Collaborative Testing Services, Inc
FORENSIC TESTING PROGRAM

P.O. Box 650820
Sterling, VA 20165-0820
e-mail: forensics@cts-interlab.com
Telephone: +1-571-434-1925
Web site: www.cts-forensics.com

GSR Distance Determination
Test No. 20-5301/5 Summary Report

Each sample set contained one of the following: An evidence piece of clothing for chemical processing for a GSR pattern (Q1) and either photographs (20-5301) or directly downloadable digital images (20-5305) 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 the Q1 clothing sample and report the range of distances, along with their conclusions and comments. Data were returned from 112 participants and are compiled into the following tables:

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

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

Manufacturer's Information

Each sample 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 Sig Sauer model MPX 9mm semiautomatic handgun and the ammunition was Prvi Partizan 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 16 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: All three predistribution laboratories reported different "greater than" ranges (in inches) that consisted of 9, 12, and 15. For the "less than" distance range (in inches), one laboratory reported 18 and two laboratories reported 27. Overall, each predistribution laboratory reported a range that included the production muzzle to target distance of 16 inches.

Summary Comments

This test was designed to allow participants to assess their proficiency in muzzle to target distance determination using gunshot residue (GSR) patterns. Each participant received an evidence piece of clothing for chemical processing (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 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) placed 16 inches away from the muzzle of the firearm. (Refer to the Manufacturer's Information for preparation details.)

In Table 1, 103 of the 112 responding participants (92%) reported a "greater than" distance between 3 and 18 inches and a "less than" distance between 18 and 30 inches. Eight participants did not report a "greater than/less than" range, but did provide distance related results in their conclusions. 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 (16 inches) was used as the baseline. A consensus of 99% of participants who reported numeric range values (in inches) did so with a greater than/less than range that included the known target distance of 16 inches. 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 larger 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. 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
2LA66M-5301	12	24	*12*	6C7GG7-5301	12	24	*12*	ACWXNB-5305	12	24	*12*
2ZRU34-5301	9	21	*12*	6GJ7YU-5301	15	21	*6*	AJPD8N-5305	6	24	*18*
3E4RKA-5301	9	21	*12*	6MACZB-5301	12	21	*9*	AK8ZAC-5301	15	21	*6*
3N83TK-5305	9	18	*9*	724FG7-5305	9	21	*12*	AR4YHC-5301	9	27	*18*
3NRJ9M-5305	15	24	*9*	7F8J6L-5301	12	24	*12*	ATZ9V3-5305	15	27	*12*
3QWBZZ-5301	12	18	*6*	83FECF-5301	12	24	*12*	AUT9QT-5301			
3W4XT4-5301	15	24	*9*	8B7ZHD-5305	12	21	*9*	AV7XT6-5305	12	18	*6*
43LPH9-5305	12	18	*6*	8UGPVB-5305				AZJMBT-5301	12	21	*9*
48YC87-5305	9	21	*12*	8UJNMY-5301	17	25	*8*	BKYMXZ-5305	6	18	*12*
4JTTW8-5305	9	24	*15*	99CTC8-5305	12	21	*9*	BXPG6M-5305	12	18	*6*
4RL2GY-5301	6	12	*6*	9DNJUV-5301	12	24	*12*	CAUWPW-5301	6	21	*15*
4XP7B4-5305	12	21	*9*	9QHXZJ-5301	15	21	*6*	CFK4FH-5301			
6766L9-5305	15	21	*6*	AAMVY7-5301	9	21	*12*	CHWWC7-5301	3	21	*18*
6AHRB8-5305	12	24	*12*	ACPXJ2-5301	15	24	*9*	CP8A7U-5305	12	24	*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*
CU9YTZ-5301	18	24	*6*	GD23XQ-5305	9	21	*12*	NAC3YW-5305	15	21	*6*
CWPVVT-5301	9	21	*12*	GZVMEG-5301	12	24	*12*	NF2EZK-5301	15	24	*9*
CYFW2G-5305	15	27	*12*	HU36DB-5305	6	18	*12*	NJ3KD6-5305	6	27	*21*
D4PAJE-5301	9	21	*12*	HWT4TU-5305	15	21	*6*	NKF3QH-5301	9	21	*12*
DGBR6R-5301	9	18	*9*	JHTP76-5301	12	24	*12*	NUHFQJ-5305	6	24	*18*
DGVQ3P-5301	12	27	*15*	KA94GX-5301	15	24	*9*	PMK6ZK-5301	12	24	*12*
DHATD4-5305	12	27	*15*	KB3RVM-5301	12	21	*9*	PRWUG9-5305	12	21	*9*
DLMXKX-5301	15	27	*12*	KW2ZAH-5301				QJ2AWR-5301	18	24	*6*
E3PUJM-5301				L3JX9P-5305	6	27	*21*	QL3BWP-5301	9	21	*12*
E9HWRT-5301	12	21	*9*	LEE7UD-5305	12	24	*12*	T99TZM-5301	15	24	*9*
EH2CCM-5305	9	18	*9*	LFTNVX-5305	15	21	*6*	TD2XTR-5301	15	24	*9*
EKC7E3-5301	9	21	*12*	LRZH7M-5301	9	21	*12*	TG3YUN-5301	9	21	*12*
EUURHC-5305	15	24	*9*	LWJD9F-5301	15	24	*9*	TRLDWQ-5301	12	24	*12*
EUVTZN-5305	12	21	*9*	MUP3VR-5301	12	27	*15*	TTEDRG-5301	6	21	*15*
F4FJZL-5301	15	21	*6*	N6H6A6-5301				U23J6E-5301	12	24	*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*
U2ZUXW-5305	12	21	*9*	XZZVEE-5305	12	18	*6*				
UAWNXF-5301	12	24	*12*	YHXEP8-5301	9	21	*12*				
UBU2JM-5305	12	27	*15*	YRYZRZ-5305	9	24	*15*				
UPTTH7-5301	12	21	*9*	YU3XZ8-5305	9	21	*12*				
UU42P3-5301	9	24	*15*	YWWJVJ-5301	15	21	*6*				
VLNFGY-5305	9	21	*12*	Z4RNG9-5301	15	21	*6*				
VRRGJD-5301	12	27	*15*	Z7FDM7-5301	9	18	*9*				
VWLMTA-5301	15	30	*15*	ZEAMTV-5301							
VXHW7Z-5301				ZHQMCH-5305	9	21	*12*				
WGR9GM-5301	9	21	*12*	ZHUARB-5301	12	24	*12*				
XBW3TB-5305	12	21	*9*								
XG72K4-5305	9	18	*9*								
XU8T9U-5301	9	21	*12*								
XURCDZ-5305	9	21	*12*								
XXRPRD-5301	12	24	*12*								

