9XENH6- 5301	12	27	15
2RFMLJ- 5301	6	27	21	74VC7W- 5301	12	24	12	AEZPW8- 5301	9	18	9
2TM9TW- 5301	15	24	9	772TKE- 5301	12	24	12	APXC3K- 5301	12	24	12
2YEC4N- 5305	18	24	6	7JJMTY- 5305	15	27	12	B4DX33- 5301	15	27	12
3TNGGA- 5305	9	24	15	7RGHQW- 5301	21	27	6	BQTDLF- 5301	15	27	12
3VX4GA- 5301	15	24	9	7U6UP3- 5301	18	27	9	BX4Y74- 5301	9	24	15
3YXFDA- 5301	12	21	9	7X6XLV- 5301	12	27	15	C3JNAD- 5301	21	27	6
46DM7X- 5301	12	27	15	7ZAP93- 5301	15	27	12	C49UP4- 5301	15	24	9
49CUTG- 5301	12	27	15	8224FR- 5305	12	24	12	C997MN- 5301	15	27	12
4D9MH6- 5301	18	27	9	83BVNB- 5301	12	24	12	CDEWRF- 5301	21	27	6
4RQAUN- 5301	21	27	6	8GEATC- 5301	15	27	12	CEC4F2- 5305	9	24	15

TABLE 1 (Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
CFADB4-5301	15	24	9	EYR9U2-5301	12	24	12	HGGQBR-5301	18	27	9
CKW94V-5305	18	27	9	F7J7WW-5305	3	27	24	HGJC88-5301	12	27	15
CLX24N-5305	15	27	12	FEJLP9-5301	18	27	9	HLE4F6-5301	12	27	15
CNKK32-5301	12	24	12	FHF6R8-5301	12	27	15	HVD3JW-5301	9	24	15
CQMHFE-5301	18	27	9	FPKRX-5301	21	27	6	HWC236-5301	12	21	9
CULXMJ-5301	12	24	12	FVQFJ4-5301	15	27	12	J496NV-5301	15	21	6
D2H7Q9-5301	12			G4DWMX-5301	15	27	12	J8B4YL-5301	21	27	6
D3CYHK-5301	24	27	3	G976PJ-5301	15	27	12	JH8AU6-5301	12	24	12
DERLXD-5301				G9QL6L-5301	18	27	9	JM2279-5301	12	27	15
DM2BDW-5301	9	24	15	GB3E4U-5301	12	21	9	K2FRHF-5305	12	24	12
DPNYPY-5305	9	18	9	GCP2FW-5305	6	24	18	K38U4C-5301	15	27	12
EAUK7H-5301	12	27	15	GCRPUM-5301	15	24	9	KEMJ43-5305	12	27	15
EDAYUP-5301	21	27	6	GQQPQW-5301	9	21	12	KL638Z-5301	9	24	15
EL63YL-5301	15	21	6	GRJPJ2-5301	21	24	3	KRQ8UB-5301	15	27	12
ELNZVJ-5301	12	27	15	HAYFXQ-5301	15	21	6	KUH2X6-5301	15	24	9

TABLE 1 (Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
L8YELJ-5305	12	15	3	PMJ2QY-5301	12	27	15	VH8BH2-5301	15	21	6
LANQLP-5301	12	27	15	Q6ZUN2-5301	21	27	6	W9X2WR-5301	9	21	12
LBJ4B3-5301	9	21	12	Q9VNJG-5301	15	24	9	WDUTZH-5301	9	24	15
LDPQLM-5301	15	21	6	QGNYUC-5301	21	27	6	WJTEPY-5301	12	24	12
LH2RQQ-5305	9	24	15	QH7KQA-5305	12	27	15	WKCC4H-5301	12	27	15
LHY3LT-5301	9	21	12	QWKTTP-5301	18	27	9	WKU66R-5301	12	27	15
LWGWRR-5301	15	24	9	R9DRXA-5301	12	27	15	WLK9TT-5301	15	27	12
MD6A7J-5301	12	27	15	RH3K6Z-5301	15	24	9	X86NQE-5301	15	27	12
MEX6QA-5301	12	24	12	RJRQLQ-5301	18	27	9	XA7TYT-5301	21	27	6
MG4L46-5301	15	24	9	RK7FMG-5301	18	27	9	XN6K4H-5301	12	27	15
MTVCLN-5301	18	24	6	TECTDU-5305	12	21	9	XYM4LV-5301	12	27	15
NC9EX2-5301	12	24	12	THVVD8-5301	18	24	6	XZ3EKL-5301	15	27	12
P92FXT-5301	18	24	6	TVG8PG-5301	15	27	12	Y7ZPQ3-5301	12	27	15
P944LX-5305	12	24	12	VCZM7J-5301	12	27	15	Y9BEBE-5305	15	21	6
PLA2LR-5301	15	27	12	VERUBF-5301	12	24	12	YCBGJN-5301	15	27	12

TABLE 1 (Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
YDMFFJ- 5301	15	27	12								
YNMVFX- 5301	12	24	12								
YQCARC- 5301	12	21	9								
Z7FBWX- 5301	12	21	9								
ZERCEU- 5301	12	24	12								
ZGWX7Y- 5301	12	24	12								
ZM4JZN- 5301	12	27	15								
ZN2UVQ- 5301											
ZQ3Z7Q- 5301	18	24	6								
ZTT7MF- 5301	12	24	12								

Response Summary				Participants: 142	
Greater Than Distance	Participants Reporting	Less Than Distance	Participants Reporting	CTS Calculated Range	Participants Reporting
Contact / 0	0 (0.00%)	Contact / 0	0 (0.00%)	3	3 (2.11%)
3	1 (0.70%)	3	0 (0.00%)	6	24 (16.90%)
6	2 (1.41%)	6	0 (0.00%)	9	30 (21.13%)
9	14 (9.86%)	9	0 (0.00%)	12	47 (33.10%)
12	53 (37.32%)	12	0 (0.00%)	15	31 (21.83%)
15	39 (27.46%)	15	1 (0.70%)	18	1 (0.70%)
18	18 (12.68%)	18	2 (1.41%)	21	1 (0.70%)
21	12 (8.45%)	21	16 (11.27%)	24	1 (0.70%)
24	1 (0.70%)	24	49 (34.51%)	Other	0 (0.00%)
27	0 (0.00%)	27	70 (49.30%)	No Response	4 (2.82%)
Other	0 (0.00%)	Other	0 (0.00%)		
No Response	2 (1.41%)	No Response	4 (2.82%)		

Conclusions

TABLE 2

WebCode-Test	Conclusions
27WTDQ-5301	<p>1) Exhibit 2 (Cloth) was visually, microscopically, and chemically examined for the presence of a pattern of gunpowder residues consistent with the discharge of a firearm. a) A hole of entry with a pattern of gunpowder residues was found near the center of the fabric. 2) Exhibit 1 (Photographs of known distance test patterns from contact to 27 inches - Visual, Modified Griess, and Sodium Rhodizonate) was submitted for comparison to the pattern of gunpowder residues found on Exhibit 2. a) The pattern of gunpowder residues that was found on Exhibit 2 was reproduced at a muzzle-to-target distance between approximately 12 inches to 24 inches. 3) Exhibit 2.1 (Modified Griess Test Paper and Sodium Rhodizonate Controls) was created during chemical examination of Exhibit 2 and is being returned with Exhibit 2.</p>
2ABM8N-5301	<p>3. On 2018-04-19 during the performance of my official duties I received a sealed evidence bag with number PW4000732451 from Case Administration of the Ballistics Section, containing the following item: 3.1 One (1) sealed envelope, marked "2018 CTS Forensic Testing Program TEST NO. 18-5301: GSR-DISTANCE DETERMINATION Sample Pack: GSRP", containing the following items: 3.1.1 One (1) sealed envelope, marked "Test No. 18-5301 ITEM Q1", containing the following exhibit: 3.1.1.1 One (1) white shirt. 3.1.2 One (1) sealed envelope, marked "Test No. 18-5301 ITEM K1a", containing the following exhibits: 3.1.2.1 Ten (10) pictures of Powder Pattern distance standards. 3.1.3 One (1) sealed envelope, marked "Test No. 18-5301 ITEM K1b", containing the following exhibit: 3.1.3.1 Ten (10) pictures of NaRh Pattern distance standards. 3.1.4 One (1) sealed envelope, marked "Test No. 18-5301 ITEM K1c", containing the following exhibits: 3.1.4.1 Ten (10) GSR – Distance Determination standards. 4. The intention and scope of this forensic examination comprise the following: 4.1 Shot range determination. 5. I examined the shirt mentioned in paragraph 3.1.1.1 and found the following: 5.1 One (1) hole, with the appearance of bullet hole, on the middle area of the shirt marked by me "149698/18A". 6. 6.1 During the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 propellant residue was found surrounding the hole mentioned in paragraph 5.1. 6.2 Modified-griess test was applied and compared to the standards mentioned in paragraphs 3.1.2.1, 3.1.3.1 and 3.1.4.1 and they indicate that the shot was fired at a distance of between "18" inches (45.72cm) and "24" inches (60.96cm).</p>
2CZTNE-5301	<p>The area around Hole 1 was microscopically examined and chemically processed for gunshot residues and a pattern of residues was found consistent with discharge of a firearm and passage of a bullet. Using a Smith & Wesson model M&P 9mm semiautomatic pistol with Remington model L9MM3BP 9mm 115 grain FMJ ammunition, this pattern of residues was reproduced at a muzzle-to-target distance of between 15 inches and 27 inches.</p>
2NB9UL-5305	<p>The muzzle to target distance from visual and chemical examinations was determined to be greater than 15 inches and less than 27 inches.</p>
2RFMLJ-5301	<p>The area surrounding the hole in the center of Item # Q1 was examined microscopically and processed chemically for the presence of gunshot residues, and a pattern of residues was found. Test patterns were produced at various distances using the suspect firearm and like ammunition. Based on these comparisons, it was determined that a pattern of residues like that found on this exhibit could be produced at muzzle-to-garment distances of greater than 6 inches, but less than 27 inches.</p>
2TM9TW-5301	<p>According to the observation to the images of GSR patterns on untreated white cotton clothes and Modified Griess Test treatments, the distance range that the muzzle of the firearm could</p>

