



GSR Distance Determination

Test No. 23-5301/5 Summary Report

Each sample set contained one of the following: A portion of a shirt with a bullet hole for chemical processing for a GSR pattern (Item Q1) and either photographs (5301) or digital images (5305) of GSR patterns produced by test shots at known distances. These were provided 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 Item Q1 and report a distance range, along with their conclusions and comments. Data were returned from 119 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 portion of a shirt with a bullet hole (Item Q1) for chemical processing. In addition, either printed photographs or digital images of known GSR distance standards marked Items K1a (Powder Pattern), K1b (Modified Griess), and K1c (Sodium Rhodizonate) were provided. Participants were requested to process Item Q1 and report the range of distances that the muzzle of the firearm could have been at the time of discharge.

SAMPLE PREPARATION: The firearm used to produce the distance standards and questioned item was a CZ 75 model SP-01 Tactical 9mm handgun and the brand of ammunition used was PMC Bronze 9mm 115-grain FMJ. The fabric used for both the questioned item (Q1) and the known GSR distance standards (K1a-c) was listed as a polyester/cotton blend knit.

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

QUESTIONED ITEM (Q1): The firearm was locked into a fixture and the fabric was placed 4 inches away from the muzzle of the firearm. After firing, the portion of the shirt with a bullet hole was packaged, and this process was repeated until all of the items were created.

SAMPLE SET ASSEMBLY: For the photograph version, Items Q1, K1a, K1b, and K1c envelopes were placed into a pre-labeled sample set envelope and sealed. For the digital download version, the Item Q1 was placed in a pre-labeled sample set envelope and sealed. The Items K1a, K1b, and K1c files were then loaded onto the CTS Portal.

VERIFICATION: The predistribution laboratories reported the following "greater than" and "less than" ranges (in inches): 3 to 9, 3 to 15, and 3 to 15.

Summary Comments

This test was designed to allow participants to assess their proficiency in muzzle to target distance determination using GSR patterns. Each participant received a portion of a shirt with a bullet hole for chemical processing (Item Q1), images of GSR patterns at known distances on untreated fabric (K1a), and images of GSR patterns at known distances on fabric chemically processed using Modified Griess (K1b) and Sodium Rhodizonate (K1c). The portion of a shirt with a bullet hole (Item Q1) was prepared with the firearm locked into a fixture and the fabric (Cotton, Polyester blend knit) placed 4 inches away from the muzzle of the firearm (refer to the Manufacturer's Information for preparation details).

In Table 1, 106 of the 119 responding participants (89%) reported a "greater than" distance between contact/0 and 6 inches and a "less than" distance response between 9 and 18 inches. Of the remaining 13 participants, 8 did not report a "greater than/less than" range but did provide distance related results in their conclusions or additional comments, 3 reported a "greater than" distance of 9 inches, and 2 had a calculated range greater than 15 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 inch allowance from the known shot distance (4 inches) was used as the baseline. CTS then reviewed the ranges based on participants' reported values and determined the most common reported range, the mode, was 12 inches. A 3 inch allowance was applied to the modal value to account for the difference between the known standard distances. Therefore, any reported range greater than 15 inches 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.

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
2HDBM9- 5305	3	15	12	7V7LZG- 5301	3	12	9	CDZGPZ- 5301	3	15	12
2JKXRZ- 5301	3	15	12	8BCAMG- 5301	9	15	6	CHX37B- 5305			
2UAC4J- 5301	3	15	12	8BEYQD- 5301	3	15	12	CJRHET- 5301	3	15	12
327KYB- 5301	3	15	12	8TEW63- 5301	3	9	6	CK3JZR- 5301	3	15	12
34PT7A- 5301	3	15	12	9C4MQK- 5301	6	15	9	CVNKG2- 5301	3	15	12
34RHB8- 5305	6	18	12	9NFTZ2- 5301	3	15	12	D32ULA- 5301	3	15	12
3QM9LC- 5301	3	15	12	9TP3ZH- 5301	6	9	3	D34JQ8- 5301	3	18	15
3X6PY8- 5301	3	18	15	9WNDVH- 5305	3	15	12	D9QC37- 5301	3	18	15
4B8FG7- 5301	3	18	15	A9YCAB- 5301	3	18	15	E26Z2B- 5305	3	15	12
4M2UHN- 5305	6	15	9	AW9HXG- 5305	6	15	9	EB7ETB- 5301	6	12	6
4Q47GG- 5305				AX37GD- 5301	6	12	6	ET962Q- 5301	6	15	9
62DUND- 5301	3	15	12	B7MY29- 5301	3	18	15	EYVQAD- 5305	6	18	12
6A7ZLK- 5305	6	15	9	B8JLBQ- 5301	3	15	12	F6EF68- 5305	3	15	12
6EJVFW- 5301	6	12	6	BG8BE7- 5305	6	15	9	F86GAV- 5305	3	15	12
6UAXWZ- 5301	9	15	6	BH4LB9- 5301	3	18	15	F894M3- 5301	3	12	9
6UFX6G- 5301	3	15	12	BVTHFD- 5301	3	18	15	FACY9Q- 5301	3	12	9
7EFJHR- 5305	3	15	12	C7M9NX- 5301	3	12	9	FC2UT7- 5305			
7R6H8A- 5301				C9RV23- 5305	3	12	9	FDXGQC- 5301	3	12	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
FEPHQ9-5305	3	12	9	M7QKH-5301	6	18	12	T4H9JH-5301	3	9	6
GMEN37-5301	6	18	12	MD9WXJ-5301	9	18	9	T4KXNE-5301	3	15	12
GQEYUY-5301	0	15	15	MLYLAD-5301	3	12	9	TBLRNU-5305			
GXW8HV-5305	3	18	15	MRLDDZ-5305	6	12	6	TWHYYB-5305	3	24	21
HANB2F-5305	3	15	12	MYP723-5305	3	15	12	TXX4VN-5301	3	12	9
HBEET3-5301	3	12	9	N4ZGRB-5301	3	15	12	U2UAPK-5301	3	15	12
HTCWHW-5301				N8H4YP-5301	3	15	12	UHXVZT-5305	6	15	9
JA3YZL-5301	3	15	12	N8ZRMB-5305	3	15	12	UNKGD8-5305	3	9	6
JBC86Z-5301	3	15	12	NEH6FH-5301	3	15	12	UTX8PU-5301	0	12	12
JHGEQ3-5301	3	15	12	NR3PXQ-5301	01	12	11	UYK9KD-5305	3	12	9
JHX4R3-5301	6	15	9	P6PX34-5301	3	9	6	V2AL8P-5305	3	15	12
JYKH7U-5305	3	15	12	PC4ZGK-5305	3	15	12	V8B64T-5301	3	18	15
KAHR7N-5301	3	12	9	PUAHCP-5301				VMMURU-5301	6	15	9
KFN363-5301	3	15	12	PVE6PU-5301	3	15	12	WBRRDR-5301			
KMJCRL-5301	3	15	12	PX9T8P-5301	3	15	12	WF7LXV-5305	3	12	9
KREEAT-5301	3	15	12	Q9M63Y-5305	3	15	12	WJ37YU-5305	3	12	9
KVG9C4-5301	6	18	12	REPNRB-5301	3	15	12	XGPX8L-5301	6	15	9
LKV9DL-5301	3	12	9	RKP63G-5305	3	12	9	XUJ4J4-5301	3	15	12
LUYG2X-5305	3	15	12	RMJTLC-5301	3	15	12	Y8JFAM-5301	3	15	12
LXFNGK-5305	3	15	12	RZM9R2-5305	3	12	9	YL4VCM-5301	0	24	24