Distance Determination

Response Summary **Participants:** 112

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	0 *(0.00%)*
3	1 *(0.89%)*	3	0 *(0.00%)*	6	18 *(16.07%)*
6	9 *(8.04%)*	6	0 *(0.00%)*	9	26 *(23.21%)*
9	29 *(25.89%)*	9	0 (0.00%)	12	42 *(37.50%)*
12	39 *(34.82%)*	12	1 *(0.89%)*	15	11 *(9.82%)*
15	23 *(20.54%)*	15	0 *(0.00%)*	18	4 *(3.57%)*
18	2 *(1.79%)*	18	12 *(10.71%)*	21	2 *(1.79%)*
21	0 *(0.00%)*	21	45 *(40.18%)*	24	0 *(0.00%)*
24	0 *(0.00%)*	24	33 *(29.46%)*	Other	1 *(0.89%)*
27	0 *(0.00%)*	27	11 *(9.82%)*	No Response	8 *(7.14%)*
Other	1 *(0.89%)*	Other	2 *(1.79%)*		
No Response	8 *(7.14%)*	No Response	8 *(7.14%)*		

Conclusions

TABLE 2

WebCode-Test	Conclusions
2LA66M-5301	The area around Hole #I 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. Using the Sig Sauer 9mm model MPX semiautomatic handgun with Prvi Partizan 9mm 115 grain FMJ ammunition, this pattern of residues was reproduced at a distance of between approximately 12 inches and 24 inches.
2ZRU34-5301	Examination of Item Q1 revealed a hole. The area around the hole was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of residues was found. The result of the chemical test also indicated the presence of lead residue, which could have come from the passage of a bullet. The residue pattern found around the hole in Item Q1 is consistent in pattern size and density with having been produced at an approximate distance between 9 inches and 21 inches.
3E4RKA-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 9 inches and 21 inches.
3N83TK-5305	Testing revealed a muzzle to target distance no closer than 9" and no farther than 18".
3NRJ9M-5305	The absence 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 powder grain patterns observed on item 2, the image set of test fire targets, K1a, and the nitrite patterns detected on item 3, the image set of test fire targets treated with the griess test, K1b, between the distances of greater than 15 inches and less than 24 inches.
3QWBZZ-5301	The powder pattern on the shirt item Q1 was compared with the series of test firings and I estimate the shot was fired from a distance of between 12 and 18".
3W4XT4-5301	After comparing the pattern of gunshot residues surrounding the hole (Q1)and the submitted photographs we can estimate that the shooting distance was greater tan 15 inches and less tan 24 inches.
43LPH9-5305	It's 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 12 to 18 inches, which is consistent with short distance.
48YC87-5305	Item Q1 was likely shot from a distance between nine and twenty-one inches.
4JTTW8-5305	Muzzle to target distance of the gunshot that caused the bullet hole to the shirt, Exhibit Q1, using the provided distance standards, Exhibit K1a-c, was determined to be greater than 9 inches and less than 24 inches.
4RL2GY-5301	Most probably in a rank between 9" and 12".
4XP7B4-5305	Distance Determination testing revealed the shot fired at Item #4 was fired at a distance greater than 12 inches and less that 21 inches.
6766L9-5305	The fragment of cloth belonging to the victim's shirt has a hole consistent with an entrance generated by the passage of a projectile fired by a single-charge firearm; based on the