TABLE 2

WebCode-Test	Conclusions
	have been from the shirt at the time of discharge should be greater than 15 inches and less than 24 inches.
2YEC4N-5305	Shooting distance of the muzzle of the firearm from the shirt has been between 18" to 24".
3TNGGA-5305	Item 2-1 was examined for the presence of bullet defects and gunshot residue using visual, microscopic, and chemical techniques. A bullet defect, Hole A, was observed to the center of item 2-1. Bullet wipe, gunpowder, nitrite residue, lead wipe, and vaporous lead residue were observed surrounding Hole A. Using the submitted photographs of gunshot residue patterns created by the evidence firearm and evidence ammunition, a range of fire was determined. The muzzle of the firearm was at some distance greater than nine inches but less than twenty-four inches from item 2-1 when the shot that created Hole A was fired, provided there was no interposed target.
3VX4GA-5301	Deposits characteristic of the discharge of a firearm were detected around the hole on item Q1 (white cloth). A pattern of nitrites was observed. The residue pattern indicates a muzzle to target distance between fifteen and twenty four inches.
3YXFDA-5301	Deposits with characteristics of gunshot residue were detected. The hole has characteristics observed in entrance holes caused by the passage of a projectile. The residue pattern indicates a muzzle-to-target distance between twelve (12) and twenty one (21) inches.
46DM7X-5301	In the absence of any intervening object(s), the distance the muzzle of the firearm would have been from the shirt (Q1) at the time of discharge would have been 12 inches to 27 inches (inclusive).
49CUTG-5301	Examination of the shirt in Item Q1 revealed the presence of one hole. The area surrounding this hole was examined microscopically and processed chemically for the presence of gunpowder and lead residues. A pattern of gunpowder and lead residues was found around the hole. Using the supplied distance standards, it was determined that a pattern of residues like those found around the hole in Item Q1 could be produced at muzzle-to-target distances of greater than twelve (12") inches, but less than twenty seven (27") inches.
4D9MH6-5301	The shirt presents a bullet hole inflected by short distance in a range between 18 and 27 inches.
4RQAUN-5301	I examined the cloth mentioned in 3.1 and found the following: A hole ± in the centre of the cloth. During the optical and chemical examination of the bullet hole mentioned, propellant residue was found surrounding the hole. Shot range determination tests were performed. Tests indicate that the shot was fired at a distance of between 21 inches and 27 inches.
4TGGAE-5301	No fouling was observed visually. Powder grains were observed visually. A wipe-off rim was observed visually. A griess test was performed on defect A entrance and a nitrite pattern was detected that indicates an intermediate approximate muzzle to target distance. The powder grain pattern and the nitrite pattern detected on the griess test for defect A entrance on item 4, the section of white shirt, is consistent in diameter and particle population with the powder grain patterns and nitrite patterns detected from the test fire targets between the distances of 18 inches to 27 inches.
4ZZWNA-5305	The distance of firing between the muzzle of the firearm and the shirt marked "Item Q1" was estimated to be between 15 inches and 27 inches.

TABLE 2

WebCode- Test	Conclusions
6GNE9X- 5301	The area around the hole in the R-1 shirt (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. The T-1, T-2 and T-3 distance standards (Items K1a-c) were compared and patterns similar to that observed on the R-1 shirt (Item Q1) were produced at distances of greater than twelve (12) inches and less than twenty-four (24) inches.
6LV3MZ- 5301	During optical and chemical examination of the bullet hole propellant residues was found surrounding the hole this could indicate that the shot was fired between the distance of 15inches and 24inches
74VC7W- 5301	The R-1 twill cloth was examined and chemically processed for the presence of gunshot residues and a pattern was found. The distance standard photographs of T-1 through T-3 were compared to the pattern seen on the R-1 twill cloth. Patterns similar to the R-1 twill cloth were produced at distances greater than twelve (12) inches and less than twenty-four (24) inches.
772TKE- 5301	Visual and microscopic examination of the area around the hole in Exhibit 1 found apparent gunpowder particles. A particle was removed from Exhibit 1 which tested positive for nitrates using diphenylamine. The area around the hole in the Exhibit 1 piece of shirt cloth was chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the Exhibit 2-4 distance determination standard photos, the pattern was determined to be reproducible at a distance range greater than twelve inches and less than twenty four inches.
7JJMTY- 5305	The white cloth (Item Q1) was shot from a distance ranging from 15 inches to 27 inches.
7RGHQW- 5301	During examination and application of the Modified Griess Test I determined that the shots on the cloth were fired at a distance of 21 and 27 inches.
7U6UP3- 5301	The shot fired in the fragment of fabric is consistent with a short distance range, between eighteen and twenty seven inches from the muzzle of the weapon and the target.
7X6XLV- 5301	The Exhibit Q1 white cloth was microscopically examined and chemically processed (designated Q1T1) for the presence of gunshot residues. A pattern of gunshot residues was found around a suspect bullet entrance hole located approximately in the center of the white cloth. Comparisons of the Exhibit Q1 pattern of residues to the Exhibit K1A, K1B and K1C photographs indicate that the pattern of residues could be reproduced at a muzzle-to-target distance of greater than twelve (12) inches and less than twenty-seven (27) inches.
7ZAP93- 5301	In the portion of the t-shirt is established the presence of a bullet hole caused by the passage of projectile fire from a firearm, being determined as distance short, with a range of 15 to 27 inches approximately between the muzzle of the weapon and impact site, that based on the comparison of the results found between the distance of standards and the sample.
8224FR- 5305	The area around the hole near the center of Item 2 (a white piece of cloth) was visually examined and chemically processed for the presence of gunshot residues. Based on a comparison against Item 1 (images of known distance patterns), the pattern of residues observed on Item 2 was reproduced at a distance of between 12 inches and 24 inches.
83BVNB- 5301	The following submitted evidence was visually and microscopically examined and chemically processed: Exhibit 1: Three sets of photographs of known distance gunpowder residue test patterns from contact to 27 inches (Visual, Modified Griess processed, and Sodium Rhodizonate processed.) Exhibit 2: White cloth square with center hole. Exhibit 2.1: Nitrite residue pattern created from Modified Griess Test. 1. A pattern of physical effects and

TABLE 2

WebCode-Test	Conclusions
	<p>gunpowder residues, which are consistent with the discharge of a firearm, were located on Exhibit 2. The pattern was compared to the known distance test pattern photos in Exhibit 1. The pattern of gunpowder residues on Exhibit 2 is consistent with those shown in the photos from a muzzle-to-target distance between approximately 12 and 24 inches. 2. A pattern of nitrite residues on photographic paper was generated during the testing of the white cloth. The paper with the pattern was labeled as Exhibit 2.1 and is being returned with Exhibit 2.</p>
8GEATC-5301	<p>The area surrounding the defect in approximately the center of the piece of white t-shirt, Item Q1, was visually examined, microscopically examined and chemically processed for the presence of gunshot residues. This examination revealed a pattern of gunshot residues. Using the provided distance standards, Items K1A-K1C, it was determined that a pattern of residues like that displayed on Item Q1, could be produced at a muzzle to target distance between fifteen (15) and twenty-seven (27) inches.</p>
8X2ZJY-5301	<p>The Q1 cloth was subjected to physical examination firstly and a chemical analysis in second term. After carrying out the indispensable comparative study among standards and the Q1 treated with Sodium Rhodizonate, we can conclude a range between 18 and 24 inches.</p>
92FYCL-5301	<p>Residues consistent with the discharge of a firearm were detected on Laboratory Item (001.D) (Q1) victim's shirt. The firearm discharge distance was determined to be greater than 12 inches.</p>
9UVP9G-5301	<p>The powder pattern on the shirt (item Q1) was compared with the series of test firings and I estimate that the shot was fired from a distance of between 21 and 27 inches.</p>
9XENH6-5301	<p>The shot was fired from a distance greater than 12 inches and less than 27 inches.</p>
AEZPW8-5301	<p>The hole in Item Q1 was microscopically examined and chemically processed for gunpowder and lead residues (gunshot residues). The patterns of gunshot residues on Item Q1 are consistent in size and density with the muzzle of a firearm having been greater than approximately 9 inches and less than approximately 18 inches, from this area, at the time of firing. The resultant materials from processing Item Q1 are being returned as Item Q1M in Sample Pack GSRP and should be maintained for possible future examinations.</p>
APXC3K-5301	<p>The area around the Item Q1 hole was examined and chemically processed for the presence of gunshot residues. Residues consistent with the discharge of a firearm and passage of a bullet were found around the hole. The gunshot residue pattern around the hole is consistent with K1a – K1c tests fired at a muzzle-to-target distance greater than 12 inches and less than 24 inches.</p>
B4DX33-5301	<p>In my opinion having compared the supplied distance standards (K1a-c) with Item Q1, the range of fire from muzzle to item Q1 can be estimated to be greater than 15" inches and less than 27" inches.</p>
BQTDLF-5301	<p>3. On 2018-04-18 during the performance of my official duties I received a sealed evidence bag with number PW4000732450 from Case Administration of the Ballistics Section, containing the following item: 3.1 One (1) sealed envelope, marked "2018 CTS Forensic Testing Program TEST NO. 18-5301: GSR-DISTANCE DETERMINATION Sample Pack: GSRP", containing the following items: 3.1.1 One (1) sealed envelope, marked "ITEM Q1", containing the following exhibit: 3.1.1.1 One (1) white shirt. 3.1.2 One (1) sealed envelope, marked "ITEM K1a", containing the following exhibit: 3.1.2.1 One (1) pair of Powder Pattern distance standards. 3.1.3 One (1) sealed envelope, marked "ITEM K1b", containing the</p>