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
YMXJVH- 5301	6	15	9								
YRM98F- 5301	3	9	6								
YYTPTM- 5301	3	15	12								
YZ2UH6- 5301	3	18	15								
ZFRX7J- 5301	3	15	12								

Distance Determination					
Response Summary			Participants: 119		
Greater Than Distance	Participants Reporting	Less Than Distance	Participants Reporting	CTS Calculated Range	Participants Reporting
Contact / 0	3 (2.52%)	Contact / 0	0 (0.00%)	3	1 (0.84%)
3	83 (69.75%)	3	0 (0.00%)	6	11 (9.24%)
6	21 (17.65%)	6	0 (0.00%)	9	29 (24.37%)
9	3 (2.52%)	9	6 (5.04%)	12	55 (46.22%)
12	0 (0.00%)	12	23 (19.33%)	15	12 (10.08%)
15	0 (0.00%)	15	63 (52.94%)	18	0 (0.00%)
18	0 (0.00%)	18	17 (14.29%)	21	1 (0.84%)
21	0 (0.00%)	21	0 (0.00%)	24	1 (0.84%)
24	0 (0.00%)	24	2 (1.68%)	Other	1 (0.84%)
27	0 (0.00%)	27	0 (0.00%)	No Response	8 (6.72%)
30	0 (0.00%)	30	0 (0.00%)		
Other	1 (0.84%)	Other	0 (0.00%)		
No Response	8 (6.72%)	No Response	8 (6.72%)		

Conclusions

TABLE 2

WebCode- Test	Conclusions
2HDBM9-5305	Item Q1 is consistent with the passage of a bullet with the muzzle of the firearm between three (3) and fifteen (15) inches from the target when discharged. The distribution of lead particulate beyond the edges of the holes, and the burned and unburned powder present, is consistent visually and chemically on Item Q1 with the known distance tests provided.
2JKXRZ-5301	The item was separated from the firearm by a distance that was greater than 3 inches and less than 15 inches at the time of discharge.
2UAC4J-5301	The victim's shirt was at a distance between 3 and 15 inches from the barrel of the pistol when the shot was fired.
327KYB-5301	The piece of cloth, Exhibit Q1, has damage to the centre of the fabric that is consistent with having been caused by the passage of a fired bullet. The damage, and a firearm discharge residue pattern present in the same area, is consistent with having been caused by a shot fired at a muzzle to target distance greater than 3 inches (7.62cm) and less than 15 inches (38.10cm).
34PT7A-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 3 inches and less than 15 inches.
34RHB8-5305	The area around the hole in the center of Item 2 (said to be a shirt with a bullet hole) was visually examined and chemically processed for the presence of gunshot residues. Based on comparisons against Item 1 (known distance pattern images), the pattern of residues observed on Item 2 is consistent with having been produced at a distance between 6 to 18 inches.
3QM9LC-5301	Patterns like the pattern appearing upon the shirt marked Q1 were produced at a distance greater than 3 inches and less than 15 inches.
3X6PY8-5301	The portion of shirt was examined and found to contain a bullet hole just off the approximate center of the piece. The hole and the areas surrounding it were visually and microscopically examined, and also chemically processed for the presence of firearm discharge residues. Using submitted distance standards the gunshot residue pattern around the hole is consistent with standards fired at a muzzle-to-target distance of greater than 3 inches and less than 18 inches.
4B8FG7-5301	The area around the hole in Item Q1 was microscopically examined and chemically processed for a pattern of residues. Residues like that observed on Item Q1 were reproduced in Items K1A, K1B, and K1C at a distance greater than 3 inches but less than 18 inches.
4M2UHN-5305	The entry hole present in the cloth was caused by a projectile fired from a firearm between 6 and 15 inches approximately
4Q47GG-5305	1) Examination of Exhibit 2 (Fabric) revealed physical characteristics consistent with those observed at a close range of fire.
62DUND-5301	The distance range that the muzzle of the firearm could have been from the shirt (Q1) at the time of discharge is greater than three (3) inches and less than fifteen (15) inches.
6A7ZLK-5305	The range of distance between muzzle of CZ 75 pistol, model SP-01 Tactical and the victim's shirt was 6 inches and 15 inches
6EJVFW-5301	The distance between the muzzle of the firearm and the shirt of the victim was between 6

TABLE 2

WebCode-Test	Conclusions
	inches and 12 inches when the shot was discharged.
6UAXWZ-5301	we apply color test technique on the shirt sample (Q1) using fresh modified griss and we conclude that there if 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 (9-15) inches.
6UFX6G-5301	Based on the results of the testing, the muzzle-to-target distance for Hole 1 in the Item Q1 cloth is determined to be greater than 3" and less than 15".
7EFJHR-5305	The presence of fouling and the powder grain pattern detected on the section of white fabric labeled Q1, and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled Q1 are consistent in diameter and particle population with the presence of fouling and powder grain patterns observed on item 2, the image set of test fire targets labeled K1a, and with the nitrite patterns detected on item 3, the image set of test fire targets labeled K1b, between the distance of greater than 3 inches and less than 15 inches.
7R6H8A-5301	Item Q1 was visually and microscopically examined and chemically processed for the presence of gunshot residues. Residues were found on Item Q1 which were consistent with an intermediate muzzle-to-target distance. In a normal laboratory setting the drop-off distance with the specific firearm and ammunition combination would have been performed. Drop-off distance is the distance where the firearm and ammunition combination will no longer deposit observable/detectible residues on a specific target material. Glossary: Gunshot residues: The total residues resulting from the discharge of a firearm. It includes both gunpowder and primer residues, carbonaceous material, metallic residues from projectiles, fouling, and any lubricant associated with the projectiles. Intermediate: The range at which a firearm and ammunition combination will deposit visible or detectible gunpowder particles on the target.
7V7LZG-5301	The residue pattern from the cloth indicates a muzzle-to-target distance between three (3) and twelve (12) inches.
8BCAMG-5301	The shooting distance has been 12 inch (+/- 3 inches).
8BEYQD-5301	Item 1D was visually examined. One defect was observed on the white cloth (Hole A). The area around Hole A on Item 1D was visually inspected, microscopically examined, and chemically processed for the presence of gunshot residues. A pattern of residues was observed. Using Items 1A, 1B and 1C, a similar pattern of residues was reproduced at an approximate muzzle-to-target distance of greater than 3 inches and less than 15 inches. The test paper created during this examination will be returned to the submitting agency.
8TEW63-5301	The distance that the muzzle of the firearm was from the shirt (Q1) at the time it was discharged was greater than 3 inches and less than 9 inches.
9C4MQK-5301	Comparisons between item Q1, a square section of white fabric to powder pattern photographs and sodium rhodizonate test photographs taken at increasing distances from the muzzle of the suspect gun were made. These comparisons show the gun that was fired towards Q1 was fired from a distance between six and fifteen inches.
9NFTZ2-5301	The area around the suspected bullet hole on Item Q1 was microscopically examined and chemically processed and a pattern of residues was found. Using the provided photographs (in Items K1A, K1B, and K1C) the pattern of residues displayed on Item Q1 most resembles the known patterns depicted at a distance of greater than 3 inches and less than 15 inches.
9TP3ZH-5301	The victim's shirt was at a distance between 6 and 9 inches from the barrel of the firearm when