TABLE 2

WebCode-Test	Conclusions
	physical, on the results of chemichal test and comparisons with photographic images of patterns taken at different distances from the dispersion of the firing residues, Griess tests and Sodium Rhodizonate; it is inferred that the shot was fired in a distance range between a minimum of fifteen inches (15") and a maximum of twenty-one inches (21") between the gun's muzzle and the jacket.
6AHRB8-5305	The damage to the shirt, Exhibit Q1, is consistent with having been caused by a gunshot at a muzzle to target distance of greater than 12-inches and less than 24-inches based upon comparison with the known distance standards, Exhibit K1.
6C7GG7-5301	The area around the hole on the white cloth (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the submitted Distance Standards this pattern of residues was reproduced at a distance of between 12 inches and 24 inches.
6GJ7YU-5301	Visual examination and chemical processing of the submitted item Q1 in comparison to submitted standards put the muzzle of the firearm further than 15 inches and less than 21 inches from the T-shirt at the time of discharge.
6MACZB-5301	Distance standards prepared using the suspect firearm were produced at ranges of contact to 27". The damage to the victim's shirt was compared to the standard test cards to determine the distance of the muzzle from the shirt. In my opinion, the questioned shot was fired from a distance of greater than 12" but no more than 21". It was likely fired from a range of approximately 15".
724FG7-5305	The piece of T-shirt of the victim has an entrance hole located in the central half, which was chemically processed and examined macroscopically and microscopically to identify the possible presence of firing residues. The previous procedures allowed to detect the presence of combustion granules and a deposit of soot (sooting) around the orifice, with characteristics of concentration and magnitude obtained through the applied tests, in comparisson with the reference standards (photographs) allows to conclude that the shooting distance, between the mouth of fire of the gun and the surface of the shirt, is in a range of shooting distance greater than 9" and 12" and less than 18" and 21".
7F8J6L-5301	The area around the hole in Item 4 was microscopically examined and chemically processed for a pattern of residues. Residues like that observed on Item 4 were reproduced in Items 1, 2, and 3 at a minimum distance of 12 inches and a maximum distance of 24 inches.
83FECF-5301	Examination of Item 4 revealed a hole in the center of the fabric. 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 on Item 4 is consistent in size, density, and appearance to the test patterns produced at muzzle-to target distances of between twelve (12) and twenty-four (24) inches. This range was determined by examining Item 4 and the submitted photo arrays which represent test patterns at known distances.
8B7ZHD-5305	In the portion of the t-shirt is established the presence of a bullet hole caused by the passage of projectile fired by a firearm, being determined as distance short, with a range greater than 12 inches and less than 21 inches approximately, between the muzzle of the weapon and the impact site in the shirt. This based on the comparison of the results found between the distance of standards and the sample.
8UGPVB-5305	The area around the hole near the center of the white fabric (Item #2) was examined microscopically and processed chemically for the presence of gunpowder, copper, and lead

TABLE 2

WebCode-Test	Conclusions
	residues (gunshot residues). A pattern of nitrite residues was detected. Copper and lead residues were also detected. Comparison of these results with the distance references (Item #1) will be reported separately by the Ballistics Unit.
8UJNMY-5301	Q1 was physically, visually, microscopically, and chemically examined. When compared to the submitted test materials, the results show that the distance between the muzzle and the target material is not less than approximately 17 inches and not more than approximately 24 inches.
99CTC8-5305	The distance of firing between the muzzle of the firearm and the shirt marked "Q1" was estimated to be between 12 inches to 21 inches.
9DNJUV-5301	The area around the hole in Q1 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which were consistent with the passage of a bullet. Utilizing reference tests from a Sig Sauer model MPX 9mm firearm with Prvi Partizan 9mm 115 grain FMJ ammunition, this pattern of residues was found to reproduce at a distance of greater than 12" and less than 24".
9QHXZJ-5301	The cut-out of section 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 that are consistent with an entrance hole of single bullet. The pattern of gunshot residues on the cut-out section of the knit shirt, Item Q1, (untreated and chemically treated) were compared to the provided untreated and chemically treated test target photographs ranging in distances from contact to twenty-seven inches in three inch increments (Items K1 a-c). The combined pattern of gunshot residues on the shirt, Item Q1, were determined to be visibly and chemically consistent with a muzzle-to-target distance range of between fifteen and twenty-one inches. Remarks: It should be noted that there are variables in any distance determination ranges obtained when compared to results obtained from the processing of evidence / garment that should be acknowledged. Results obtained from generation and processing of known distance determination targets were typically carried out in a laboratory environment with minimal handling to prevent any potential contamination. Unknown variables include handling of the garment prior to removal from the (living or deceased) victim, and treatment of the garment by medical personnel or officers after removal, but prior to packaging. These and other unknown variables of evidence handling prior to examination may add or subtract to the distances reported as compared to the results observed on the laboratory generated distance determination targets.
AAMVY7-5301	The muzzle to garment distance is greater than 9 inches and less than 21 inches.
ACPXJ2-5301	Shooting distance is from 15 to 24" from end of barrel to impact surface
ACWXNB-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 greater than 12" but less than 24".
AJPD8N-5305	Item 1 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 six inches and less than twenty-four inches.
AK8ZAC-5301	Item 1 was found to consist of a piece of white fabric with an apparent bullet hole in the centre. Black coloured residue was visible around the hole, extending to a radius approximately 7cm from the hole. Some black coloured residues were visible outside the 7cm

TABLE 2

WebCode-Test	Conclusions
	radius. Test firings from the suspected firearm used were also submitted. Chemical testing indicated a pattern of firearm residues was produced consistent with the discharge of the firearm in question at a distance of between 15 inches and 21 inches from the fabric.
AR4YHC-5301	The questioned cloth was processed for the presence of nitrites and lead using the the direct application technique for both the modified Griess and sodium rhodizonate tests. A pattern of pinpoint-like reactions indicative of a positive result for the presence of nitrites was observed surrounding the hole on the questioned cloth. A ring-like reaction encircling the hole indicative of a positive reaction for lead wipe was also observed. There was also a faint and incomplete reaction near the hole indicative of a positive reaction for vaporous lead. The observed reactions were compared to the reactions developed on the test patterns, and an estimated muzzle-to-garment range was developed. The firearm was separated from the cloth at an approximate distance that was greater than 9 inches and less than 27 inches at the time of discharge.
ATZ9V3-5305	The distance between the muzzle of the exhibit 9mm Sig Sauer model MPX pistol and the exhibit shirt (item Q1) was greater than 15" and less than 27" at the time it was discharged.
AUT9QT-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 range shot.
AV7XT6-5305	Observations and comparisons between shirts allow us to estimate the distance of the muzzle of the firearm from the shirt greater than 12" and less than 18". However an interpretation can be made by knowing elements of the investigation. Therefore, all new data may have an effect on the interpretation of analytical results.
AZJMBT-5301	The bullet hole was examined and found to be entrance hole made by a firearm projectile while the item Q1 shirt was at the distance of between 12 inches to 21 inches from the muzzle of the firearm at the time of firing.
BKYMXZ-5305	-With very high probability, the hole in the shirt (Q1) is a bullet entrance hole. -With high probability, the bullet was shot at a distance in the range of 6"-18" (muzzle to target). This shooting distance estimation is based on the assumption that this target was the first medium hit by the bullet.
BXPG6M-5305	According with the distance standards, the hole in the fabric “Q1” was produced by the entry of a ballistic projectile shooted at a distance ranging from 12 inches to 18 inches approximately.
CAUWPW-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/copper residues was found. The pattern of residues present on the Item 1 shirt was reproduced at a muzzle-to-target range of greater than six and less than twenty-one inches when using the submitted distance standards. No other residues were detected.
CFK4FH-5301	1) A hole of entry and a pattern of gunpowder, all consistent with the discharge of a firearm, were located on Exhibit 2 (Piece of Fabric) and are consistent with characteristics observed at a close range of fire.
CHWWC7-5301	The Q1 fabric was visually examined and chemically processed for gunshot residue, and compared to the K1a, K1b, and K1c photographs. The distance from the muzzle of a firearm to the Q1 fabric was determined to be between 3 inches and 21 inches.