TABLE 2

WebCode-Test	Conclusions
	<p>following exhibit: 3.1.3.1 One (1) pair of NaRh Pattern distance standards. 3.1.4 One (1) sealed envelope, marked "ITEM K1c", containing the following exhibit: 3.1.4.1 One (1) Modified-Griess test distance standards. 4. The intention and scope of this forensic examination comprise the following: 4.1 Shot range determination. 5. I examined the shirt mentioned in paragraph 3.1.1.1 and found the following: 5.1 One (1) hole, with the appearance of bullet hole, on the mid-section of the shirt marked "A". 6. During the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 propellant residue was found surrounding the hole. Modified-griess test was applied and compared to the standards mentioned in paragraphs 3.1.2.1 and 3.1.4.1 and they indicate that the shot was fired at a distance of between "15" inches (38.1)cm and "27" inches (68.58)cm.</p>
BX4Y74-5301	<p>Examination of item Q1 revealed damage to the following area: small hole/damage located in the middle of the white shirt (Q1). Chemical and microscopic examination of the area immediately adjacent to the damaged area on item Q1 revealed residue characteristic of a firearm discharge and firearm projectile entrance hole. Distance testing of item Q1 revealed a muzzle to target distance no closer than 9" and no further than 24".</p>
C3JNAD-5301	<p>3. On 2018-04-23 during the performance of my official duties I received a sealed evidence bag with number PW4000732447 from Case Administration of the Ballistics Section, containing four (4) yellow envelopes marked (1) Test No.18-5301 Item Q1, (2) Test No.18-5301 Item K1a, (3) Test No.18-5301 Item K1b and Test No.18-5301 Item K1c the following exhibits: In (1) 3.1 A portion of a white cotton cloth shirt. In (2) 3.2 Images showing powder pattern on untreated cloth with distance standards of 3" increments from contact to 27". In (3) 3.3 Images showing Sodium Rhodizonate (NaRh) pattern with distance standards of 3" increments from contact to 27". In (4) 3.4 Images showing Modified Griess pattern with distance standards of 3" increments from contact to 27". 4. The intention and scope of this forensic examination comprise the following: 4.1 Short range determination. 5. I examined the white cotton cloth shirt mentioned in paragraph 3.1 and found the following: 5.1 One (1) hole consistent with the appearance of a bullet entrance in the middle area of the shirt marked by me "149745/18A". 6. During the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 some particles of propellant residue were observed surrounding the hole. Comparison of the GSR pattern obtained after application of the Modified Griess chemical treatment on the shirt with the distance standards mentioned in paragraphs 3.2 and 3.4 indicate that the hole mentioned in paragraph 5.1 was created by a shot fired at a distance between 21" and 27".</p>
C49UP4-5301	<p>Visual and chemical examination on Item (Q1) indicated that the estimated distance of the muzzle of the firearm from the shirt was between 15 inches and 24 inches.</p>
C997MN-5301	<p>The hole located on the received piece of fabric (from the shirt Q1) was produced by the entry of a ballistic projectile fired at a distance above 15 inches and less 27 inches approximately, based in the results from the gunshot residues testing of the received fabric and their comparison with the received distance standards.</p>
CDEWRF-5301	<p>I applied modified Griess Test on the cloth and determined that the shot was fired at a distance between 21 inches and 27 inches.</p>
CEC4F2-5305	<p>Item 1-1 (Q1) was examined visually and microscopically and processed chemically for the presence of bullet defects and gunshot residue. One bullet entry defect, Hole A, was observed in item 1-1 (Q1). Gunshot residue in the form of bullet wipe, gunpowder particles, nitrite residue, lead wipe, and vaporous lead residue were observed surrounding Hole A. Item 5 (K1) consists of photographs of untreated and chemically processed test targets produced at muzzle</p>

TABLE 2

WebCode-Test	Conclusions
	to target distances of contact, 3 inches, 6 inches, 9 inches, 12 inches, 15 inches, 18 inches, 21 inches, 24 inches, and 27 inches. Based on data obtained by examination of item 5 (K1), the muzzle of the gun was at a distance greater than 9 inches but less than 24 inches from item 1-1 (Q1) at the time the shot that created Hole A was fired, provided that no interposed object was between the muzzle of the gun and item 1-1 (Q1) at the time the shot was fired.
CFADB4-5301	One (1) defect, designated #1, was located in the center of Item Q1. The defect is circular and measures approximately 3/16 inch in diameter. The defect and area surrounding the defect were examined microscopically and processed chemically for the presence of gunshot residues and a pattern of residues was developed. Using the distance standards listed under Items K1a-c, this pattern of residues was reproduced at a muzzle distance of between fifteen (15) and twenty-four (24) inches.
CKW94V-5305	The distance between the causative weapon and the victims shirt at the time of discharge was between 18" and 27", with the most likely distance being approximately 21".
CLX24N-5305	Item 2 has one hole located in the center of the material. It is consistent with the passage of a bullet, with a muzzle to target distance greater than 15 inches to 27 inches.
CNKK32-5301	The area around the hole in the shirt in Item #Q1 was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of residues was found. Using the recovered firearm and ammunition, this pattern of residues was reproduced at a distance between twelve and twenty-four inches.
CQMHFE-5301	3. On 2018-05-07 during the performance of my official duties I received a sealed evidence bag with number PW4000732453 from Case Administration of the Ballistics Section, containing the following: 3.1 One (1) brown envelope marked "K1A" containing the following: 3.1.1 A set of photographs of distance standards shot on white cotton cloths at three (3) inch increments from a contact shot to twenty seven (27) inches. 3.2 One (1) brown envelope marked "K1B" containing the following: 3.2.1 A set of photographs of distance standard GSR patterns on white cotton cloths at three (3) inch increments from a contact shot to twenty seven (27) inches and Sodium Rhodizonate chemical treatments. 3.3 One (1) brown envelope marked "K1C" containing the following: 3.3.1 A set of photographs of distance standard GSR patterns on white cotton cloths at three (3) inch increments from a contact shot to twenty seven (27) inches and modified Griess test. 3.4 One (1) brown envelope marked "Q1" containing the following: 3.4.1 One (1) 215mm x 218mm piece of white coloured cotton cloth, marked by me "149684/18 Q1". 4. The intention and scope of this forensic examination comprise of the following: 4.1 Intermediate shot range determination. 5. I examined the piece of cotton cloth mentioned in paragraph 3.4.1 and found the following: 5.1 The piece of cotton cloth mentioned in paragraph 3.4.1 has one (1) hole with the appearance of a bullet entrance hole. 5.2 The result obtained during the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 were compared to the exhibits mentioned in paragraphs 3.1.1 and 3.3.1 and it indicated that the hole mentioned in paragraph 5.1 was fired at a distance of between eighteen (18) inches and twenty-seven (27) inches.
CULXMJ-5301	The area around the hole near the middle of Q1 was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. The pattern of residues was compared to standards received as items K1a, K1b, and K1c and determined to be consistent with having been produced with a muzzle to target distance of between 12 inches and 24 inches.

TABLE 2

WebCode-Test	Conclusions
D2H7Q9-5301	Examination of Item Q1 revealed a hole. Visual/microscopic examination and chemical processing of the area around the hole revealed a pattern of gunshot residues. Test patterns were provided. The residue pattern from Item Q1 indicates a muzzle-to-target distance greater than 12 inches. The evidence will be returned to the submitter.
D3CYHK-5301	Comparing the shirt with the bullet hole and distance standard prepared with suspect firearm reveal that the distance range between muzzle of firearm and bullet hole on the shirt grater than 24" and less than 27"
DERLXD-5301	The Item Q1 shirt was visually and microscopically examined and chemically processed for the presence of gunshot residues. Residues were found that were consistent with an intermediate range shot. Definitions: Contact/near contact: The muzzle of the firearm was in contact with or very near the target at the time of discharge with possible sooting, ripping, tearing, and/or singeing of the target material. Intermediate: The range at which a firearm and ammunition combination will deposit visible or detectible gunpowder particles on a target. Distant: Only the bullet reaches the target {determined by chemical testing (bullet wipe), defect characteristics, or autopsy information}. No tearing of the target material observed and no gunpowder particles or soot are observed or chemically detected.
DM2BDW-5301	The Item 1 piece of cotton twill was examined and one suspect bullet hole was located in the approximate center. The area around the hole was chemically processed for the presence of gun shot residues. Residues were found. Using the submitted created standards, a qualitative comparison was made to determine the muzzle to target distance. The muzzle to target distance was determined to be between 9 and 24 inches.
DPNYPY-5305	The area around the hole in Item 1-2 was microscopically examined and chemically processed for the presence of gunshot residues (lead, nitrites, and particulate matter). A pattern of residues (vaporous lead, nitrites, and particulate matter) was found. Using the identified weapon with ammunition similar to the questioned cartridges, this pattern of residues was reproduced at a distance from the weapon to the target of between 9 inches and 18 inches.
EAU7H-5301	Gunshot residue patterns similar to the pattern appearing on the shirt marked Q1 were produced at a distance greater than 12 inches and less than 27 inches.
EDAYUP-5301	During the optical and chemical examination of the bullet hole on Item Q1 propellant residue was found surrounding the hole. Shot range determination were performed. Photographs of test shots marked Item K1c indicate that the shot on Item Q1 was fired at a distance of between 21 inches and 27 inches.
EL63YL-5301	Using the received distance standards, it is possible to indicate that the firing that caused the entrance hole in the piece of cloth received as a Q1 sign was produced by the entry of a ballistic projectile fired at a distance ranging from 15 inches to 21 inches approximately.
ELNZVJ-5301	Item 1.2 was microscopically examined and chemically processed for gunshot residues and a pattern of residues was found. Using the provided distance standards, this pattern of residues was reproduced at a distance greater than twelve inches and less than twenty-seven inches.
EYR9U2-5301	Based on the comparisons between the developed nitrite and lead residue patterns on Q1 and the patterns developed on K1b and K1c, the Q1 garment was separated from the muzzle of the pistol at some distance that was greater than 12 inches and less than 24 inches at the time of discharge.
F7J7WW-5305	The area around the hole of Item 1-2 was microscopically examined and chemically processed

TABLE 2

WebCode-Test	Conclusions
	for the presence of gunshot residues (lead, copper, nitrites and particulate matter). A pattern of residues (vaporous lead, copper, nitrites and particulate matter) were found. Using the identified weapon with ammunition similar to the questioned cartridges, the pattern of residue was reproduced at a distance from the weapon to the target of between 3 and 27 inches.
FEJLP9-5301	The hole in Item Q1 was examined visually and processed chemically for the presence of gunshot residues. These tests indicated that the muzzle of the firearm was greater than 18 inches and less than 27 inches from the shirt when discharged.
FHF6R8-5301	The area around the hole in the submitted garment (Item Q1/Hole A) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the submitted photographs of known patterns, this pattern of residues was reproduced at a distance between twelve (12) inches and twenty-seven (27) inches.
FPKRX-5301	During the optical and chemical examination of the bullet hole Q1, propellant residue was found surrounding the hole with a bullet wipe around the edges of the hole. I studied the images provided and took measurements of gunshot residue patterns and they indicate that the shot was fired at a distance of between 21 inches and 27 inches.
FVQFJ4-5301	Item #2 (Q1: shirt with apparent bullet defect) was visually and microscopically examined on 04/24/2018. Item #2 (Q1: shirt with apparent bullet defect) was chemically processed for gunshot residues on 04/25/2018. A pattern of residues consistent with the discharge of a firearm and the passage of a bullet was observed near the center of the shirt section. Using Item #1 (Distance Standards K1 a-c) the muzzle to target distance was determined to be between 15 inches and 27 inches.
G4DWMX-5301	Item 001-A was examined and determined to be a piece of twill cloth exhibiting a suspected bullet hole. Item 001-A was examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. The test materials from Item 001-A were retained as Items 001-A-01 and 001-A-02. Test patterns were created at known muzzle to target distance intervals using the same firearm and ammunition used to generate the defect in Item 001-A. These test patterns were also chemically processed and all three sets were retained as digital images, Items 001-B through 001-D. Items 001-A, 001-A-01 and 001-A-02 were compared to the known test patterns, Items 001-B through 001-D, and it was determined that the firearm used to generate the defect in Item 001-A was approximately fifteen to twenty-seven inches from the target.
G976PJ-5301	In the piece of shirt received (Item Q1) there is evidence of a bullet entry hole. The area around the hole in the t-shirt (Item Q1) was visually and chemically examined for the presence of gunshot residues and a pattern of gunshot residues was found. Based on the pattern of gunshot residue observed around the hole in the item Q1 and comparing it to the Known test fired distances (unprocessed, K1a, Modified Griess Test, K1b and Sodium Rhodizonate test, K1c), it was determined to that the muzzle of the firearm was between 15 and 27 inches from the target at the time of discharge. However, not all the necessary elements of judgment are available to indicate with total certainty that this is the only range of possible shooting distance.
G9QL6L-5301	Visual examination and chemical processing of the submitted item Q1 in comparison to submitted standards put the muzzle of the firearm between 18 and 27 inches from the T-shirt at the time of discharge.
GB3E4U-5301	The defect present in the t-shirt (item Q1) is consistent with entrance hole. After comparing the pattern of gunshot residues surrounding this hole (Q1) and the submitted photographs of