TABLE 2

WebCode-Test	Conclusions
	the shot was fired.
9WNDVH-5305	Examination of the fabric in Item Q1 revealed the presence of one (1) hole. The area around the hole in Item Q1 was microscopically and chemically processed for gunshot residues and a pattern of residues were found. Comparison of the known patterns in Item K1 with the pattern of residues in Item Q1, revealed that a pattern of residues like that found on Item Q1 could be produced at a distance of greater than 3 inches but less than 15 inches.
A9YCAB-5301	Based on visual observations and chemical testing, the muzzle to garment distance regarding Q1 H1 is greater than 3" and less than 18".
AW9HXG-5305	The shot fired in the fragment of fabric consistent with a short distance range, between six and fifteen inches from the muzzle of the weapon and the target.
AX37GD-5301	The cloth Q1 was visually and chemically examined for gunshot residue patterns. The result from the visual and chemical treatment of the item Q1 was compared with the tests items submitted (item K1 a-c). The results show that the shooting distance is somewhere between 6 and 12 inches.
B7MY29-5301	The area around Hole #1 in the center of the Item Q1 shirt was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. The pattern of residues found on the Item Q1 shirt was compared to the provided images of GSR patterns and was found to be consistent with the firearm muzzle having been at a distance greater than three (3) inches and less than eighteen (18) inches when discharged.
B8JLBQ-5301	The area around Hole #1 in Item 4 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which are consistent with passage of a bullet and discharge of a firearm. Using the CA 75 model SP-01 Tactical 9mm firearm with PMC Bronze 9mm 115 grain FMJ ammunition, the pattern of residues observed around Hole #1 in Item 4 was reproduced at a distance of between approximately 3 inches to 15 inches.
BG8BE7-5305	Item Q1 was examined and has one (1) hole. The area around this hole was visually and microscopically examined and processed chemically for the presence of gunpower and lead residues (gunshot residues). The muzzle of a firearm, based on size and density of the developed gunshot residues, was approximately greater than 6 inches and less than approximately 15 inches from this area of Item Q1 at the time of firing. Materials produced from the microscopic examination and chemical processing of Item Q1 are being returned as Item Q1M in sample pack GSRD and should be maintained for possible future examinations.
BH4LB9-5301	The muzzle to target distance from visual and chemical examinations was determined to be greater than 3 inches and less than 18 inches.
BVTHFD-5301	The results of the visual examinations and chemical tests for item 1.1.1 were compared to the results of the visual examinations and chemical tests of the generated test patterns (items from 1.2, 1.3, and 1.4). The residue patterns from item 1.1.1 indicate a muzzle-to-target distance greater than 3" and less than 18".
C7M9NX-5301	Visual examination and chemical processing of the submitted item, Q1, in comparison to submitted standards put the muzzle of the firearm further than 3 inches and less than 12 inches from the t-shirt at the time of discharge.
C9RV23-5305	In my opinion, the muzzle of the causative weapon had been between 3" and 12" from Item Q1 at the time the shot was fired.

TABLE 2

WebCode- Test	Conclusions
CDZGPZ- 5301	The muzzle to target distance of the gunshot, Item 2, was greater than 3- inches and less than 15-inches.
CHX37B- 5305	1. Examination of Exhibit 2 disclosed a shirt with a perforating defect near the center of the fabric. a. The area around the hole was visually and microscopically examined. b. Physical characteristics and a pattern of gunshot residues associated with the discharge of a firearm were observed. These characteristics are consistent with a close range of fire.
CJRHET- 5301	Clothing Analysis: Methodology: Physical (Visual Examination). Chemical (Color Test Modified Griess/Sodium Rhodizonate). Microscopy (Stereo/Comparison Microscope). One (1) apparent defect was observed on Item 1A (Q1), the shirt sample, and described as follows: The defect, designated as "A", measured approximately 1/4 inch in greatest dimensions and was located approximately 3 3/4 inches from the bottom and 4 inches from the left on the anterior portion of the shirt sample. Visual/microscopic examination of defect "A" revealed the presence of apparent bullet wipe, soot and gunpowder. Chemical testing of defect "A" indicates the presence of nitrite and lead residues which are found in gunpowder residue. Opinion/Interpretation: 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: Methodology: Physical (Visual Examination) Chemical (Color Test Modified Griess/Sodium Rhodizonate) Opinion/Interpretation: The pattern of gunpowder/gunpowder residues observed and documented from Item 1A (Q1), the shirt sample, was compared to the test standards identified to be produced by CTS and determined to be between 3 and 15 inches.
CK3JZR- 5301	Clothing Analysis: Methodology: Physical (Visual Examination). Chemical (Modified Griess/Sodium Rhodizonate). Microscopy (Stereo Microscope). One (1) defect was observed on Item Q1, the shirt. No visible red-brown stains were observed on this item. The defect/hole, designated as "A", measured approximately 1/4 inch in greatest dimensions and was located approximately 4 inches below the top seam and 4 1/4 inches from the right side seam on the anterior portion of the shirt. Visual examination of defect/hole "A" revealed the presence of apparent bullet wipe, soot, and gunpowder. Chemical testing of defect/hole "A" indicates the presence of *nitrite residues/**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/hole "A" indicated that it was visually consistent with the passage of a bullet based upon the physical characteristics observed and the chemical tests performed. Distance Determination: Methodology: Physical (Visual Examination). Chemical (Modified Griess/Sodium Rhodizonate). The pattern of gunpowder, gunpowder residues, and chemical residues observed and documented from Item Q1, the shirt, was reproduced at a muzzle to target distance between 3 and 15 inches. Miscellaneous: Methodology: Physical (Visual Examination). Item Q1A, Chemical test patterns, collected from Item Q1 during laboratory examination. These items were sealed in a manila envelope and will be returned with the evidence to the submitting agency. Items K1a, K1b, and K1c, the photographs, were sealed in a manila envelope and will be returned with the evidence to the submitting agency.
CVNKG2- 5301	After visual observation and chemical testing it was determined that at the time of discharge, the distance between the muzzle of the firearm and the target was between three (3) inches and fifteen (15) inches.
D32ULA- 5301	Using the distance standards listed under Item K1a-c, the pattern of residues on Item Q1 was reproduced at a muzzle distance of approximately three (3) to fifteen (15) inches.

TABLE 2

WebCode-Test	Conclusions
D34JQ8-5301	The item 1-4 shirt cutting displayed one (1) hole that appears to have been made by the passage of a bullet. The hole will be referred to as hole 1. The areas around the hole were examined visually and microscopically for the presence of gunpowder particles. Gunpowder particles were observed around hole 1. Item 1-4 was tested chemically using the Modified Griess Test and the Sodium Rhodizonate Test. The Modified Griess Test and the Sodium Rhodizonate Test are color-producing tests for the presence of nitrites (burned or partially burned gunpowder) and lead, respectively, found in gunshot residue. A particulate nitrate pattern and a vaporous lead pattern were developed around hole 1. Using the supplied photographs of the Gunshot Residue, Modified Griess Test, and Sodium Rhodizonate Test standards, the distance from the muzzle of the suspect firearm to item 1-4 was determined to be greater than three (3) inches and less than eighteen (18) inches. The item MGT1 test sample will be forwarded to the submitting agency.
D9QC37-5301	As a result of the visual and microscopic examinations and chemical testing, the muzzle to object distance was determined to be greater than three inches and less than eighteen inches.
E26Z2B-5305	The fouling pattern, the powder grain pattern, and the nitrite pattern from the griess test of defect A entrance on the section of white fabric labeled shirt with bullet hole, Q1, (item 1), are consistent in diameter and particle population with the fouling patterns and the powder grain patterns of the test fire series labeled distance standards on untreated cotton cloth targets, K1a, (item 2), and are consistent in diameter and particle population with the nitrite patterns of the test fire series labeled modified griess tests of untreated white cotton cloth targets, K1b, (item 3), between the distances of 3 inches and 15 inches.
EB7ETB-5301	The distribution of smoke and the few grains of powder on the piece of tissue have been compared with the pictures from Item K1a. The density and the pattern seem to be the same that we observe on the pictures of the tissues shot at 6, 9 and 12 inches. So we can conclude that the distance range could be between 6 and 12 inches.
ET962Q-5301	Conclusion: A series of controlled test firings were performed using the questioned firearm (CZ 75 Model SP-01 Tactical 9mm) and ammunition (PMC Bronze 9mm 115 grain FMJ) on a comparable target material at multiple ranges. These test materials and the exhibit were examined and subjected to a series of chemical enhancement techniques to assist in the examination of shooting distance. Based on the examinations performed, including comparison between the questioned item and the results of the controlled test firings, it is my opinion that the distance between the muzzle of the firearm and the target at the time the firearm was discharged was not less than approximately 6" (~15cm) and not greater than approximately 15" (~38cm). It should be noted that: The above conclusion is based on the assumption that test firings were generated under conditions comparable to those encountered in the incident under investigation. Case information indicates that the incident under investigation occurred outside, which may introduce a number of uncertainties that cannot be replicated under controlled laboratory conditions. Nil detail regarding the performance of test firings has been provided.
EYVQAD-5305	In the shirt is established the presence of an bullet hole caused by the passage of projectile fired of a firearm, being determined as distance short, with a range greater that 6 inches and less than 18 inches aproximately between the muzzle of the weapon and impact site in the shirt. This based on the comparison of the results found between the distance of standards and the sample analized
F6EF68-5305	1. Upon examining hole 1 in the shirt (Exhibit Q1), I have found a full match to characteristics of a bullet entrance hole. 2. Upon examining hole 1 in the shirt (Exhibit Q1), I have found a