TABLE 2

WebCode-Test	Conclusions
CP8A7U-5305	The pattern of GSR on the shirt is consistent with test patterns generated at muzzle to target distances of greater than 12 inches and closer than 24 inches. The pattern is most consistent with test targets generated at 15-18 inches.
CU9YTZ-5301	By mean of physical study and chemical analysis, gun shot residues (gun powder, nitrites and lead) were detected around the shirt's (Q1) hole consistent with firing a gun from a muzzle to garment distance between eighteen (18") to twenty four (24") inches. The provided distances standards (K1a, K1b and K1c) were used for the distance determination.
CWPVVT-5301	Examination of Item Q1 revealed one hole in the center of the fabric. The area around this hole was microscopically examined and chemically processed for the presence of gunshot residues (gunpowder and lead residues), and a pattern of residues was found. The residue pattern found around the hole in the center of Item Q1 is consistent in pattern size and density with having been produced at an approximate distance between 9 inches and 21 inches. Materials produced from chemically processing Item Q1 are being returned as Item Q1M in Container 1 and should be maintained for possible future examinations.
CYFW2G-5305	The gun shot residue pattern on item # 1 is consistent with having been made at a muzzle to target distance of between 15 inches and 27 inches.
D4PAJE-5301	The area around the suspected bullet hole on Item Q1 was microscopically examined and chemically processed and a pattern of residues was found. The pattern on Item Q1 was compared to the photographs of provided known distance patterns depicted in Items K1A, K1B, and K1C. The pattern of residues displayed on Item Q1 most resembles the known test patterns generated between a minimum distance of 9 inches, and a maximum distance of 21 inches.
DGBR6R-5301	The delivered Item Q1 was first searched for penetrations. Figure 1 shows an identified penetration that, due to shape and size, could be induced by a bullet of caliber 9mm. From the penetration area possible traces of GSR were transferred to a secondary trace carrier, which was subsequently treated with chemographical coloring methods. Firstly the Na-Rhodizonate method was applied. Hereby a bullet wipe ring could be identified as it occurs when a bullet penetrates an object like a fabric. Additionally, cloudy and spot-like colored traces could be identified around the entrance hole. Subsequently, the delivered shirt was investigated regarding potential NC particles using a modified Griess Test. Hereby several colored NC particles could be identified. For the estimation of the shooting distance a comparison shot series was performed using the delivered weapon and ammunition. The treatment of the comparison shots was performed using the same procedures as with the delivered T-shirt. The visual comparison of the archived colored pattern with the comparison shots results in an estimation of a shooting distance in the range of 9 to 18 inches. This statement is made under the assumption that no depletion of GSR has taken place (e.g. by other objects present in the line of fire or by the ablation of GSR by blood or in process of the medical supply).
DGVQ3P-5301	Examination of the item Q1 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 residue was found. Comparison of the items K1a, K1b and K1c 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 K1a, K1b and K1c 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

TABLE 2

WebCode-Test	Conclusions
	seven (27) inches from muzzle to target.
DHATD4-5305	Examination of Item #1 (Questioned) revealed a gunshot residue pattern associated with bullet hole in the middle of the cloth. Distance determination testing using Item #1 (Questioned) and the Item #1 test images indicated a similar pattern could be produced at distances greater than 12 inches and less than 27 inches.
DLMXKX-5301	The hole in Item Q1 was examined visually and process chemically for the presence of gunshot residues. These tests indicated that the muzzle of the firearm was greater than 15 inches and less than 27 inches from the target when discharged.
E3PUJM-5301	The muzzle to target distance to the gunshot residue pattern on Q1 was determined to be intermediate. Intermediate is defined as the range at which the firearm and ammunition combination will deposit visible or detectible gunpowder particles on the target material. Drop off is the minimum distance at which the firearm, ammunition, and substrate combination no longer deposits gunpowder particles on the target material.
E9HWRT-5301	The residue pattern from item 1.4.1 indicates a muzzle-to-target distance between 12 – 21 inches.
EH2CCM-5305	Testing revealed a muzzle to target distance no closer than 9" and no farther than 18".
EKC7E3-5301	The area around the hole in Item Q1 was examined and chemically processed for the presence of gunshot residues. The gunshot residue pattern around the hole in Item Q1 is consistent with tests fired at a muzzle-to-target distance greater than 9 inches and less than 21 inches using the known standards K1a, K1b, and K1c.
EUURHC-5305	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 1, 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 15 inches and 24 inches.
EUVTZN-5305	The shirt, Exhibit Q1, has damage to it 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 12 inches (30.48 cm) and less than 21 inches (53.34 cm).
F4FJZL-5301	BOTH A VISUAL COMPARISON AND PRESUMPTIVE CHEMICAL TEST (SODIUM RHODIZONATE) WAS PERFORMED ON THE SUBMITTED QUESTIONED SAMPLE. THE RANGE OF FIRE WAS ESTIMATED TO BE BETWEEN 15 AND 21" AT THE TIME OF DISCHARGE.
GD23XQ-5305	Distance determination testing using Items #1, #2, #3 and #4 indicated a similar pattern could be processed at distances greater than 9 inches and less than 21 inches.
GZVMEG-5301	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 twelve (12) and twenty-four (24) inches.