TABLE 2

WebCode- Test	Conclusions
	gunshot residues patterns we can estimate that the shooting distance was greater than 12 inches and less than 21 inches
GCP2FW-5305	The area around the hole of Item 1-2 was microscopically examined and chemically processed for the presence of gunshot residues (lead, copper, nitrites and particulate matter). A pattern of residues (vaporous lead, copper, nitrites and particulate matter) was found. Using the identified weapon with ammunition similar to the questioned cartridges, this pattern of residue was reproduced at a distance from the weapon to the target of between 6 and 24 inches.
GCRPUM-5301	I examined the white shirt marked Q1 and found the following: 1. One bullet entry hole through the shirt marked Q1. 2. During the optical and chemical examination of the shirt marked Q1 propellant residue was found surrounding the hole and bullet wipe was visible on the edges of the hole. Test shots were fired and compared and, they indicate that the shot was fired at a distance of between 15 inches and 24 inches.
GQQPQW-5301	The distance of firing between the muzzle of the firearm and the shirt marked "Q1" was estimated to be between 9 inches to 21 inches.
GRJPJ2-5301	[No Conclusions Reported.]
HAYFXQ-5301	It is been established that the drilling hole found in the piece of cloth analyzed was produced by the passage of the projectile shot by a firearm of single charge, made between the muzzle of the firearm and the affected area, in a distance of approximately 15 to 21 inches, which is consistent with short distance.
HGGQBR-5301	The minimum distance between the muzzle of the firearm and the cloth is eighteen (18) inches and the maximum distance is twenty seven (27) inches.
HGJC88-5301	Hole Q1 on Item 1 is located 4 inches from the top and 4 1/2 inches from the left side. Gunshot residue patterns were found and the following conclusion was reached: Hole Q1 was fired at a distance greater than 12 inches but less than 27 inches.
HLE4F6-5301	Gunshot residue patterns like the pattern appearing upon the shirt marked Q1 were produced at a distance greater than 12 inches and less than 27 inches.
HVD3JW-5301	Examination of item Q1 revealed damage to the following areas: hole in the center of white shirt. Chemical and microscopic examination of the area immediately adjacent to the damaged area on item Q1 revealed residue characteristic of a firearm discharge and firearm projectile entrance hole. Distance testing of item Q1 revealed a muzzle to target distance no closer than 9" and no further than 24".
HWC236-5301	Results of Physical/Microscopic Examination: The area around the hole in the submitted article (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the 9mm Luger caliber, Smith & Wesson, M&P, Semiautomatic pistol, with ammunition like that represented by the evidence from the scene (9mm Luger caliber, Remington, Model L9MM3B9 115 grain FMJ) this pattern of residues was reproduced at a distance of greater than 12 inches and less than 21 inches.
J496NV-5301	The cut-out portion of the white knit shirt (item Q1) bears one hole. The area around the hole was stereoscopically examined and chemically treated for the presence of gunshot residues. Gunshot residues and partially burned gunpowder particles were detected in an area surrounding the hole which is consistent with an entrance hole of single bullet. The pattern of

TABLE 2

WebCode-Test	Conclusions
	gunshot residues (untreated and chemically treated) on the cut-out of the knit shirt was compared to the provided test target photographs (Items K1 a-c) and was determined to be consistent with a muzzle-to-target distance of between fifteen to twenty-one inches.
J8B4YL-5301	I examined the white shirt marked Q1 and found the following: 1. One possible bullet entry hole through the shirt marked Q1. 2. During the optical and chemical examination of the shirt marked Q1 propellant residue was found surrounding the hole and bullet wipe was visible on the edges of the hole. Test shots were fired and compared and, they indicate that the shot was fired at a distance of between 21 inches and 27 inches.
JH8AU6-5301	The area around the hole in the Item 1 shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of nitrite and lead residues was found. The pattern of residues present on the Item 1 was reproduced at a muzzle-to-target range greater than twelve inches and less than twenty-four inches when compared to the submitted distance standards.
JM2279-5301	Items Q1, K1-a, K1-b and K1-c: Examination of the Item Q1 piece of fabric revealed the presence of a hole approximately in the middle of the item. The area around this hole was examined microscopically, and processed chemically for the presence of propellant and lead residues (gunshot residues), and a pattern of residues was found. Comparison of the Items K1-a, K1-b and K1-c submitted test patterns to the Item Q1 submitted piece of fabric showed the Item Q1 residue pattern to be consistent in size and density with patterns observed on the items K1-a, K1-b and K1-c submitted standards. Based on this comparison, the bullet hole observed on Item Q1 is consistent with a shot fired from a distance between approximately twelve (12) inches, and approximately twenty seven (27) inches from muzzle to target.
K2FRHF-5305	Item Q1, the shirt with a bullet hole, was visually and microscopically examined. It was then chemically processed for the presence of gunshot residues. Gunshot residue was detected. The muzzle to target distance was greater than 12 inches and less than 24 inches.
K38U4C-5301	An examination of the exhibit shirt displayed partially burnt and unburnt propellant particles. A spread of propellant particles was measured to be approximately 13cm x 11cm. The defect caused by the bullet measured approximately 5mm in diameter. Bullet wipe surrounding the entry hole measured approximately 9mm in diameter. A comparison between the exhibit shirt propellant pattern and test samples revealed that the muzzle of the firearm was approximately 15 inches to 27 inches from the shirt at the time of discharge.
KEMJ43-5305	The area around the hole in Item 1-2 (Shirt) was microscopically examined and chemically processed for the presence of gunshot residues (lead, copper, nitrites and particulate matter). A pattern of residues (vaporous lead, copper, nitrites and particulate matter) were found. Using the identified weapon with ammunition similar to the questioned cartridges, this pattern of residue was reproduced at a distance from the weapon to the target of between 12 and 27 inches.
KL638Z-5301	The portion of shirt was examined for the presence of bullet holes, and one hole was observed. The area around the hole was visually examined for the presence of gunshot residues. Gunpowder particles were observed. The area around the hole was chemically processed using the Modified Griess Test for the presence of nitrites, and the Sodium Rhodizonate Test for the presence of lead. Both nitrite residues and lead were found to be present. The nitrite and lead residues on the shirt were compared to the photographs of the test patterns (Item 1), and a muzzle-to-target range was developed. The firearm was discharged at a muzzle-to-target range of 9 to 24 inches from the shirt.

TABLE 2

WebCode-Test	Conclusions
KRQ8UB-5301	The cloth was visually and chemically examined for gunshot residue patterns. Several powder particles was visible around the damage. The results from the visual and chemical treatment of the item Q1 was compared with test samplings (Item K1a and Item K1b). The result shows that the shooting distance is greater than 15" but less than 27".
KUH2X6-5301	3. On 2018-05-07 during the performance of my official duties I received a sealed evidence bag with number PW4000732448 from Case Administration of the Ballistics Section, containing the following: 3.1 One (1) brown envelope marked "2018 CTS Forensic Testing Program" "Test No. 18-5301" "GSR DISTANCE DETERMINATION", "Sample Pack: GSRP" containing the following: 3.1.1 One (1) brown envelope marked "Test No. 18-5301", "K1a" containing the following: 3.1.1.1 One set of ten (10) photographs of distance standards shot on white cotton cloths at three (3) inch increments from a contact shot to twenty seven (27) inches. 3.1.2 One (1) brown envelope marked "Test No. 18-5301", "K1b" containing the following: 3.1.2.1 One set of ten (10) photographs of distance standard GSR patterns on white cotton cloths at three (3) inch increments from a contact shot to twenty seven (27) inches and Sodium Rhodizonate chemical treatments. 3.1.3 One (1) brown envelope marked "Test No. 18-5301", "K1c" containing the following: 3.1.3.1 One set of ten (10) photographs of distance standard GSR patterns on white cotton cloths at three (3) inch increments from a contact shot to twenty seven (27) inches and modified Griess test. 3.1.4 One (1) brown envelope marked "Test No. 18-5301", "Q1" containing the following: 3.1.4.1 One (1) piece of white coloured cotton cloth "shirt" material, marked by me "149735/18 Q1" with one hole in it. 4. The intention and scope of this forensic examination comprise of the following: 4.1 Intermediate shot range determination. 5. I examined the piece of cotton cloth mentioned in paragraph 3.1.4.1 and found: 5.1 The piece of cotton cloth mentioned in paragraph 3.1.4.1 has one (1) hole with the appearance of a bullet entrance hole. 5.2 The result obtained during the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 were compared to the photograph distance standards mentioned in paragraphs 3.1.1.1 and 3.1.3.1 and it indicated that the hole mentioned in paragraph 5.1 was fired at a distance of between fifteen (15) inches and twenty-four (24) inches.
L8YELJ-5305	Using Griss Method we decided that the shooting distance must be between 12" and 15".
LANQLP-5301	Evaluation of the "Shirt with bullet hole" (item Q1) versus the provided known distance standards (items K1a and K1c), the "Shirt with bullet hole" (item Q1) was determined to have been shot at a distance greater than 12" and less than 27". The provided distance standard (item K1b) was received and documented.
LBJ4B3-5301	The area around the hole in the Item 1 shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of nitrite and lead residues was found. The pattern of nitrite residues present on the Item 1 shirt was reproduced at a muzzle-to-target range of greater than nine and less than twenty-one inches when using the submitted Item 2 distance standards. No other residues were detected.
LDPQLM-5301	We apply color test technique on the shirt sample (Q1) using fresh modified griss and we conclude that there is nitrite anion which give indication of the presence of close shooting. By comparing the result obtained above we can estimate the distance of the muzzle of the firearm from the shirt was between (15-21) inches.
LH2RQQ-5305	Item 3-1 (Q1) was examined visually and microscopically and processed chemically for the presence of bullet defects and gunshot residues. A single bullet entry defect (Hole A) was observed near the center of item 3-1. Gunshot residue in the form of bullet wipe, soot,