TABLE 2

WebCode-Test	Conclusions
	high-level match to the scenario in which the shooting towards the victim occurred from an estimated distance in the range of 3" to 15". *The shooting distance estimation is based on the assumption that exhibit 1 was the first medium to be hit by the bullet, and that the shooting was performed under normal conditions.
F86GAV-5305	Q1 had one hole that was consistent with the passage of a bullet. There was burned powder and lead residue present. The firearm's muzzle was between 3 to 15 inches when discharged. The gunshot residue pattern on Q1 was reproduced on the tests between this range.
F894M3-5301	The area around the hole in the center of the Q1 shirt was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. The pattern of residues was reproduced at a distance of between three (3) and twelve (12) inches, based on the provided distance standards.
FACY9Q-5301	A visual comparison of the results obtained from the 'shirt' (Item Q1) in its original form and after it has undergone both the Modified Griess Test and the Sodium Rhodizonate Test to the known distances for each method, it is my opinion that the distance between the target (Item Q1) and muzzle of the firearm is greater than 3 inches (minimum) and less than 12 inches (maximum), with indications between 3-9 inches.
FC2UT7-5305	1. Exhibit 2 is a white piece of cloth with a defect in the center. a. Examination of Exhibit 2 revealed characteristics consistent with those observed at a close range of fire. Technical Notes: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
FDXGQC-5301	According to the tests made in our Lab, we could come to the conclusion that the shooting might have been produced between 3 and 12".
FEPHQ9-5305	The gunshot residue pattern present on Q1 shirt was produced at a muzzle-to-target distance of between 3 and 12 inches from the muzzle of the firearm when compared to the K1a-c known distance standards.
GMEN37-5301	The swatch of white cloth from item Q1 was visually examined. A single hole was located in the approximate center of the swatch. The area around the hole was visually and microscopically examined and chemically processed for the presence of gunpowder and lead residues. Residues consistent with the discharge of a firearm were observed and chemical patterns were developed. Comparison of the resulting patterns to known distance patterns disclose that the Q1 pattern is consistent with a shot fired from between six (6) and eighteen (18) inches.
GQEYUY-5301	The area surrounding the defect A on 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 the pattern displayed on Item Q1 could be produced at a muzzle to target distance of greater than contact to less than fifteen (15) inches.

TABLE 2

WebCode-Test	Conclusions
GXW8HV-5305	<p>The piece of white cloth reported to be a cut piece of the victim's shirt, CTS item Q1, was examined visually and with the aid of a stereomicroscope. A bullet hole was observed near the middle of the cloth. Visible firearm discharge residues were marked on a piece of clear acetate overlay. The acetate was placed into a manila envelope, tape sealed, and derived as item Q1A. The cloth was then chemically processed for the presence of nitrite residues using the Modified Griess Test and lead residues using the Sodium Rhodizonate Test. The Modified Griess Test paper was packaged into a manila envelope, tape sealed, and derived as item Q1B. The results of these examinations were compared to the provided images of the targets test-fired at distances of 3-inches, 6-inches, 9-inches, 12-inches, 15-inches, 18-inches, 21-inches, 24-inches, 27-inches, and 30-inches (CTS item K1a-c). Based on these comparisons, it is my opinion that the muzzle-to-target distance of CTS item Q1 was greater than 3-inches and less than 18-inches.</p>
HANB2F-5305	<p>The fouling pattern, the powder grain pattern and the nitrite pattern detected on the griess test for defect A entrance on item 1, the section of shirt with the bullet hole labeled Q1, is consistent in diameter and particle population with the fouling patterns, powder grain patterns, and nitrite patterns detected from the test fire targets between the distances of 3 inches and 15 inches.</p>
HBEET3-5301	<p>Item 1A (twill square) was visually examined. One defect was observed in the center, Hole A. The area around Hole A on the cotton twill square (Item 1A) was visually inspected, microscopically examined, and chemically processed for the presence of gunshot residues. A pattern of residues was observed. Using the submitted known powder patterns (Item 1B) and known sodium rhodizonate patterns (Item 1D) a consistent pattern was observed at an approximate muzzle-to-target distance of greater than 3 inches and less than 12 inches. Item 1A-G1 (Griess test paper) was destroyed upon completion of the examination.</p>
HTCWHW-5301	<p>The piece of fabric, item Q1, was visually, stereoscopically, and chemically examined for possible bullet defects and gunshot residues. One bullet defect was located in the center of the fabric. The defect tested positive for copper and lead residues and was consistent with having been created by the passage of a bullet. Gunpowder particles were stereoscopically and chemically detected surrounding the bullet defect. Based on the presence of gunpowder particles, the muzzle to target distance for the bullet defect in item Q1 was determined to be intermediate. Intermediate: The range at which a firearm and ammunition combination will deposit visible or detectible gunpowder particles on a target.</p>
JA3YZL-5301	<p>Clothing Analysis: Methodology: Physical (Visual Examination). Chemical (Color Test Modified Griess/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 1/4 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, soot, and gunpowder. 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: Methodology: Physical (Visual Examination). Chemical (Color Test Modified Griess/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 3 and 15 inches. Miscellaneous: Item Q1A, the</p>