TABLE 2

WebCode-Test	Conclusions
HU36DB-5305	Distance determination testing indicated a similar pattern at distances greater than 6 inches and less than 18 inches.
HWT4TU-5305	The shooting distance range between the firegun canonn mouth and the impacted garmend (piece of fabric) is 15 to 21 inches.
JHTP76-5301	The area around Hole 1 in was microscopically examined and chemically processed for gunshot residues and a pattern of residues was found consistent with passage of a bullet and discharge of a firearm. Using a Sig Sauer model MPX 9mm semiautomatic handgun and Prvi Partizan 9mm 115 grain FMJ ammunition, this pattern of residues was reproduced at a muzzle-to-target distance of between 12 inches and 24 inches.
KA94GX-5301	Clothing Analysis: Methodology: Physical (Visual Examination) Chemical (Color Test Modified Griess/Sodium Rhodizonate) Microscopy (Stereo 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 ¼ inch in greatest dimensions and was located approximately 4 inches from the left edge and 6 inches from the bottom on the anterior portion of the shirt sample. Visual/microscopic examination of defect "A" revealed the presence of apparent bullet wipe and gunpowder. Chemical testing of defect "A" indicates the presence of nitrite residues 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 properties observed and the chemical tests performed. Distance Determination: Methodology: Physical (Visual Examination) Chemical (Color Test Modified Griess/Sodium Rhodizonate) Microscopy (Stereo Microscope) 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 15 and 24 inches.
KB3RVM-5301	The residue pattern from item 1 indicates a muzzle to target distance between twelve and twenty one inches.
KW2ZAH-5301	RESULTS/CONCLUSIONS: The defect in the shirt, item Q1, was positive for lead. The defect is consistent with having been made by the passage of a bullet fired from an intermediate range. See glossary. METHODS/OBSERVATIONS: The shirt, item Q1, was examined for possible bullet defects and gunshot residues. There was a single firearm/bullet related defect observed. The defect was stereoscopically examined and chemically processed for the presence of lead. The defect in the shirt tested positive for lead. Powder particles were visually and stereoscopically observed in the proximity of the defect. GLOSSARY: 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.
L3JX9P-5305	Based on the comparison of test shots (K1a-c) to the GSR pattern on the shirt (Item Q1), Item Q1 is estimated to have a muzzle-to-target distance of approximately greater than 6 inches and less than 27 inches.
LEE7UD-5305	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 12 inches and less 24 inches approximately, based in the results from the gunshot residues testing of the received fabric and their

TABLE 2

WebCode-Test	Conclusions
	comparation with the received distance standards.
LFTNVX-5305	The distance of firing between the muzzle of the firearm and the cloth fragment marked as "Item Q1" was estimated to be between 15 inches and 21 inches.
LRZH7M-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 nine inches and less than twenty-one inches when compared to the submitted distance standards
LWJD9F-5301	In My opinion: The minimum distance the muzzle of the firearm could have been from the victims shirt, Item Q1 when the shot was discharged is 15 inches and the maximum distance it could have been from the victims shirt, Item Q1 is 24 inches.
MUP3VR-5301	The clothing was treated using the standard Na-Rhodizonate test. Using this test the presence of bi-valent metallic elements can be shown. As in classic GSR particles both lead and barium will be colored using this test, the distribution of GSR particles around the entrance hole can be observed. From the observed pattern on the clothing it is clear that a shooting occurred at a distance smaller than 80 inches. Using the provided photographs of reference shots at known distances, it can be further estimated that the shooting was not a contact shot, but took place at a muzzle to target distance larger than 12 and smaller than 27 inches.
N6H6A6-5301	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 located. These characteristics are consistent with a close range of fire.
NAC3YW-5305	The shirt presents a bullet hole inflected by short distance in a range between 15 and 21 inches.
NF2EZK-5301	The residue pattern indicates a muzzle-to-target distance between fifteen (15) and twenty four (24) inches.
NJ3KD6-5305	Distance determination testing using Item #2 and test images provided in Item #1 indicated a similar pattern could be produced at distances greater than 6 inches and less than 27 inches.
NKF3QH-5301	Based on visual examination, chemical testing, and comparison to distance standards generated using the same type of ammunition and the suspect firearm, the muzzle to shirt distance at the time of discharge was determined to be greater than 9 inches and less than 21 inches.
NUHFQJ-5305	Examination of Item Q1 revealed a bullet hole. Visual, microscopic, and chemical testing revealed that a similar pattern could be produced at distances greater than 6 inches and less than 24 inches.
PMK6ZK-5301	The Item Q1 piece of shirt was visually inspected, stereoscopically examined and chemically processed for the presence of gunshot residues. The Item Q1 piece of shirt was examined and found to have a defect located in the middle. Visual and stereoscopic examination revealed a pattern of particles consistent with that of propellant around the defect. No vaporous residue was visible around the defect. Based on the presence of powder particles and bullet wipe, the defect is consistent with an entrance hole. The defect and pattern were diagrammed and mapped for comparison purposes. The piece of shirt was chemically processed for the presence of nitrites using the Modified Griess Test. A pattern of nitrites was obtained from the defect. The piece of shirt was then chemically processed for the presence of lead using Sodium