TABLE 2

WebCode-Test	Conclusions
	<p>gunpowder, nitrite residue, vaporous lead residue and particulate lead residue were observed surrounding Hole A. Items 4-1 (K1a), 4-2 (K1b), and 4-3 (K1c) are scaled photographs depicting untreated and chemically processed test targets fired at known muzzle to target distances of contact, 3 inches, 6 inches, 9 inches, 12 inches, 15 inches, 18 inches, 21 inches, 24 inches, and 27 inches. Based on the data obtained by examination of items 3-1, 4-1, 4-2, and 4-3, the muzzle of the gun was at a distance greater than 9 inches but less than 24 inches from item 3-1 (Q1) at the time the shot was fired that created Hole A, provided that no interposed object was between the muzzle of the gun and item 3-1 at the time the shot was fired.</p>
LHY3LT-5301	<p>The muzzle of the firearm was at a distance greater than 9 inches and less than 21 inches from the shirt at the time of discharge.</p>
LWGWRR-5301	<p>[Laboratory] Item 1 CTS Q1 square piece of white colored cloth displays a single perforating defect consistent with the passage of a bullet having been fired when the muzzle of the firearm was at a distance greater than 15 inches and less than 24 inches.</p>
MD6A7J-5301	<p>The muzzle-to-target distance of the gunshot that caused the bullet hole to the shirt, Item Q1, using the provided distance standards, Item K1a-c, was determined to be greater than 12 inches and less than 27 inches.</p>
MEX6QA-5301	<p>Q1. One (1) sealed manila envelope labeled in part "Item Q1" containing one (1) cotton twill jean unknown sample with one (1) defect. Q1A. Chemical test pattern collected from Item Q1, the cloth, during laboratory examination. K1a. One (1) manila envelope labeled in part "Item K1a", containing ten (10) standard distance panel photographs (unprocessed) shot at contact, 3 inches, 6 inches, 9 inches, 12 inches, 15 inches, 18 inches, 21 inches, 24 inches, and 27 inches. K1b. One (1) manila envelope labeled in part "Item K1b", containing ten (10) standard distance panel photographs (processed with sodium rhodizonate) shot at contact, 3 inches, 6 inches, 9 inches, 12 inches, 15 inches, 18 inches, 21 inches, 24 inches, and 27 inches. K1c. One (1) manila envelope labeled in part "Item K1a", containing ten (10) standard distance panel photographs (processed with Modified Griess) shot at contact, 3 inches, 6 inches, 9 inches, 12 inches, 15 inches, 18 inches, 21 inches, 24 inches, and 27 inches. Clothing Analysis of Item Q1: Methodology – Visual Examination/Microscopy: Chemical – Color Test (Modified Griess and Sodium Rhodizonate). No visible red-brown stains were observed on the Item Q1, the cloth. One (1) defect was observed on Item Q1, the cloth, and described as follows: The defect/hole, designated as "A", measured approximately ¼ inch in greatest dimensions and was located approximately in the center of the cloth. Visual and microscopic examination of defect/hole "A" revealed the presence of apparent bullet wipe and gunpowder. Visual and microscopic examination of defect/hole "A" did not revealed the presence of apparent soot. Chemical testing of defect/hole "A" indicates the presence of *nitrite residues and **lead residues. Note: *Nitrites are present in gunpowder residue. **Lead residue can be present in bullets/bullet cores and ammunition primers. Opinion/Interpretation: Examination of defect "A" indicated that it was visually consistent with the passage of a projectile/bullet based upon the physical properties observed and the chemical tests performed. Distance Determination Analysis: Methodology – Visual Examination: Chemical – Color Test (Modified Griess and Sodium Rhodizonate). The pattern of gunpowder and gunpowder residues observed and documented from Item Q1, the cloth, and Q1A, the chemical analysis of defect/hole "A", was reproduced at a muzzle to target distance between 12 and 24 inches. Miscellaneous: Item Q1A, the chemical test patterns, will be sealed in a manila envelope and will be returned with the evidence to the submitted agency. Item K1a, the photographs, will be sealed in a manila envelope and will be returned with the evidence to the submitted agency.</p>

TABLE 2

WebCode-Test	Conclusions
MG4L46-5301	<p>Item K1b, the photographs, will be sealed in a manila envelope and will be returned with the evidence to the submitted agency. Item K1c, the photographs, will be sealed in a manila envelope and will be returned with the evidence to the submitted agency.</p> <p>3. On 2018-04-23 during the performance of my official duties I received a sealed evidence bag with number PW4000732362 from Case Administration of the Ballistics Section, containing the following: 3.1 Test item Q1: A portion of a cotton cloth shirt marked by me "149629/18 A". 3.2 Three (3) sets of distance standards taken at 3" increments from contact to a distance of 27" as follows: 3.2.1 Item K1a: Images showing powder patterns on untreated cotton cloth. 3.2.2 Item K1b: Images showing GSR- patterns after application of Sodium Rhodizonate chemical treatment. 3.2.3 Item K1c: Images showing GSR- patterns after application of Modified Griess chemical treatment. 4. The intention and scope of this forensic examination comprise the following: 4.1 Shot range determination. 5. I examined the cotton cloth shirt mentioned in paragraph 3.1 and found the following: 5.1 One (1) hole consistent with the appearance of a bullet entrance hole in the lower mid-section of the exhibit. 6. During the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 propellant residue was found surrounding the hole. Comparison of the the GSR spread pattern obtained after application of the Modified Griess chemical treatment to the exhibit with the distance standards mentioned in paragraphs 3.2.1 to 3.2.3 indicate that the hole mentioned in paragraph 5.1 was created by a shot fired at a distance of between 15"/36,75 cm and 24"/58,8 cm.</p>
MTVCLN-5301	<p>The piece of fragment of cloth analyzed presents an entrance hole, according to the macroscopic, microscopic and chemical findings that were made to it, results that were compared with the reference samples of shot sent in photographs, established that the projectile that the impact contains copper and lead in its constituion, and the range of distance to which the shot was fired between the muzzle of the firearm and the impacted surface is comprised of 18 inches for the minimum and 24 inches for the maximum.</p>
NC9EX2-5301	<p>3. On 2018-04-20 during the performance of my official duties I received a sealed evidence bag with number PW4000732449 from Case Administration of the Ballistics Section containing the following: 3.1 One (1) white shirt marked by me "149725/18A". 3.2 Three (3) sets of photographs marked K1a-c distance standards at 3" increments `from contact to 27". 4. The intention and scope of this forensic examination comprise of the following: 4.1 Shot range determination. 5. I examined the shirt mentioned in paragraph 3.1 and found: 5.1 One (1) hole with the appearance of a bullet entrance hole. 6. During the optical and chemical examination of the bullet entrance hole mentioned in paragraph 5.1 propellant residue was found surrounding the hole. 6.1 The shot mentioned in paragraph 5.1 was fired at a distance of between 12" /30.48cm and 24"/ 60.96 cm.</p>
P92FXT-5301	<p>We observe in the trimmed piece of shirt submitted the presence of a bullet hole compatible with the entrance of a bullet with a caliber 9 mm.</p>
P944LX-5305	<p>Visually examining Item Q1 revealed a single defect surrounded by particles. The edges of the defect displayed bullet wipe. Item Q1 was processed using the Modified Griess Test (MGT) and a pattern was obtained. Processing Item Q1 for lead using Sodium Rhodizonate revealed spot reactions. After comparing the patterns observed and obtained after chemical processing of Item Q1 to known distance standards, it was determined that the muzzle of the firearm was between 12" and 24" from the target at the time of discharge.</p>
PLA2LR-5301	<p>The area around the hole in item 1 was microscopically examined and chemically processed for gunshot residues and a pattern of residues was found. Using a Smith & Wesson Model</p>

TABLE 2

WebCode-Test	Conclusions
	M&P 9mm semiautomatic handgun and Remington Model L9MM3BP 9mm 115 grain FMJ ammunition, the pattern of residues around the hole on the swatch was reproduced at a muzzle to target distance of greater than 15 inches and less than 27 inches.
PMJ2QY-5301	The pattern of gunshot residues around defect A is consistent with a muzzle to target distance between 12 inches and 27 inches.
Q6ZUN2-5301	During the optical and chemical examination of the bullet hole in Exhibit Q1 propellant residue was found surrounding the hole. Shot range determination were performed. Photographs of test shots marked K1c indicate that the shot in Q1 was fired at a distance between 21 inches and 27 inches.
Q9VJNG-5301	Distance testing of the item Q1 revealed a muzzle to target distance between 15 inches and 24 inches.
QGNYUC-5301	During the optical and chemical examination of the bullet hole propellant residue was found surrounding the hole. Bullet wipe was also noticed surrounding the edges of the bullet hole. Shot range determination tests were performed and the results of the tests were compared. The determination was made that the hole was caused by a shot fired at a distance of between 21 inches and 27 inches.
QH7KQA-5305	A sparse pattern of gun powder was observed on the garment surrounding approximately 4+ inches around a heavy bullet wipe hole. The muzzle to target distance is greater than approximately 12 inches and closer than approximately 27 inches with the evidence looking most like the test targets at 18-21 inches.
QWKTPR-5301	The powder grain pattern observed on defect A entrance on item 4, Q1, the section of shirt with bullet hole, and the nitrite pattern detected on the griess test for defect A entrance on item 4, Q1, the section of shirt with bullet hole, are consistent in diameter and particle population with the powder grain patterns observed on item 1, K1a, the images of test fire series on white cotton, and with the nitrite patterns detected from item 3, K1c, images of griess test fire series, between the distances of 18 inches and 27 inches.
R9DRXA-5301	Exhibit Q1 is a square-shaped portion of a white cloth shirt with a defect located in the approximate center. Exhibit Q1 was microscopically examined and chemically processed (designated Q1.T1) for the presence of gunshot residues. Results of chemical processing indicate the defect observed in Exhibit Q1 is consistent with the passage of a bullet. Additionally, a pattern of residues was detected and visually compared to the known distance standards represented by Exhibits K1a, K1b, and K1c. Based on these comparisons, the pattern of residues present on Exhibit Q1 is consistent with having been produced at a muzzle-to-target distance of greater than twelve (12) inches and less than twenty-seven (27) inches.
RH3K6Z-5301	3. On 2018-04-23 during the performance of my official duties, I received a sealed evidence bag with number PW4000732455 from Case Administration of the Ballistics Section, containing the following exhibits: 3.1 One (1) sealed yellow envelope marked "Test No. 18-5301: GSR DISTANCE DETERMINATION", containing the following: 3.1.1 One (1) sealed yellow envelope marked "Test No. 18-5301, Item Q1" containing the following exhibit: 3.1.1.1 One (1) white cloth marked by me "149643/18 Q1". 3.1.2 One (1) sealed yellow envelope marked "Test No. 18-5301, Item K1a" containing the following exhibits: 3.1.2.1 Ten (10) photographic reference samples of white cotton cloth with powder patterns, of distances ranging within 3 inches increments, from contact to 27 inches. 3.1.3 One (1) sealed yellow envelope marked "Test No. 18-5301, Item K1b" containing the following exhibits: 3.1.3.1 Ten (10) photographic reference samples of white cotton cloth treated according to the Modified