TABLE 2

WebCode-Test	Conclusions
	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. 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.
JBC86Z-5301	The area on item Q1 around H1 was both visually and microscopically examined for the presence of gunshot residue. Apparent bullet wipe, smoke, and a pattern of burned, partially burned, and unburned gunpowder particles were visible in the area around H1. H1 is consistent with having been made by the passage of a bullet. H1 was also chemically processed using the Modified Griess Test and the Sodium Rhodizonate Test. These are color producing tests that are sensitive to nitrites and lead respectively. The residue patterns surrounding H1 were compared to the photographs contained in Items K1a, K1b, and K1c. As a result of the examinations and chemical tests performed, the muzzle to target distance for H1 is greater than 3 inches and less than 15 inches. The item 1 envelope was not examined. Item MGT will be forwarded to the submitting agency.
JHGEQ3-5301	Photographs were supplied of test patterns fired at 3 inch intervals from 3 inches to 30 inches inclusive. An examination of the test patterns indicates that the gunshot residue on the questioned garment, Q1, were produced at a distance greater than three inches but less than fifteen inches.
JHX4R3-5301	The findings of the investigation to the damage in the victim's shirt are appreciably more probable if the firing distance is between 6 and 15 inches, than if the firing distance is less than 6 inches or more than 15 inches. The following set of conclusions is used to express the strength of the evidence with respect to the proposed set of hypotheses: The findings of the investigation are [...approximately equally probable / slightly more probable / more probable / appreciably more probable / far more probable / extremely more probable...] if hypothesis 1 is correct, than if hypothesis 2 is correct.
JYKH7U-5305	The section of white cloth (Item 0001-AA) was visually examined for holes/defects. One hole, designated Hole #1, was observed. The area around hole # 1 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found that are consistent with the passage of a bullet. Further gunshot residue patterns were observed that were compared to photographs (Item 0001-AB) of developed and undeveloped distance standards reportedly made using the suspect's firearm. Based upon a comparison of residue patterns on the cloth (Item 0001-AA) to the distance standard photographs, the muzzle to target distance is consistent with being greater than three (03) inches and less than fifteen (15) inches.
KAHR7N-5301	By means of physical study and chemical analysis, gunshot residues (gun powder, nitrites and lead) were detected around the shirt's (Q1) hole consistent with firing a gun from muzzle to garment distance between three (3") inches to twelve (12") inches. The provided distance standards (K1a, K1b and K1c) were used for distance determination.
KFN363-5301	Lab Item #2 (shirt with bullet hole) was microscopically examined and chemically processed for gunshot residues on 04/14/2023. A pattern of residues consistent with passage of a bullet and discharge of a firearm was observed near the center of the shirt. Using Lab Item #1 (distance standards), the muzzle to target distance was determined to be between three (3) inches and fifteen (15) inches.

TABLE 2

WebCode- Test	Conclusions
KMJCRL- 5301	During the optical and chemical examination of the bullet hole (Q1), propellant residue was found surrounding the holes. Shot range determination tests were performed with the Modified Griess Test. Test shots were fired with the exhibit pistol and ammunition with the same specifications, and they indicate that the shots were fired at a distance of between 3 inches (76mm) and 15 inches (381mm).
KREAT- 5301	Damage to the shirt, Exhibit Q1, is consistent with having been caused by a gunshot having a muzzle to target distance of greater than 3 inches, less than 15 inches.
KVG9C4- 5301	Item Q1 was examined visually and processed chemically for the presence of gunshot residues. Distance determination testing indicate that the muzzle of the firearm was greater than 6 inches and less than 18 inches from Item Q1 when discharged.
LKV9DL- 5301	[No Conclusions Reported.]
LUYG2X- 5305	Item 1 is a piece of fabric with a possible bullet hole. It 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 three inches and less than fifteen inches.
LXFNGK- 5305	In my opinion the shot was fired with the muzzle to target distance greater than 3" but less than 15".
M7QKH- 5301	The Item Q1 cotton cloth was received between cardboard panels in a flat manner. The cotton cloth was visually and stereoscopically examined, and a defect was observed. It was examined for the presence of gunpowder and/or residues and revealed a gunpowder residue pattern, vaporous lead for comparison purposes and bullet wipe. The area around the defect was chemically processed using the Modified Griess and Sodium Rhodizonate tests for the presence of gunshot residues. The Item Q1 cotton cloth was visually and stereoscopically examined and chemically processed for the presence of gunshot residues. Item Q1 was visually compared to all the photographs provided within Items K1a, K1b, and K1c. The residue pattern found around the hole in Item Q1 is consistent in pattern size and density with having been produced at a muzzle-to-target distance that is further than 6 inches and closer than 18 inches. Limitations: Interpretation of gunshot residues is stated in terms of residues that are found to be present on an item. Distance determination bracketed ranges are based on the current condition of the cotton cloth as received in the laboratory. Distance determination bracketed ranges are based on the evaluation, documentation, and images provided by Collaborative Testing Services (CTS). Distance determination bracketed ranges are based on the presence and comparison of gunshot residue patterns.
MD9WXJ- 5301	Item Q1 was found to consist of a piece of white fabric with an apparent bullet hole near the centre. Test firings from a suspect firearm were also submitted. The area around the bullet hole was visually and chemically examined for the presence of gun shot residue. Visual and chemical testing indicated a pattern of residue consistent with the discharge of the firearm in question at a distance of between 9 inches and 18 inches from the fabric.
MLYLAD- 5301	In our opinion the damage is consistent with the discharge of a pistol with a muzzle to target range of between 3" and 12".
MRLDDZ- 5305	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 6 inches and less than approximately 12 inches from this area, at the time of firing. The area around the hole of Item Q1 was visually and microscopically examined and chemically processed for lead residues. According to the

TABLE 2

WebCode-Test	Conclusions
	<p>procedure that are used in our lab, the coloring process is not directly performed on the fabrics (case shot and comparison shot series). A secondary trace carrier is used in the case of Sodium Rhodizonate treatment. These circumstances may lead to a different distance estimation (as the case shot was treated according to our procedure and not colored directly on the fabric as done with the comparison shots). This was taken into consideration by using wider error ranges when estimating the range margins.</p>
MYP723-5305	<p>The fouling pattern, the powder grain pattern and the nitrite pattern detected on the griess test for the bullet defect on item 1, the section of the white shirt, is consistent in diameter and particle population with the fouling pattern, the powder grain pattern and the nitrite pattern detected from the test fire targets between the distances of 3 inches and 15 inches.</p>
N4ZGRB-5301	<p>The area around Hole #1 in Item 4 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 CZ 75 model SP-01 Tactical 9mm firearm with PMC Bronze 9mm 115 grain FMJ ammunition, the pattern of residues observed around Hole #1 in Item 4 was reproduced at a distance of between approximately 3 inches to 15 inches.</p>
N8H4YP-5301	<p>Clothing Analysis: Methodology: Physical (Visual Examination). Chemical (Color Test Modified Griess/Sodium Rhodizonate). Microscopy (Stereo Microscope). Analysis of Item Q1: No visible red-brown stains were observed on Item Q1, the white cloth. The defect/hole, designated as "A", measured approximately 1/4 inch in greatest dimensions and was located 4 from the top and 3 from the left side. Visual/microscopic examination of defect/hole "A" revealed the presence of apparent bullet wipe/soot/gunpowder. Chemical testing of defect/hole "A" indicates the presence of *nitrite residues/**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/hole "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: Methodology: Physical (Visual Examination). Chemical (Color Test Modified Griess/Sodium Rhodizonate). Microscopy (Comparison Microscope). The pattern of gunpowder/gunpowder residues observed and documented from Item Q1, defect A, the white cloth, was reproduced at a muzzle to target distance between 3 and 15 inches. The chemical residue pattern as observed and documented from Item Q1, defect A, the white cloth was reproduced at a muzzle to target distance between 3 and 15 inches. Miscellaneous: Item Q1A, the chemical test patterns, will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1a, the photographs, will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1b, the photographs will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1c, the photographs will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Evidence in this case will be returned to the investigating agency.</p>
N8ZRMB-5305	<p>The presence of fouling and the powder grain pattern detected on the section of white fabric labeled shirt with bullet hole, 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, are consistent with the presence of fouling and the powder grain patterns observed on item 2, the photographs of gunshot residue patterns on untreated white cotton cloths, K1a, and the nitrite patterns detected on item 3, the photographs of modified griess tests of the untreated white cotton cloths, K1b, between the distances greater than 3 inches and less than 15 inches.</p>