TABLE 2

WebCode-Test	Conclusions
	Rhodizonate. No vaporous lead residue was observed around the defect. Comparison of the patterns observed visually and chemically from Item Q1 to known distance patterns (Item K1a, Item K1b and Item K1c) determined that 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 between 12 inches and 24 inches.
PRWUG9-5305	By comparing the distribution of gunshot residues around the entry hole in the analyzed sample (ITEM Q1), with the patterns generated with the firearm Sig Sauer model MPX 9mm semiautomatic handgun and the Ammunition Prvi Partizan 9mm 115 grain FMJ, used to perform the investigated facts, it is possible to conclude that the firing distance ranges between 30 cm (12 inches) and 53 cm (21 inches).
QJ2AWR-5301	[No Conclusions Reported.]
QL3BWP-5301	[No Conclusions Reported.]
T99TZM-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 15 inches and less than 24 inches.
TD2XTR-5301	A visual and chemical examination was conducted of the bullet damage on the exhibit shirt. The damage measured approximately 2mm x 4mm with surrounding bullet wipe measuring approximately 9mm in diameter. Surrounding the bullet damage were deposits of partially burnt and unburnt propellant particles, measuring out to approximately 200mm from the actual defect. In my opinion the muzzle of the exhibit self-loading pistol was between approximately 15 to 24 inches from the shirt when the shot was discharged.
TG3YUN-5301	The area around the hole in the shirt (Item Q1) bears gunshot residue and is consistent with a muzzle to target distance between 9 and 21 inches.
TRLDWQ-5301	Clothing Analysis: Methodology: Physical (Visual Examination) Chemical (Color Test Modified Griess/Sodium Rhodizonate) Microscopy (Stereo Microscope). 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, 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) Microscopy (Stereo Microscope). 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. 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

TABLE 2

WebCode-Test	Conclusions
	photographs, will be sealed in a manila envelope and will be returned with the evidence to the submitted agency. Evidence in case will be returned to the investigating agency.
TTEDRG-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 6 inches and 21 inches.
U23J6E-5301	The area around Hole A in Item Q1 (twill) was microscopically examined and chemically processed for the presence of gunshot residues. Residues observed were consistent with the passage of a bullet, and the patterns displayed were consistent with a firearm being discharged at a range of greater than 12" and less than 24".
U2ZUXW-5305	The powder grain pattern observed around defect A entrance and the nitrite pattern detected on the griess test of defect A entrance for item 1, the section of white fabric with bullet defect labeled Q1, are consistent in diameter and particle population with the powder grain patterns observed on item 2, the ten images of test fire series on white cotton labeled K1a, and with the nitrite patterns observed on item 3, the ten images of griess test fire series labeled K1b, between the distances of greater than 12 inches and less than 21 inches.
UAWNXF-5301	The area around the hole in the cotton cloth (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the submitted distance standards (Item K1a and K1b), the pattern of residues observed on item Q1 were reproduced at a distance of between 12 inches and 24 inches.
UBU2JM-5305	Item #1 contained one bullet hole with gunshot residue pattern. Evaluating the white cloth in Item #1 utilizing visual, microscopic, Modified Griess chemical testing and Sodium Rhodizionate chemical testing and comparing to the test images in Item #1, a similar pattern could be produced as distances greater than 12 inches and less than 27 inches.
UPTTH7-5301	Item Q1 "shirt" exhibits a single perforating defect surrounded by a pattern of black-in-color particles and light sooting. One particle was removed and tested positive for gunpowder. The combination of visual and chemical examinations reveal that the defect in Q1 is consistent with the entry of a projectile occurring when the muzzle of the seized firearm, using lab ammunition, was at a distance greater than 12 inches and less than 21 inches from the surface of the "shirt" at the time of firing.
UU42P3-5301	Based upon the comparison of the Exhibit 1 (Q) pattern to the photos of the provided test patterns (Exhibit 2 K1a, K1b, K1c), the gunshot residue pattern on Exhibit 1 (Q) was likely deposited at a muzzle-to-target distance between 9 and 24 inches
VLNFGY-5305	Based on visual examination, microscopic examination and chemical processing, the perforation in Item #2 is from a fired bullet. Distance determination testing utilizing Item #2 and submitted known patterns indicated a similar pattern could be produced at distances greater than nine inches and less than twenty-one inches.
VRRGJD-5301	The area around the hole in the white cloth (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the known patterns (K1a, K1b and K1c), the pattern of residues was produced at a distance between 12 inches and 27 inches.
VWLMTA-5301	Please note that this examiner working in isolation from covid19 at home, did not have the opportunity to test the cloth sample Q1 with lead or nitrate detecting reagents. A direct comparison between the bullet damaged cloth QI and photographs of the test shots suggested a closest match between the powder patterns on Q1 and the test shots fired at 27 inches. However when I photocopied the cloth Q1 for my records i found that a much greater density