TABLE 2

WebCode-Test	Conclusions
	<p>Greiss method, of distances ranging within 3 inches increments, from contact to 27 inches. 3.1.4 One (1) sealed yellow envelope marked "Test No. 18-5301, Item K1c" containing the following exhibits: 3.1.4.1 Ten (10) photographic reference samples of white cotton cloth treated according to the Sodium Rhodizonate method, of distances ranging within 3 inches increments, from contact to 27 inches. 4. .The intention and scope of this forensic investigation comprise the following: 4.1 Shot range determination. 5. I examined the white cloth mentioned in paragraph 3.1.1.1 and found: 5.1 One (1) hole, with the appearance of a bullet entrance hole, in the middle of the white cloth, marked "A". 6. During the optical and chemical examination (Modified Greiss) of the bullet hole mentioned in paragraph 5.1, propellant residue was found surrounding the hole. Shot range determination tests mentioned in paragraph 3.1.3.1 performed with the same ammunition and firearm combination as specified , indicate that the distance range the muzzle of the firearm was to the white cloth, were between 15" (38.1cm) and 24" (60.96cm).</p>
RJRQLQ-5301	<p>The absence of fouling and the powder grain pattern detected on the section of white fabric labeled "shirt with bullet hole, Q1", (item 4), and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled "shirt with bullet hole, Q1", (item 4), are consistent in diameter and particle population with the powder grain patterns observed on item 1, the photo set of test fire targets, K1a, and the nitrite patterns detected on item 3, the photo set of test fire targets treated with griess test, K1c, between the distances of greater than 18 inches and less than 27 inches.</p>
RK7FMG-5301	<p>The garment (cloth) received ofr physico-chemical study was hit by gunfire a short distance from a range of about 18 to 27 inches.</p>
TECTDU-5305	<p>a. It is extremely probable that the hole in the T-shirt (Exhibit Q1) is a bullet entrance hole. b. It is highly likely that this bullet was shot at a distance in the range of 12"-21" (muzzle to shirt). This shooting distance estimation is based on the assumption that this target was the first medium hit by the bullet.</p>
THVVD8-5301	<p>By means of physical study and chemical analysis gunshot residues (gunpowder, nitrites, lead) were detected around the shirt (Q1) hole consistent with a muzzle to garment distance between 18 to 24 inches. The provided distance standards (K1a, K1b, K1c) were used for distance determination.</p>
TVG8PG-5301	<p>The shooting distance range to the periphery of the entry hole present in cutting cloth; it was established between minimum fifteen (15) inches and maximum twenty seven (27) inches from muzzle of the gun until the cloth, the above was set by comparison with CTS photograph received with the results of the study physical and chemical tests on fabric.</p>
VCZM7J-5301	<p>The hole in item 2 was examined (macro/microscopically) and chemically treated for the presence of gunshot residue and a pattern of residues was detected. These patterns were reproduced at a distance greater than 12" but less than 27".</p>
VERUBF-5301	<p>The area around the hole in the white cloth submitted by the agency (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the agency provided photographic samples (Items K1a, K1b and K1c) this pattern of residues is consistent with having been produced between 12 and 24 inches.</p>
VH8BH2-5301	<p>Based on subjective visual and chemical enhancement comparison examinations including the modified Griess test for nitrites and the sodium rhodizonate test for lead, it is my opinion that the estimated muzzle to target distance lies between 15" to 21".</p>

TABLE 2

WebCode-Test	Conclusions
W9X2WR-5301	The area around the hole in the Item 2 shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of Nitrite and lead residues was found. The pattern of residues present on the Item 2 shirt was reproduced at a muzzle-to-target range of greater than nine and less than twenty-one inches when using the submitted Item 1 test patterns.
WDUTZH-5301	Examination of item Q1 revealed damage to the following areas: center of twill (garment) Chemical and microscopic examination of the area immediately adjacent to the damaged area on item Q1 revealed residue characteristic of a firearm discharge and firearm projectile entrance hole. Distance testing of item Q1 revealed a muzzle to target distance no closer than 9" and no further than 24".
WJTEPY-5301	Clothing Examination (Item Q1) Methodology: Visual Examination/Microscopy: Chemical-Color Test (Modified Griess and Sodium Rhodizonate). One (1) apparent defect was observed on Item 1, the shirt sample and described as follows: The defect, designated as "A", measured approximately 1/4" inch in greatest dimensions and was located approximately 4 1/2" inches from left side and 3 3/4" inches from the top edge on the shirt sample. Visual/microscopic examination of defect "A" revealed the presence of apparent bullet wipe and gunpowder. Visual/microscopic examination of defect "A" did not reveal the presence of apparent soot. Chemical testing of defect "A" indicates the presence of nitrite residues and lead residues which are found in gunpowder residue. Opinion/Interpretations: Examination of defect "A" indicated that it was visually consistent with the passage of a projectile/bullet based upon the physical characteristics observed and the chemical tests performed. Distance Determination: Opinion/Interpretation: The pattern of gunpowder/gunpowder residues observed and documented from Item Q1, the shirt sample was compared to the test standards identified to be produced by CTS and determined to be between 12 and 24 inches.
WKCC4H-5301	The muzzle to garment distance for hole 1 in item Q1 is greater than 12 inches and less than 27 inches.
WKU66R-5301	The pattern of gunshot residues around defect A is consistent with a muzzle to target distance between 12 inches and 27 inches.
WLK9TT-5301	I inspected the item and observed an area of gunshot damage which consisted of a lead wipe surrounded by a diffuse cloud of particles (powder deposits). Based on the photographs supplied in K1a and K1b, the item Q1 and the limits of this test, in my opinion the deposition of residues indicated that the shot had been fired with the muzzle of the gun at a range of between 15 inches and 27 inches from the fabric. Based on the comparison materials supplied I cannot entirely discount the possibility that the gun was fired from a distance greater than 27 inches.
X86NQE-5301	The area around the hole in the center of item Q1 (damaged white cloth) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was observed. Using K1a, K1b and K1c (photographs of the known distance standards), the observed pattern of gunshot residues is consistent with a muzzle to garment distance of greater than 15 inches and less than 27 inches.
XA7TYT-5301	On 2018-04-23 during the performance of my official duties I received a sealed evidence bag with number PW4000732446 from Case Administration of the Ballistics Section, containing the following items: 3.1 One (1) piece of white material marked by me "149654/18 A". 3.2 Three (3) sets of GSRP sample pack photographs not marked by me. 4. The intention and scope of this forensic examination comprise of the following: 4.1 Shot range determination. 5.

TABLE 2

WebCode-Test	Conclusions
	I examined the piece of white material mentioned in paragraph 3.1 and found the following: 5.1 One (1) hole with the appearance of a bullet entrance hole. 5.2 During the optical and chemical examination of the bullet hole mentioned in paragraph 3.1 propellant residue was found surrounding the hole. 5.3 The shot mentioned in paragraph 3.1 was fired at a distance between 21" (53cm) and 27" (69cm).
XN6K4H-5301	Examination of Item 4 revealed a hole in the center of the submitted cloth. The area surrounding the hole was visually and microscopically examined and chemically processed and a pattern of gunshot residues was detected. Using the submitted photographs (Items 1, 2, and 3), test patterns that were produced at the following muzzle-to-target distances were examined: contact, three (3) inches, six (6) inches, nine (9) inches, twelve (12) inches, fifteen (15) inches, eighteen (18) inches, twenty-one (21), twenty-four (24) inches, and twenty-seven (27) inches. The detected pattern surrounding the hole in the center of Item 4 is consistent in size, density, and appearance to the test patterns produced at muzzle-to-target distances of between twelve (12) inches and twenty-seven (27) inches.
XYM4LV-5301	1. Examination of Exhibit 2 (shirt) disclosed a perforating defect near the center of the fabric. a. The area around the hole was visually examined and chemically processed. b. Exhibit 2.1 (Modified Griess test standard) was created for comparison purposes and is being returned with Exhibit 2. c. Physical characteristics and a pattern of gunshot residues associated with the discharge of a firearm were located. 2. The pattern of gunshot residues on Exhibit 2 was compared to Exhibit 1 (photographs of known-distance test-patterns). The pattern of gunshot residues on Exhibit 2 was reproduced at a muzzle-to-target distance between approximately 12 inches and 27 inches.
XZ3EKL-5301	Item #2 (Q1: shirt with apparent bullet defect) was microscopically examined and chemically processed for gunshot residues on 04/25/2018. A pattern of residues consistent with the discharge of a firearm and the passage of a bullet was observed near the center of the shirt. Using Item #1 (Distance Standards K1 a-c) the muzzle to target distance was determined to be between 15 inches and 27 inches.
Y7ZPQ3-5301	The area around the hole in Exhibit Q1 was microscopically examined and chemically processed for the presence of gunshot residues (Modified Griess paper retained as Exhibit Q1.T1). A pattern of residues was observed and compared to the standards and photos provided. Based on visual, microscopic and chemical analysis, the distant from the muzzle of the firearm to Exhibit Q1 was greater than 12", but less than 27".
Y9BEBE-5305	Observations and comparisons between shirts allow us to estimate the distance of the muzzle of the firearm from the shirt greater than 15" and less than 21". An interpretation can be made by knowing elements of the investigation. The emergence of new data may have an effect on the interpretation of analytical results.
YCBGJN-5301	Using the submitted photographs for comparison purposes, the gunshot residues observed around Hole A (on Item Q1) would suggest the muzzle to garment distance was between 15 inches and 27 inches.
YDMFFJ-5301	A series of test patterns was examined and compared to the section of cloth, item 1.1. A similar pattern of residues as that seen on the cloth, item 1.1, can be produced at distances of greater than 15 inches but less than 27 inches.
YNMVFJ-5301	I have observed the results of the firing distance experiments using the Smith & Wesson Model M&P 9mm calibre pistol and Remington 9mm calibre 115 grain FMJ ammunition. I have compared the residue patterns in the test fired distance standards (items K1a - c) with the