TABLE 2

WebCode- Test	Conclusions
NEH6FH- 5301	Based on the available evidence, it is my opinion that the shot was fired when the muzzle of the gun was more than 3 " but less than 15" away from the shirt.
NR3PXQ- 5301	The item Q1 cloth piece was examined microscopically and one hole H1 was observed. The hole H1 was examined and found to be entrance hole made by a firearm projectile while the item Q1 was at the distance of between approximately 01 to 12 inches from the muzzle of the firearm at the time of firing.
P6PX34- 5301	Due to the dispersion of GSR particles observed around the hole, it is determined to be a shot fired at close range, between 3 and 9 inches, and a distance of about 6 inches can be determined.
PC4ZGK- 5305	The unknown target was processed visually and chemically for the presence of gunpowder, nitrites and vaporous lead deposition. The target was generated at a muzzle to target distance of farther than approximately 3 inches but closer than approximately 15 inches. The unknown target was most like test targets in the 6 inch to 9 inch range.
PUAHCP- 5301	The current laboratory procedure is to report distances as Contact/Near contact, intermediate, or distant and not a bracketed distance. The defect on Item Q1 exhibited gunshot residues consistent with the passage of a bullet. This defect was determined to have been fired at an intermediate muzzle-to-target range. Once a suspect firearm and ammunition are recovered, the drop-off distance for that specific firearm and ammunition can be determined.
PVE6PU- 5301	The Item Q1 was examined and consisted of a white cloth with a defect located in the middle. The defect had apparent bullet wipe on the peripheral edges, which is indicative of the passage of a bullet. Surrounding the defect was a pattern of gunshot residues that include partially burnt and unburnt powder particles, as well as vaporous lead. The Item Q1 was visually and stereoscopically examined and chemically processed using the Modified Griess test and Sodium Rhodizonate. Gunshot residue patterns were detected. The visual and chemically obtained gunshot residue patterns from Item Q1 were compared to Item K1a, K1b and K1c. The residue pattern found around the defect in Item Q1 is consistent in pattern size and density with having been produced at a muzzle-to-target distance that is further than 3 inches and closer than 15 inches. Limitation Statements: Interpretation of gunshot residues is stated in terms of residues that are found to be present. Distance determination bracketed ranges are based on the photograph and documentation provided by CTS.
PX9T8P- 5301	Examination of the Item A1-1 piece of fabric revealed the presence of a hole, consistent with a bullet hole, through the fabric. 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 A1-2, A1-3 and A1-4 submitted test patterns to the item A1-1 submitted piece of fabric, showed the Item A1-1 residue pattern to be consistent in size and density with patterns observed on the items A1-2, A1-3 and A1-4 submitted standards. Based on this comparison, the bullet hole observed on Item A1-1 is consistent with a shot fired from a distance between approximately 3 inches and approximately 15 inches from muzzle to target.
Q9M63Y- 5305	The presence of fouling and the powder grain pattern detected on the section of white fabric labeled Q1, and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled Q1, are consistent with the presence of fouling and the powder grain patterns observed on item 2, the photographs of gunshot residue patterns on untreated white cotton cloths, K1a, and the nitrite patterns detected on item 3, the photographs of modified griess tests of the untreated white cotton cloths, K1b, between the distances greater than 3 inches and less than 15 inches.

TABLE 2

WebCode- Test	Conclusions
REPNRB- 5301	The garment was separated from the muzzle at a distance that was greater than 3 inches and less than 15 inches at the time of discharge.
RKP63G- 5305	[No Conclusions Reported.]
RMJTL- 5301	The area around Hole 1 in Item 4 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which are consistent with the discharge of a firearm and passage of a bullet. Using the suspect firearm and ammunition, the pattern of residues observed around Hole 1 in Item 4 was reproduced at a distance of between approximately three (3) to fifteen (15) inches.
RZM9R2- 5305	Based on the comparison between the digital photographs of the shot distance residue sample package received and the results of the physical studies and chemical tests applied to the textile fragment (Item Q1), the estimated distance for the shot that caused the analysed hole, is within a range of 3 inches to 12 inches, considered between the muzzle of the weapon and the surface of the textile fragment.
T4H9JH- 5301	I concluded that the muzzle of the suspect's firearm was at a distance range between 3 inches to 9 inches from the bullet hole, in the victim's shirt (Q1), at the time of discharge.
T4KXNE- 5301	The area around the questioned hole in the shirt, Item Q1, was microscopically examined and chemically processed for the presence of gunshot residues. Visible residues which are indicative of the passage of a bullet were found around the hole during a microscopic examination prior to chemical processing. Patterns of nitrite and lead residues were chemically detected on Item Q1 and compared with the distance standards provided for evaluation. Based on the presence, overall pattern, and density of residues observed between Item Q1 and the provided photographs of the distance standards, the questioned bullet hole on Item Q1 appears to have been created by a shot fired at a distance of greater than three (3) inches and less than fifteen (15) inches from the shirt. This is a conservative estimate based on an evaluation of the untreated and chemically processed residue patterns and assumes there were no intervening objects between the muzzle of the firearm and the shirt at the time the shots were created.
TBLRNU- 5305	1. Exhibit 2 is a piece of white fabric with a defect near the center. Examination revealed that the defect is consistent with the discharge of a firearm at a close range of fire.
TWHYYB- 5305	The piece of cloth, Exhibit Q1, has damage that is consistent with having been caused by the passage of a fired bullet. This damage and a firearm discharge residue pattern present in the same area is consistent with having been caused by a shot fired at a muzzle to target distance beyond 3.0 in (7.6 cm) and within 24 in (61 cm), fired using the firearm and ammunition combination that were used to generate the firing test images, Exhibit K1A-C.
TXX4VN- 5301	The area around the hole in the center of the Q1 shirt was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. This pattern of residues was reproduced at a distance of between three (3) and twelve (12) inches, based on the provided distance standards.
U2UAPK- 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 3 inches and 15 inches.

TABLE 2

WebCode- Test	Conclusions
UHXVZT- 5305	The cloth was visually and chemically examined for gunshot residue patterns. The results from the visual and chemical treatment of the item Q1 was compared with test samplings. The result shows that the shooting distance is estimated to be greater than 6" but less than 15".
UNKGD8- 5305	The muzzle to target distance at the time of discharge that we estimate was greater than 3 inches and less than 9 inches
UTX8PU- 5301	The residue pattern from item 1.1 indicates a muzzle-to-target distance between contact and 12 inches.
UYK9KD- 5305	[No Conclusions Reported.]
V2AL8P- 5305	The distance of firing between the muzzle of the CZ 75 model SP-01 Tactical 9mm handgun and the cloth marked "Q1" was estimated to be between 3 inches and 15 inches.
V8B64T- 5301	Item Q1 was examined visually and processed chemically for the presence of gunshot residues. Distance determination testing indicate that the muzzle of the firearm was greater than three inches but less than eighteen inches from Item Q1 when discharged.
VMMURU- 5301	The best fitting distance for the shoot distance is greater than 6 inches and less than 15 inches.
WBRRDR- 5301	The defect in the piece of fabric, item Q1, was consistent with the passage of a bullet. The presence of lead residues, soot, and powder particles was consistent with a muzzle-to-target distance of intermediate. Based on the submitted test panels, items K1a through K1c, drop-off distance is beyond 30". Note: drop-off distance is defined as the maximum distance that gunshot residue particles will be deposited barring the presence of an intervening object.
WF7LXV- 5305	In view of the revelations obtained on the tee-shirt, which was the subject of the sealed record in question, and the comparisons made with the matrix/weapon/ammunition trio, the shooting distance is estimated to be between (3;12). It should be noted, however, that an interpretation can only be made on the basis of the elements brought to our attention in the investigation. The emergence of an additional element may have an influence on the interpretation of analytical results.
WJ37YU- 5305	According to the tests made in our Lab, we could come to the conclusion that the shooting might have been produced between 3 and 12".
XGPX8L- 5301	The area around hole # 1 of Item Q1 was microscopically examined and chemically processed for the presence of gunshot residue. Examinations showed hole # 1 was consistent with the passage of a bullet. The residue and physical effects were consistent with a muzzle to garment distance of six (6) inches to fifteen (15) inches.
XUJ4J4- 5301	The Item CTS Q1 cloth exhibits one perforating defect surrounded by bullet wipe, sooting, and a visual pattern of black particulate. One particle was removed from the area and was morphologically and chemically positive for gunpowder. The combination of visual and chemical examinations reveals the defect on CTS Q1 is consistent with the passage of a projectile occurring when the muzzle of the firearm was at a distance greater than 3 inches and less than 15 inches from the surface of the material at the time of firing.
Y8JFAM- 5301	The area around defect A was visually examined, microscopically examined and chemically processed for the presence of gunshot residues. The pattern of gunshot residues around defect A is consistent with a muzzle to target distance between 3 inches and 15 inches.
YL4VCM- 5301	The area around Hole A on the center of Item 1D (white fabric) was visually inspected, microscopically examined, and chemically processed for the presence of gunshot residues. A