TABLE 2

WebCode-Test	Conclusions
	of powder particle deposits was visualised, showing a best match between the photocopy of Q1 and the photograph of the test shot fired at 18 inches.. Taking into consideration that there was no opportunity to evaluate the shot to shot variation of multiple shots at the same distances, or the difference betwween shots fired from a clean barrel and a dirty one, or the chance to see any results beyond 27 inches, in casework i would report the actual distance of firing to be between 15 and 30 inches.
VXHW7Z-5301	1. Exhibit 2 is a piece of white fabric with a defect near the center. Visual and microscopic examination as well as chemical processing of Exhibit 2 revealed that the defect is consistent with the discharge of a firearm at a close range of fire, due to the presence of an entry hole, vaporous lead, and gunshot residue pattern. The material used for chemical processing of Exhibit 2 was sub-exhibited as Exhibit 2.1 and is being returned with Exhibit 2.
WGR9GM-5301	Clothing Analysis: Methodology: Physical (Visual Examination) Chemical (Color Test Modified Griess Test/Sodium Rhodizonate) Microscopy (Stereo/Comparison Microscope). No visible red-brown stains were observed on Item Q1, the twill jean. One (1) defect was observed on Item Q1, the twill jean, and is described as follows: The defect/hole, designated as "A" of Item Q1, measured approximately ¼ inch in greatest dimensions and was located approximately 5 ½ inches above the bottom of the twill jean and 4 inches from the left side of the twill jean. Visual/microscopic examination of defect/hole "A" revealed the presence of apparent bullet wipe/gunpowder. No soot was observed. Chemical testign 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/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 Test/Sodium Rhodizonate). The pattern of gunpowder/gunpowder residues observed and documented from defect A of Item Q1, the twill jean, and from Item Q1A, the chemical test patterns from Item Q1, the twill jean, was reproduced at a muzzle to target distance between 9 and 21 inches.
XBW3TB-5305	Examination of Item 1 revealed a hole and residue characteristic of the passage of a bullet. Muzzle-to-garment distance determination testing revealed that a similar pattern could be produced at a distance greater than 12 inches but less than 21 inches.
XG72K4-5305	Testing revealed a muzzle to target distance no closer than 9" and no farther than 18".
XU8T9U-5301	Item Q1 was examined visually and processed chemically to develop a pattern of muzzle residues. A comparable pattern was observed / developed. This pattern appeared to be most similar in size and distribution to the provided test patterns generated between 9 and 21 inches.
XURCDZ-5305	The area around the hole in the center of Item 2 (a shirt) was visually examined and chemically processed for the presence of gunshot residues. Based on comparisons against Item 1 (known distance standards), the pattern of residues observed on Item 2 was consistent with being produced at a distance of between 9 and 21 inches.
XXRPRD-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 12 inches and less than 24 inches when using the submitted Item 2 distance standards. No other residues were detected.

TABLE 2

WebCode-Test	Conclusions
XZZVEE-5305	The shooting distance is between a minimum range o twelve (12") inches and a maximum of eighteen (18") inches between the firearm and the garment.
YHXEP8-5301	Examination revealed that the residue pattern found around the hole in Q1 is consistent in pattern size and density with having been produced at an approximate distance between 9 inches and 21 inches. Materials produced as a result of chemically processing Item Q1 are being returned as Item Q1P in Container 1 and should be maintained for possible future examinations.
YRYZRZ-5305	Item Q1 has one hole that is consistent with the passage of a bullet. Using the lead and powder distribution, it was determined that the muzzle of the firearm was greater than 9" and less than 24" from the shirt when discharged.
YU3XZ8-5305	Examination of Item #4 revealed a shot pattern. Distance determination testing using Item #4 indicated a similar pattern could be produced at distances greater than 9 inches and less than 21 inches.
YWWJVJ-5301	We observe in the trimmed piece of T-shirt submitted the presence of a bullet hole compatible with the entrance of a bullet hole with a caliber 9 mm.
Z4RNG9-5301	Using the distance standards listed as K1a, K1b, and K1c, this pattern of residues was reproduced at a muzzle distance of between (15) and (21) inches.
Z7FDM7-5301	Using the distance standards listed as K1a-c, the pattern of residues was reproduced at a muzzle distance of approximately nine (9) to eighteen (18) inches.
ZEAMTV-5301	The following exhibits were examined: Exhibit 2: White cloth with hole Exhibit 2.1: Nitrite test pattern 1. Exhibit 2 was visually and microscopically examined and chemically processed for the presence of gunpowder residues. A hole of entry, vaporous lead residues, and a pattern of gunpowder residues were located on Exhibit 2 that are consistent with the characteristics observed at a close range of fire. 2. Exhibit 2.1 was created as a product of chemical testing for gunpowder particles and is being returned with Exhibit 2 for accountability.
ZHQMCH-5305	Distance determination testing using known distance test images in Item #K1a-c and Item #Q1 indicated a similar pattern could be produced at distances greater than 9 inches and less than 21 inches.
ZHUARB-5301	The area around the hole in item Q1 was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the submitted firearm and ammunition submitted, this pattern of residues was reproduced at a distance of between 12 inches and 24 inches.

Additional Comments

TABLE 3

WebCode-Test	Additional Comments
4JTTW8-5305	Insufficient test fires (only receiving 1 at each range instead of 3) resulted in larger bracket than would typically be provided in real casework.
6AHRB8-5305	A smaller distance bracket may have been possible given 3 test shots at each known distance standard, Exhibit K1.
6MACZB-5301	The Griess test is not used in [Laboratory], therefore these test cards were not used. Tartrate buffer is not used at [Laboratory] with the Na Rhod test. Note: In [Laboratory] casework, range would not be assessed in such small increments. The requested range determination is therefore not comparable to casework.
83FECF-5301	The reported range is based on the examination of photographs of test patterns produced from one test shot. This laboratory typically requires three test shots to show reproducibility of residue patterns in order to establish an intermediate range.
8UGPVB-5305	The reason question #1 is blank is because our Trace Unit only chemically processes Q and K items for GSR. Distance determination is performed by our Ballistics Unit.
8UJNMY-5301	A small but visible fragment of the projectile's copper jacket was embedded in Item Q1. Some of the smokeless propellant had been dislodged from Item Q1 and had been transferred to the cardboard cover sheet. Although this disrupted the pattern from its original condition, it was insignificant and did not affect the conclusions.
9QHXZJ-5301	Which end is up on the cut out section of fabric, Item Q1?
ACWXNB-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, Modified Griess test, DTO for cupper and Modified Sodium Sulphite test for lead.
AUT9QT-5301	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.
BKYMXZ-5305	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 different, and the probability, therefore lower.
BXPG6M-5305	* With respect to standards would require explicit reference mark points of location (for example, up [arrow]), since only presents a scale (photographic scale). In this order, the fabric in this test does not have a reference mark either (eg label), so you can not know what the lower or upper of it. * The size of the standards and the piece of fabric (Q1) does not offer the option of viewing the complete distribution of the gunshot residue. * The procedure used in our laboratory is different from that used in the processing of fabrics from test firings. We use 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