TABLE 2

WebCode-Test	Conclusions
	residue pattern around the bullet hole in the t-shirt (item Q1). In my opinion, the muzzle of the pistol was no closer than 12 inches and no further than 24 inches from the victim's t-shirt at the time the pistol was discharged.
YQCARC-5301	Based on visual examination and chemical testing, the defect in Item Q1 was determined to be a bullet entrance hole with a surrounding pattern of gunshot residues. Range patterns produced in three inch increments were evaluated from contact (0 inches) to 27 inches. Based on the visual examination and the chemical testing for nitrites, it was determined that the firearm was discharged from a muzzle-to-target range of further than 12 inches and closer than 21 inches. Limitation Statements: Range patterns were shot with the firearm held in a traditional hand hold where the muzzle-to-target presentation was at 90 degrees. Interpretation of the range patterns should not be applied to any other angle of incidence. Range patterns are based upon indoor range conditions with limited handling of the patterns prior to their evaluation.
Z7FBWX-5301	Visual and chemical testing of the submitted shirt determined that the muzzle to shirt surface discharge distance was greater than 12 inches and less than 21 inches.
ZERCEU-5301	A hole was present in the approximate center of the Q1 shirt. The hole and the area around the hole was visually, microscopically, and chemically processed for the presence of firearm discharge residues. The gunshot residue pattern around the hole is consistent with tests fired at a muzzle -to-target distance greater than 12 inches and less than 24 inches.
ZGWX7Y-5301	The defect upon the item Q1 garment, if created by the Smith & Wesson brand semiautomatic pistol, 9mm Luger caliber, model M&P loaded with Remington brand, model L9MM3BP, 115 grain full metal jacket ammunition, is consistent with having been created at a distance between twelve (12) inches and twenty-four (24) inches based upon comparison of the item Q1 garment to test targets created at known distances.
ZM4JZN-5301	The pattern of gunshot residues around defect A is consistent with a muzzle to target distance between 12 inches and 27 inches.
ZN2UVQ-5301	The fabric, item Q1, was visually and chemically examined for the presence of gunshot residues. Powder particles were on the fabric. There was a Griess positive pattern on the fabric. There was sodium rhodizonate positive reaction on the bullet wipe (no vaporous lead). Based on the presence of gunshot residues and a lack of tearing of the fabric, the muzzle to target distance determination is intermediate. Intermediate is the range at which a firearm and ammunition combination will deposit visible or detectable gunpowder particles on a target. In cases where an 'Intermediate' finding is appropriate, a drop-off value may be reported. Drop-off distance is the muzzle to target distance (barring the presence of an intervening object) where gunshot residue is no longer detected visually or chemically.
ZQ3Z7Q-5301	3. On 2018-04-23 during the performance of my official duties I received a sealed evidence bag with number PW4000732454 from Case Administration of the Ballistics Section, containing the following: 3.1 One (1) sealed envelope, marked with a sticker "TEST NO. 18-5301 : GSR DISTANCE DETERMINATION" and "Sample Pack: GSRP", containing the following: 3.1.1 One (1) sealed envelope, marked with a sticker "Test No. 18-5301" and "Item Q1", containing the following: 3.1.1.1 One (1) white cloth, representing the shirt of the victim. I marked this exhibit with "149666/18". 3.2.1 One (1) sealed envelope, marked with a sticker "Test No. 18-5301" and "Item K1a", containing the following: 3.2.1.1 Ten (10) distance standards at 3" increments, starting from Contact (0") to 27" of the powder patterns on untreated white cotton cloths, marked by me with "149666/18" each and "K1a.1" to

TABLE 2

WebCode- Test	Conclusions
	<p>"K1a.10" respectively. 3.3.1 One (1) sealed envelope, marked with a sticker "Test No. 18-5301" and "Item K1b", containing the following: 3.3.1.1 Ten (10) distance standards at 3" increments, starting from Contact (0") to 27" of the Sodium Rhodizonate chemical treatments, marked by me with "149666/18" each and "K1b.1" to "K1b.10" respectively. 3.4.1 One (1) sealed envelope, marked with a sticker "Test No. 18-5301" and "Item K1c", containing the following: 3.4.1.1 Ten (10) distance standards at 3" increments, starting from Contact (0") to 27" of the Modified Griess Test, marked by me with "149666/18" each and "K1c.1" to "K1c.10" respectively. 4. The intention and scope of this forensic examination comprise the following: 4.1 Shot range determination. 5. I examined the white cloth mentioned in paragraph 3.1.1.1, representing the shirt of the victim, and found the following: 5.1 One (1) bullet hole being present in the centre of the cloth. 6. During the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 on the cloth mentioned in paragraph 3.1.1.1, propellant residue was found surrounding the hole. 6.1 Shot range determination tests that were performed and test shots that were fired with the Smith & Wesson model M&P 9mm Semi-automatic pistol and ammunition with the same specifications, which were supplied as distance standards after optical and chemical examinations were conducted, as mentioned in paragraphs 3.2.1.1, 3.3.1.1 and 3.4.1.1, indicate that the shot was fired at a distance of between 18" (45,72 cm) and 24" (60,96 cm).</p>
ZTT7MF- 5301	<p>The area around Hole #1 in Item 1 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which are consistent with the passage of a bullet and the discharge of a firearm. Using the Smith & Wesson Model M&P 9mm semiautomatic handgun with Remington Model L9MM3BP 9MM 115 grain full metal jacket ammunition, this pattern of residues was reproduced at a muzzle-to-target distance of greater than 12 inches and less than 24 inches.</p>

Additional Comments

TABLE 3

WebCode- Test	Additional Comments
2NB9UL- 5305	This laboratory considers that this test needs to be revised. If electronic images of the test results are to be provided, and compared to a tested item, then consideration should be given to providing images of the tested item including the visible, Griess and Rhodizonate images. The proficiency test would thus be to compare the images of the tests made of the exhibit item to images of the test distance appearance and reactions. This would ensure that the chemicals and the testing regime was strictly controlled by the originator of the test. It was found that the reactions this laboratory attained were considerably fainter than those in the images, and it was difficult to be completely sure of the reactions. If the test provider were to provide images of the tested exhibit (Q1) and images of the tests (K1 a-c) then a fairer test would be provided. Another reason for consideration being given to revising the test are transport difficulties. Often when the test material is first examined, there is a quantity of dislodged unburnt propellant particles visible on one portion of the material, indicating the particles have dislodged during transit and formed a linear mark upon the surface of the cloth. This then reduces the density of particles present within the pattern, and obviously does not provide an optimal environment for a competency test to be performed. This would also have benefits for CTS in that they would be able to provide a competency test fully electronically.
7JJMTY- 5305	None of the known distance ladders exhibit a clear linear growth pattern or provide information regarding shot to shot variation.
8GEATC- 5301	The provided standards for the sodium rhodizonate, all exhibited lots of purple haze. This could confuse results.
92FYCL- 5301	A numerical value could not be determined for the "Less than" value because the discharge distance of the victim's shirt, based on chemical testing, appeared to be further than the furthest 27 inch distance standard provided.
APXC3K- 5301	A background pink/purplish color on the K1b Sodium Rhodizonate known photos made determining the distance of vaporous lead drop-off nearly impossible. This is a huge problem and is due to some kind of unknown contamination. I have seen this on past tests and it needs to be rectified. A better way to administer this test would be to make the Q1 unknown a photograph - this way we would be comparing like with like under the exact same circumstances, lighting, and timeline.
C997MN- 5301	Some observations and recommendations: 1. Our standard operating procedure (SOP) is different from that used in the processing of fabrics from test firings. Our SOP includes an additional step that consists in a lifting with adhesive plastic sheet to remove gunpowder granules on the fabric. Each adhesive plastic is processed by alkaline hydrolysis of nitrate esters (with heating). Finally, detection is performed with photo paper impregnated with Griess reagent. This procedure was described by the staff of Toolmarks and Materials Laboratory of Division of Identification and Forensic Science Israel National Police Headquarters, in: Glattstein B, Vinokourov, Levin N, Zeichner. Improved method for shooting distance estimation. Part 1. Bullet holes in clothing items. J Forensic Sci 2000; 45 (4): 801-806. That situation influences the comparison of our results with the test distance standards of this proficiency test, principally in the Modified Griess Test. 2. I think it's INDISPENSABLE to review all the replicates of test distance standards (unprocessed and their rhodizonate/Griess test results) and not only one of them at each distance, for considerate the variability in the gunshot residues deposition on the fabric or surface. 3. I think the test could include some controlled sources of complexity such as other kind of fabrics, dark fabrics, impermeable

TABLE 3

WebCode- Test	Additional Comments
	fabrics; fabrics with two adjacent orifices, etc., for more realistic approach.
CKW94V- 5305	It should be noted that as a laboratory we do not use the Griess test or Sodium Rhodizonate test in the manner outlined in the document and therefore the results of these tests were not used in the above interpretation. The powder and gas dispersion formed the basis of our interpretation.
CNKK32- 5301	The verbiage above is similar to what would be written had the actual firearm and ammunition been submitted for analysis.
DERLXD- 5301	Normally a drop off distance would be determined using the suspect firearm and ammunition and this would be reported. The drop off distance is the distance where the firearm and ammunition combination will no longer deposit observable/detectable residues on a specific target material, barring the presence of an intervening object, environmental factors affecting the deposition of gunshot residues, or factors that may have dislodged particles. NOTE: The patterns provided in the sodium rhodizonate test results (Item K1c) had a purple haze in most of the photographs that did not appear to be related to vaporous lead. This could cause an incorrect conclusion to be reached. When testing the Item Q1 shirt with sodium rhodizonate, there were unexpected color results with a large area of the material turning yellow. The material itself may have been treated with something that reacted with one of the chemicals in the sodium rhodizonate test.
DM2BDW- 5301	The pictures provided were not of the best quality and did not show the edges of the standards. In addition, there should be multiple shots at each distance to show reproducibility. This would allow for a better estimation.
EL63YL- 5301	With respect to photographic standards would require explicit reference mark points of location (for example, up [arrow]), since only presents a scale (photographic scale). The cloth in this test has no reference mark (eg label) so you can not know what the lower or upper of it. The piece of cloth should be larger, in order to evaluate the complete distribution of gunshot residues, since in this case the rodizonato stain is incomplete. The procedure used in our laboratory is different from that used in the processing of cloths from test firings. We use an additional step that consists in a lifting with adhesive plastic sheet to remove gunpowder granules on the cloth. Each adhesive plastic is processed by alkaline hydrolysis of nitrate esters (with heating). Finally, a detection is performed with photo paper impregnated with Griess reagent. This procedure was described by the staff of Toolmarks and Materials Laboratory of Division of Identification and Forensic Science Israel National Police Headquarters, in: Glattstein B, Vinokourov, Levin N, Zeichner. Improved method for shooting distance estimation. Part 1. Bullet holes in clothing items. J Forensic Sci 2000; 45 (4): 801-806.
F7J7WW- 5305	Please provide photo prints of the standards with a scale that is one to one.
FHF6R8- 5301	Hole A was tested using the Modified Griess test and the Sodium Rhodizonate test. A pattern of approximately 5x5.5" was developed with the Modified Griess test. A positive reaction was observed with the Sodium Rhodizonate test with faint lead residues and a distinct bullet wipe. Based on the above observations of the photographs at known distances, it appears that Hole A was fired from a distance between 12 and 27".
HGJC88- 5301	Last 3 distances provided are very similar and do not show clear differences. Evidence is similar to all of these and results in poor differences to determine a max distance. Apparent contamination for sodium rhodizonate testing is unacceptable.