TABLE 2

WebCode-Test	Conclusions
YMXJVH-5301	<p>pattern of residues was observed. A similar pattern of residues was observed at an approximate muzzle-to-target distance of greater than contact and less than 24 inches.</p> <p>EVIDENCE SUBMITTED: Lab Item #. Agency Item #. Description: 1) GSRP- One (1) manila envelope containing: 1.1) GSRP- Ten 10 photographs of witness panels with powder pattern. 1.2) GSRP- Ten 10 photographs of witness panels with Griess test results. 1.3) GSRP- Ten 10 photographs of witness panels with sodium rhodizonate test results. 1.4) GSRP- One (1) section of t-shirt with defect. CONCLUSIONS OF ANALYSIS: The section of t-shirt, item 1.4, was examined and found to have a defect consistent with the perforation of a bullet with a pattern of gunshot residue. Based upon the patterns observed on the witness panel photographs and macroscopic, microscopic, and chemical testing, the pattern on the t-shirt, item 1.4, can be reproduced at distances of greater than 6" and less than 15", with the most likely range being between 9" and 12".</p>
YRM98F-5301	<p>Result between 3" and 9" based on comparison made between sample Q1 chemically treated with RdNa, and GSR patterns on untreated white cotton cloths and those treated with RdNa. On the other hand, this laboratory has the [Forensic Laboratory Software] analysis equipment, which can give a range between 3" and 6", closer to the 6".</p>
YYTPTM-5301	<p>The item Q1 section of cloth displayed one hole that appeared to have been made by the passage of a bullet. The hole will be referred to as hole 1. The areas around the hole were examined visually and microscopically for the presence of gunpowder particles. Gunpowder particles were found all around the hole. Item Q1 was tested chemically using the Modified Griess Test and the Sodium Rhodizonate Test. The Modified Griess Test and the Sodium Rhodizonate Test are color-producing tests for the presence of nitrites (burned or partially burned gunpowder) and lead, respectively, found in gunshot residues. A particulate nitrite pattern was detected around hole 1. A vaporous lead pattern was also developed around hole 1. Using the supplied photographs of the test shots, the photographs of the results of the Modified Griess Tests and the Sodium Rhodizonate Tests, the distance from the muzzle of the suspect firearm to item Q1 was determined to be greater than 3" and less than 15".</p>
YZ2UH6-5301	<p>Examination of Item 4 revealed a hole in the center of the cloth. The area surrounding the hole was visually and microscopically examined and chemically processed and a pattern of gunshot residues was detected. 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 three (3) and eighteen (18) inches. Comparison of Item 4 to Items 1 and 3, (submitted photos of test patterns) were used to determine this range. Item 2 and the results of the Griess test were not used to determine muzzle to target distance determination due to an indistinct pattern development.</p>
ZFRX7J-5301	<p>The supplied test pattern images indicate they were fired from 3 to 30 inches at 3-inch intervals. The Q1 shirt was visually and chemically analyzed. A comparison of test patterns to the Q1 shirt indicate the muzzle to garment distance was greater than 3 inches and less than 15 inches.</p>

Additional Comments

TABLE 3

WebCode-Test	Additional Comments
4Q47GG-5305	TECHNICAL NOTES: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
6EJVF-5301	Results were based on visual comparison and Na Rho test. Modified Griess test not used.
6UAXWZ-5301	we do an color test of the muzzle by the sodium rhodizonate and compare the result with (Klc) samples .
6UFX6G-5301	It would have been helpful to provide a contact shot as part of the test shots. Also, a test shot at 30" was not necessary.
7R6H8A-5301	The current laboratory procedure is to report distances as contact/near contact, intermediate, or distant and not a bracketed distance.
7V7LZG-5301	The uncertainty of measurement in the creation of known test fire patterns was established for our laboratory. Since we were supplied with test patterns created by CTS, our uncertainty of measurement does not apply and will not be reported.
8BEYQD-5301	Conclusion Scale for Microscopic Comparisons: The following descriptions are meant to provide context to the levels of opinions reached in this report. Identification: This is the strongest statement of association that can be expressed. An identification is made to a degree of practical certainty when there is agreement of all discernible class characteristics and sufficient agreement of the individual characteristics of toolmarks. When sufficient agreement exists, in part, this means the likelihood of another tool producing the same marks is so remote it is considered a practical impossibility. Elimination: This is the strongest statement of non-association that can be expressed. An elimination is made when it is physically impossible (i.e., there is a clear, demonstrable incompatibility in class characteristics) for the items to have been marked by the same tool/fired in the same firearm. Inconclusive: An inconclusive is made when one of the following situations is true. Agreement of all discernible class characteristics and some agreement of individual characteristics, but insufficient for identification. Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility. Agreement of all discernible class characteristics and disagreement of individual characteristics. Agreement of all discernible class and subclass characteristics. The individuality of the characteristics is not discernible; therefore, the items may have been fired from the same firearm or from another firearm that was machined with the same tool in the approximate same state of wear. Unsuitable: An item is considered unsuitable for comparison when it does not bear any class, subclass, and/or individual toolmarks of value for microscopic comparison. The interpretation of the data and authorization of the results was performed by the undersigned forensic analyst. Other staff members may have performed laboratory activities concerning evidence associated with this report. For a complete listing of all staff members who performed laboratory activities in this case, please contact the laboratory via the telephone number above. [Numbers not provided with Data Sheet].