TABLE 3

WebCode-Test	Additional Comments
	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 fabricing items. J Forensic Sci 2000; 45 (4): 801-806.
CAUWPW-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.
CFK4FH-5301	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.
DGBR6R-5301	According to the SOPs 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 which is desensitized photo paper in the case of Sodium Rhodizonate treatment, and adhesive

TABLE 3

WebCode-Test	Additional Comments
	transparency film for the NC verification (following the method of B. Glattstein et al.). These circumstances may lead to a different distance estimation (as the case shot was treated according to our SOP and not colored directly on the fabric as done with the provided comparison shots). This was taken into consideration by using wider error ranges when estimating the range margins.
DHATD4-5305	The size of the test images/file required several hours of time to download. Also our LIMS/worksheets required us to covert the images from TIFF files to JPEGs to allow inclusion into our files. These issues made the test logistically cumbersome.
E3PUJM-5301	Our protocol is to not report a distance (or bracketed distance) and only report "Contact/near contact, Intermediate, Distant."
E9HWRT-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.
F4FJZL-5301	WE DO NOT PERFORM THE MODIFIED GRIESS TEST AT OUR LABORATORY.
KB3RVM-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. It would be better to supply the labs with photographs of the Griess-Walker and Sodium Rhodizonate test results on the questioned sample, rather than having each laboratory do their own chemical testing. This way, it takes away any differences that might arise simply based on the type of paper used, the recipe for making up the chemicals, the way the heat is applied, etc. Comparing our test results to your photos is a bit like being asked to compare apples to oranges. There could be a separate portion of the proficiency that tests our abilities to perform the chemical testing.
KW2ZAH-5301	Per laboratory protocol, gunshot residue proximity opinions are limited to contact/near contact, intermediate, or distant based on residue patterns/damage.
LEE7UD-5305	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. Recently this methodology has been recommended by Berger, J.; Upton, C.; Springer, E. (2018). Evaluation of Total Nitrite Pattern Visualization as an Improved Method for Gunshot Residue Detection and its Application to Casework Samples. Journal of Forensic Sciences. 10.1111/1556-4029.13802. That situation influences the comparison of our results with the test distance standards of this proficiency test, principally in the Griess Test. 2. I think it´s INDISPENSABLE to review 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 fabrics; fabrics with two adjacent orifices, etc., for more realistic approach.
LRZH7M-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

TABLE 3

WebCode-Test	Additional Comments
	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.
MUP3VR-5301	Our results for this test are based only on the performance of the Na-Rhodizonate method. We do not perform IR imaging nor Griess reagent testing in our lab. Furthermore, as we do not treat the sheet with acid after Rhodizonate reaction (to eliminate the possible Ba particles), it is possible that we under-estimate the shooting distance, since we see more colored particles than we normally would if only pure lead-containing particles were left over. These effects are taken into account in our regular reporting by stating that we observe the presence of lead-containing GSR particles, and thus conclude that a medium-range shooting distance - larger than a few inches, but smaller than about 80 inch (2m) - was observed. We have found that even this rough estimate suffices to aid police in their inquiries in most cases.
N6H6A6-5301	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.
NF2EZK-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

TABLE 3

WebCode-Test	Additional Comments
	measurement does not apply and will not be reported.
T99TZM-5301	Visually I could not separate out the 24" and included 27". After the chemical tests it appeared that 24" was the upper bracket and I feel the chemical tests bear that out.
TD2XTR-5301	Various circumstances, including the environmental conditions at the time of the discharge as well as subsequent handling of the exhibit shirt after the shooting could influence the results.
VWLMTA-5301	Peer reviewer did the test in the laboratory with DTO and sodium rhodizonate. Based on K1A alone then 15 inches to 30 inches would be possible range of fire. Based on DTO and NaRh tests then possible range of fire would be greater than 27 inches using K1B and K1c. If use the combined results and photos then range of fire would possibly be greater than 18 inches in my opinion as the K1B and K1c for 18 inches show dense colour, so could rule out 15 inches. Possibly 21 inches was the best match to Q1.
VXHW7Z-5301	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.
WGR9GM-5301	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.
XXRPRD-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

TABLE 3

WebCode-Test	Additional Comments
	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.
YU3XZ8-5305	It is unknown if there were any intervening objects or if the handling of Item #4 may have disturbed any residues prior to being submitted to the laboratory.
YWWJVJ-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.
ZEAMTV-5301	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.

-End of Report-
(Appendix may follow)

Collaborative Testing Services ~ Forensic Testing Program

Test No. 20-5301: GSR Distance Determination

DATA MUST BE SUBMITTED BY **June 8, 2020, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A WebCode: QFHBLJ

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 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 on the victim. A suspect was apprehended later that day and the police seized a Sig Sauer model MPX 9mm semiautomatic handgun from his possession. The bullet recovered from the victim was identified as having come from the suspect's firearm. Rounds of Prvi Partizan 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):
Item K1a-c: Distance Standards at 3 inch increments from Contact to 27 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. If reporting Contact, indicate with the numeral 0.

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

Test No. 20-5301 Data Sheet, continued

Participant Code: U1234A
WebCode: QFHBLJ

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

Test No. 20-5301 Data Sheet, continued

Participant Code: U1234A
WebCode: QFHBLJ

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)