TABLE 3

WebCode-Test	Additional Comments
JH8AU6-5301	<p>Methods: Gunshot Residue: Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively. If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less"). When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the [Item #] are rarely deposited at a distance of six feet or greater"). If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made. Limitations: Gunshot Residue: While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions. When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items. Distance determinations involving a wound and/or injury are outside the scope of this procedure.</p>
KRQ8UB-5301	<p>The laboratory standard procedures is not the same as used in the test samplings. Our standard operating procedures for examination of gunshot damages are: Visual examination, IR-detection, Modified Griess test, DTO for copper and Modified Sodium Sulphite test for lead.</p>
LANQLP-5301	<p>The provided photographs of distance standards treated with Sodium Rhodizonate (K1b) were not utilized for this analysis. Based on my observations of the chromophoric results and associated patterns, it appeared the provided samples had been contaminated with lead during processing. Based on this evaluation I felt that these distance standards were not suitable for comparison against Q1. Our laboratory has recently validated the use of a product known as QUANTOFIX Nitrite Sheets. This validation has allowed for QUANTOFIX to be utilized as a direct substitution for the treated photographic or inkjet photo paper in the Modified Griess Test. Other laboratories throughout the country may be following suit in the not to distant future as QUANTOFIX is a ready to use product that does not require pretreatment. The results obtained using QUANTOFIX Nitrite Sheets are on par with or superior to those obtained with traditional treated papers currently in use; however the results obtained are not a one to one comparison. With the above being said, it may be in the best interest of CTS to provide the option of QUANTOFIX distance standards for future GSR</p>

TABLE 3

WebCode- Test	Additional Comments
	Distance Determination proficiency tests. Laboratories that transition to the use of QUANTOFIX and discontinue the use of traditionally treated papers for the Modified Griess test, will not be able to compare their results to those provided by CTS if the option to choose QUANTOFIX distance standards is not offered.
LBJ4B3- 5301	Methods: Gunshot Residue: Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively. If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less"). When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the [Item #] are rarely deposited at a distance of six feet or greater"). If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made. Limitations: Gunshot Residue: While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions. When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items. Distance determinations involving a wound and/or injury are outside the scope of this procedure.
LDPQLM- 5301	we do an color test of the muzzle by the Sodium Rhodizonate and compare the result with (K1c) samples.
LWGWRR- 5301	Background response in the submitted Sodium Rhodizonate tests made determination of the point of extinction for vaporous lead difficult to determine. Smearing and unclear orange colored pinpoint reactions in the Modified Griess test patterns led to a broad distance bracket.
MTVCLN- 5301	In the garment after the realization of negative and positive control of reagents, and testing of pollution on the garment; chemical tests were applied Lunge (patter detection of nitrites and nitrates), sodium rhodizonate (for lead screening) and dictioxamida (for detection of copper).
P92FXT- 5301	Shooting distance patterns to display Pb was made adapting the method published on the Journal of Forensic Science 2000; 45 (4); 801-806 and (5) 1000-1008.

TABLE 3

WebCode-Test	Additional Comments
TECTDU-5305	.1 The probability scale used in our laboratory for examinations like this is, (in descending order): A. Extremely probable; B. Highly likely; C. Probable; D. Possible; E. Cannot be Ruled Out. 2. The procedures used by the manufacturers of this test, as well as the conditions of the test firing used here, are different from those applied routinely by our laboratory. As a result, the figures quoted for the minimum and maximum shooting ranges may be wider, and the probability, therefore lower. 3. In estimating the shooting distance on this test, we used mainly the test shot results supplied with the proficiency test.
VCZM7J-5301	Reactions for tests of "shirt" not as vivid as what was seen in photos. Controls were excellent and bright colors.
VH8BH2-5301	Note - this opinion assumes that the test firings were conducted in a manner comparable to the alleged case circumstances.
W9X2WR-5301	Methods: Gunshot Residue: Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively. If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less"). When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the (Item #) are rarely deposited at a distance of six feet or greater"). If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made. Gunshot Residue: While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions. When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items. Distance determinations involving a wound and/or injury are outside the scope of this procedure.
WLK9TT-5301	In our lab we would conduct more than one test shot at each distance to assess the shot to shot variation of powder deposits. Our lab does not do the Griess test. Our lab uses HCl with the sodium rhodizonate test and we test the area using moistened filter paper on the area of interest and then apply the saturated solution of sodium rhodizonate to the filter paper, rather than direct to the item being examined, so our results look slightly different. For the purposes

TABLE 3

WebCode- Test	Additional Comments
XN6K4H- 5301	of this test I applied NaRH to both the filter paper and the fabric to see how the results differed. I have assumed that there was no intervening material between the gun muzzle and the fabric when the shot was fired.
Y9BEBE- 5305	If additional test pattern photos were available, the reported range may have been condensed. Laboratory policies states that 3 test patterns are to be produced at each distance to determine if GSR patterns are reproducing with the submitted ammunition and firearm combination. A purple background haze was noted on photographs of sodium rhodizonate test patterns, which made it difficult to determine at which distance there was no vaporous lead pattern present.
YNMVFX- 5301	This CTS test was achieved without Modified Griess chemical treatment. This method is not currently used in our lab for the moment.
YNMVFX- 5301	A typical assessment of firing distance would involve examining replicates at various distances to assess variability of the ammunition and firearm combinations. No replicates were supplied. The quality of some of the distance standards was poor. For example, there was motion blurring in some of the Griess tests, and a noticeable background effect in the Sodium Rhodizonate tests.
YQCARC- 5301	The K1b patterns were not utilized for the distance determination. The Sodium Rhodizonate chemical testing of Item Q1 failed to produce a reaction for the presence of lead. A delayed reaction for lead developed at the bullet entrance.
ZERCEU- 5301	Something has to be done about the haze in the higher distance test shots. In the 21 - 27" test shots, although no vaporous, there is a "vaporous haze" that can easily be confused with actual vaporous deposit and can be confusing when analyzing the sample. The tests should be clean of any artifacts that are not part of the actual chemical testing. In this particular case it was an issue and made the determination a little more difficult.
ZN2UVQ- 5301	We are no longer providing number ranges and moving to observational based examinations and determining drop off distances to help define the transition from intermediate and distant muzzle to target distances.

-End of Report-
(Appendix may follow)

Appendix: Data Sheet

Collaborative Testing Services ~ Forensic Testing Program

Test No. 18-5301: GSR Distance Determination

DATA MUST BE RECEIVED BY May 14, 2018 TO BE INCLUDED IN THE REPORT

Participant Code:

WebCode:

Accreditation Release Statement

CTS submits external proficiency test data directly to ASCLD/LAB, ANAB, and 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 on the last page must be completed and submitted.)
- This participant's data is NOT intended for submission to ASCLD/LAB, ANAB, and/or A2LA.

Scenario:

Police are investigating a shooting at a residence. The victim's shirt was cut and removed by paramedics. The portion of the shirt with the bullet hole was recovered and is being submitted for examination. The coroner confirmed that no exit hole was present. A suspect was apprehended later that day and the police seized a Smith & Wesson Model M&P 9mm semiautomatic handgun from his possession. The bullet recovered from the victim was identified as having come from the suspect's firearm. Rounds of Remington Model L9MM3BP 9mm 115 grain FMJ ammunition (which was consistent with the bullet recovered from the victim) were test fired with the suspect firearm and the distance standards prepared. Investigators are asking you to compare the recovered victim's shirt with the distance standards provided to determine the distance of the muzzle of the firearm from the shirt.

Please note the following:

-The Modified Griess treatment was performed in accordance to the following article:

Dillon, J.H. (1990) The Modified Griess test: A chemically specific chromophoric test for nitrite compounds in gunshot residues. AFTE J. 22(3), 243-250.

-The Sodium Rhodizonate treatment was performed in accordance to the following article:

Dillon, J.H. (1990) The Sodium Rhodizonate test: A chemically specific chromophoric test for lead in gunshot residues. AFTE J. 22(3) 251-256.

Items Submitted (Sample Pack GSRP - Photographs):

K1a-c: Distance Standards at 3" increments from Contact to 27" provided as images of GSR patterns on untreated white cotton cloths, and Modified Griess Test and Sodium Rhodizonate chemical treatments.

Q1: Shirt with bullet hole.

- 1.) What is the distance range that the muzzle of the firearm could have been from the shirt (Q1) at the time of discharge? Please report a numeral response (e.g. "6") from the supplied Distance Standards. If reporting "Contact", indicate with the numeral "0".

Greater than _____ (inches) and Less than _____ (inches)

Please return all pages of this data sheet.

Page 1 of 3

Participant Code:

WebCode:

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

3.) Additional Comments

Return Instructions: Data must be received via online data entry, fax (please include a cover sheet), or mail by <i>May 14, 2018</i> to be included in the report. Emailed data sheets are not accepted. QUESTIONS? TEL: +1-571-434-1925 (8 am - 4:30 pm EST) EMAIL: forensics@cts-interlab.com www.ctsforensics.com	Participant Code:
	ONLINE DATA ENTRY: www.cts-portal.com FAX: +1-571-434-1937 MAIL: Collaborative Testing Services, Inc. P.O. Box 650820 Sterling, VA 20165-0820 USA

Please return all pages of this data sheet.

RELEASE OF DATA TO ACCREDITATION BODIES

The following Accreditation Releases will apply only to:

Participant Code:

WebCode:

for Test No. **18-5301: GSR Distance Determination**

This release page must be completed and received by **May 14, 2018** to have this participant's submitted data included in the reports forwarded to the respective Accreditation Bodies.

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

Signature and Title _____

Laboratory Name _____

Location (City/State) _____

Accreditation Release

Return Instructions

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

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

Please return all pages of this data sheet.

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