TABLE 3

WebCode-Test	Additional Comments
C9RV23-5305	In a live casework situation I would have fired additional patterns at 3", 9" and 12", and then further patterns at smaller 1" increments either side of those distances.
CHX37B-5305	TECHNICAL NOTES: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
D32ULA-5301	Griess standards inconsistent pattern growth from 6 to 12 inches. Because of this, not high confidence in reproducibility in this range with gun/ammunition combination resulting in larger reported bracketed distance.
D9QC37-5301	In previous years, photos of tests from contact to 27" were supplied, but this year it was changed to 3" to 30". Photographs of contact shot tests would have been appreciated and pertinent in this case. The evidence looked similar enough to the photographs of 3" tests that I would have considered making my bracket from greater than contact to 18" rather than 3" to 18".
F6EF68-5305	1. The match-level scale that is made use of in our laboratory for this type of examinations is (in descending order): A. Full match. B. High-level match. C. Partial match. D. Inconclusive. 2. The procedures that are made use of by the manufacturers of this test, as well as the conditions of the test firing here, are different from those that are routinely applied by our laboratory. As a result, the above quoted figures for the minimum and maximum shooting distances may be wider, and the match therefore lower.
FACY9Q-5301	Only one example for each increment of the standards (known distances) were included and casework would require additional (up to three) in order to demonstrate and account for variation in the 'patterns' when determining an estimated range. It was observed that Item Q1 was not attached or adhered to the cardboard and this may have resulted in possible loss of residues due to disturbance in transit. It was also noted that directionality of the target was not nominated (for example - top vs bottom) which would be required in casework.
FDXGQC-5301	The conclusion indicated in #2 is similar to the one we would put in our real reports.
GQEYUY-5301	I feel like a photo of contact included in the standard photos would have been beneficial to actually supply a "bracket". It would be clearer then, to say greater than contact...
GXW8HV-5305	Multiple examples of the powder pattern, Griess pattern, and Sodium Rhodizonate pattern from each distance would be beneficial to help with assessing reproducibility. Also, images of the sodium rhodizonate test prior to spraying with the dilute Hydrochloric Acid would also be helpful as it is known that the purple color fades upon the confirmation of lead.
HBEET3-5301	The Griess test did not yield any results though my positive controls worked. It still seemed like there was an issue with the test rather than an negative results so the Griess results were discounted when reporting the final result.
HTCWHW-5301	Per [Laboratory] protocol, bracketed ranges are not reported for gunshot residue muzzle to target distant determinations. Our range of conclusions are contact/near contact, intermediate, and distant. For intermediate and distant conclusions, typically drop-off distance for the firearm and ammunition would be determined and reported. Drop-off distance is

TABLE 3

WebCode-Test	Additional Comments
	defined as the distance where the firearm and ammunition combination will no longer deposit observable/detectable residues on a specific target material. None of the provided test panels indicated/represented drop-off distance.
JHGEQ3-5301	Visual/Particulates approximately 3" pattern.
JHX4R3-5301	To determine the firing distance we used the distance standards increments on untreated white cotton and the sodium rhodizonate chemical treatments. The modified Griess test is not used in this investigation.
JYKH7U-5305	Please include physical copies of the Distance Standard photographs with the test packet. Our section does not have direct access to a color printer.
LXFNGK-5305	Not enough test papers and diff method used by lab vs CTS so no DTO samples to compare to.
M7QKHX-5301	The 30" powder pattern panel was not received.
MLYLAD-5301	Our normal laboratory procedure would be to do repeated shots at each distance to improve accuracy and we would narrow the distance gap between tests.
NEH6FH-5301	More than 1 test at each distance would have been helpful to establish the extent of shot-to-shot variation. Question the usefulness of a test that expects us to carry out an examination type that we don't do (Modified Griess test). Question the usefulness of a test that uses far smaller increments than we do in real casework (where typically it's the difference between (i) arm's reach and (ii) beyond arm's reach that matters). Would be better if we had the necessary equipment to do the NaRH tests in the same way as the people who set the test (i.e. use 5% HCl rather than 1% as per our SOP, plus use a tartrate buffer, which we have never done). I feel we are better equipped for testing small areas with the BTK than we are testing larger areas by directly spraying the item.
P6PX34-5301	The study is carried out by comparison with patterns made in the gallery with the same ammunition and the same weapon. All of them have been analysed with the [Forensic Software Equipment]. A chemometric comparison is made with the sample submitted for study.
PUAHCP-5301	Glossary: Drop-off distance: Drop-off distance is the distance where the firearm and ammunition combination will no longer deposit observable/detectable residues on a specific target material. Gunshot residues: The total residues resulting from the discharge of a firearm. It includes both gunpowder and primer residues, carbonaceous material, metallic residues from projectiles, fouling, and any lubricant associated with the projectiles. Intermediate: The range at which a firearm and ammunition combination will deposit visible or detectable gunpowder particles on the target.
TBLRNU-5305	TECHNICAL NOTES: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
TWHYYB-5305	Would have liked to see multiple tests at a given range to establish reproducibility.

TABLE 3

WebCode-Test	Additional Comments
UHXVZT-5305	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, Reversed Modified Griess test, DTO for copper and Modified Sodium Sulphite test for lead.
UNKGD8-5305	Visual was closer to 3 to 9, Griess was closer to 3 to 9 and Lead (violet color) was within 6 inches but couldn't find the violet color around the bullet's passage.
UTX8PU-5301	The uncertainty of measurement in the creation of known test fire patterns was established for our laboratory. Since we were supplied with test patterns created by CTS, our uncertainty of measurement does not apply and will not be reported. The Sodium Rhodizonate treatment was performed using a different procedure than that of the one used by CTS.
VMMURU-5301	We use the method recommended by [Name and Institute] to determine the shooting distance.
WBRRDR-5301	Greater than and less than fields intentionally left blank on answer page. Bracketing type conclusion based on submitted test panels for proficiency purposes in case file notes was approximately between 3 and 15 inches based on K1a-K1c test panels. Per this agency's technical procedures range bracketing is not typically reported. The following is typically added to the Glossary section of a lab report for Distance Determination casework: 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 detectable 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. Drop-off Distance: The distance where the firearm and ammunition combination will no longer deposit observable/detectable residues on a specific target material.
WJ37YU-5305	The conclusion indicated in #2 is similar to the one we would put in our real reports.
YRM98F-5301	Our laboratory does not use the Modified Griess Test considering it a slow procedure and a bit outdated. Our team go to the direction of accrediting the shooting distance with the [Forensic Laboratory Software] chemical analysis equipment.
YYTPTM-5301	It would have been helpful to have a test shot at contact. In real case work, I would have created a test shot at contact.
YZ2UH6-5301	Reported Range: 3-18" Due to differences in the lighting, camera settings, only having (1) target per distance, known vs questioned samples processed with different chemical lots, and the Griess test not being used due to the apparent issue with the emulsion coated photo paper the reported range is conservative. The positive control worked on all four corners, but a void in the center of the paper was noted when Item 4 was processed. If it was possible to evaluate reproducibility, mitigate differences in camera settings and lighting it maybe possible that the reported range could be restricted 3-6" further.

-End of Report-
(Appendix may follow)

Test No. 23-5301: GSR Distance Determination

DATA MUST BE SUBMITTED BY **May 01, 2023, 11:59 p.m. EDT** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: ZP2NUN

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

Scenario:

Police are investigating a shooting at a motel. 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 medical examiner confirmed that no exit hole was present on the victim. A suspect was apprehended later that day and seized a CZ 75 model SP-01 Tactical 9 mm handgun from his possession. The bullet recovered from the victim was identified as having come from the suspect's firearm. Rounds of PMC Bronze 9mm 115 grain FMJ (which was consistent with the bullet recovered from the victim) were test fired with the suspect's 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 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):

Item K1a-c: Distance Standards at 3 inch increments from 3 to 30 inches provided as images of GSR patterns on untreated white cotton cloths, and Modified Griess Test and Sodium Rhodizonate chemical treatments.

Item 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.

Greater than (inches) and Less than (inches)

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

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

3.) Additional Comments

RELEASE OF DATA TO ACCREDITATION BODIES

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

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

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

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

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

ANAB Certificate No.
(Include ASCLD/LAB Certificate here)

A2LA Certificate No.

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

Authorized Contact Person and Title

Laboratory Name

Location (City/State)