



## **GSR-Distance Determination Test No. 16-530 Summary Report**

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This test was sent to 226 participants. Each sample set contained an evidence piece of clothing (Q1) for chemical processing for a GSR pattern. The set also contained photographs of GSR patterns produced by test shots at known distances on untreated test fabric (K1a) and treated test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). Participants were requested to process the clothing sample and report the range of distances, along with their conclusions and comments. Data were returned from 185 participants (82% response rate) and are compiled into the following tables:

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

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

## **Manufacturer's Information**

Each sample set contained a piece of clothing evidence (Q1) for chemical processing in addition to photographs of known distance test GSR patterns on unprocessed test fabric (K1a) and processed 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 GSG model 522P caliber .22 LR semiautomatic pistol with a 9" barrel and the ammunition was Federal 36 grain copper plated hollowpoint ammunition.

**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. Multiple shots were taken at the same distance to ensure reproducibility and the best representative shot was chosen for further processing. First, the known GSR patterns were scanned. Each known pattern was then processed using the Modified Griess procedure. Immediately following processing, the film paper was scanned. Finally, the known patterns were processed with Sodium Rhodizonate reagents, and the fabric scanned immediately after processing. The scanned images were printed onto photograph paper, packed into three pre-labeled envelopes (K1a, K1b and K1c) and packaged into the sample set as described below.

**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 5 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:** Q1, K1a, K1b, and K1c envelopes were placed into a pre-labeled sample pack envelope, sealed with evidence tape, and initialed "CTS."

**VERIFICATION:** The predistribution laboratories reported the minimum distance to be 3 inches and the maximum distance to be 12 inches. CTS is aware of differing laboratory reporting policies and varying acceptable ranges. It will therefore be at the discretion of the laboratory to evaluate results based on their own policies and ranges.

## **Summary Comments**

This test was designed to allow participants to assess their proficiency in muzzle to target distance determination using gunshot residue patterns. Each participant received an evidence piece of clothing (Q1) for chemical processing in addition to photographs of GSR patterns at known distances on untreated test fabric (K1a) and treated test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). The evidence piece of clothing (Q1) was prepared with the firearm locked into a fixture and the white T-shirt material (60% Cotton, 40% Polyester blend knit) was placed 5 inches away from the muzzle of the firearm. (Refer to the Manufacturer's Information for preparation details.)

In Table 1, 172 of the 185 responding participants (93%) reported a minimum distance between Contact/0 and 6 inches. One hundred and sixty six of the 185 responding participants (90%) reported a maximum distance between 9 and 18 inches. In the Summary Table on page 7, CTS has grouped the responses provided by the participants based on their minimum and maximum distance results. A Consensus was considered to be the minimum and maximum values reported by greater than 10% of the participants. Not included in this 10% were four participants that reported a maximum of 6 inches. In the manufacturing of this test, the questioned item was positioned 5 inches from the muzzle of the firearm. Therefore, these four participants' responses were not 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 evaluate results based on their own policies and reported ranges.

In response to many of the Additional Comments provided by participants, in future Distance Determination tests, CTS will implement new reporting terminology (greater than/less than) and re-evaluate the packaging of the T-shirt material. In addition, CTS will reference the Sodium Rhodizonate and Modified Griess processing techniques used on the data sheet and provide orientation on the Q1 material.

## Distance Determination Results

*What is the minimum and maximum distance 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	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range
26QLNC	3	15	12	4NRN9K	3	9	6	9R3TE6	3	18	15
2BDGJN	9	15	6	4TN8EP	0	12	12	A2J2AC	3	6	3
2CCKDY	6	15	9	4WMJBP	3	15	12	A2MJE3	6	18	12
2EDRFN	9	21	12	4XH2CQ	3	12	9	A4U2DX	6	9	3
2HDW9V	3	18	15	4ZA2TA	3	12	9	A7FM7K	6	12	6
2JM2MK	2	10	8	6AF6GK	6	15	9	A8LAEJ	3	15	12
2LFYUQ	3	9	6	6BLRPH	6	9	3	A8PPU6	1	12	11
2MRENR	6	15	9	6ELYBF	9	21	12	AECH66	6	15	9
2Q796P	3	9	6	6FGLMJ	15	18	3	AKC37E	3	15	12
2V6K7G	6	12	6	6K8WWH	9	18	9	AQ2KJQ	6	12	6
3DZBZP	3	12	9	6QDKGB	0	12	12	AXN6TX	3	15	12
3WFK3B	3	18	15	78HG8M	6	12	6	B43B2N	0	12	12
3WV7CC	3	12	9	7B2BAF	15	21	6	BGRE6E	3	12	9
493AFL	0	18	18	7BKCY4	3	12	9	BNRPGY	3	12	9
4B74W4	3	9	6	7H3LMZ	3	15	12	BRRZDY	3	9	6
4BRHLG	3	12	9	7WM2QY	3	12	9	C2Y2AJ	3	15	12
4JLRPK	3	6	3	88XVGH	1	12	11	CB2CKF	3	21	18
4JXJJM	3	15	12	997ML6	9	12	3	CP6HVD	3	15	12
4MK4RC	3	12	9	9CPGPW	3	15	12	CQCZUA	6	15	9

TABLE 1 (Distance in Inches)

WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range
CW6ZCB	0	15	15	FFKLGG	0	12	12	JEX99M	3	12	9
CXYQF6	6	18	12	FGYBH9	1	15	14	JQAJVC	3	15	12
CY9VTT	3	15	12	FHPAXR	3	12	9	JXDHB9	3	15	12
CYQRDF	6	18	12	FJKRZT	3	12	9	K3ZVLV	3	12	9
D37W9F	6	12	6	FLQEBD	3	15	12	KA26U9	3	12	9
DHFKJV	0	15	15	FNFJ8Q	3	15	12	KBU6PY	0	12	12
DLBGZA	21	27	6	FNV6GR	3	9	6	KRGH6C	3	15	12
DVP2Q2	0	18	18	G467T9	0	15	15	KVHLXY	3	9	6
DXTZK7	13	18	5	G6YYNR	3	12	9	KWAMUA	0	9	9
EAEPWG	0	12	12	G8N66H	3	15	12	L3FBE3	3	15	12
ENWK98	6	12	6	GABRX7	3	15	12	LAVAN8	0	9	9
EP9FUY	3	9	6	GAF6K2	3	12	9	LMYK99	3	9	6
EXQLTR	3	15	12	GCUYYD	3	18	15	LNC644	3	15	12
EYL4VT	3	21	18	GG9GEA	3	12	9	LWCG3	3	12	9
F26J2E	3	12	9	GV9DHU	3	9	6	LYGZH3	0	15	15
F4B2YA	3	12	9	GW34N9	3	15	12	LYWJ3Z	3	10	7
F6ZA66	6	15	9	H2GY67	3	18	15	MF23H4	6	21	15
FB3NJE	0	18	18	HPLT82	0	12	12	MJK3UD	3	12	9
FC2L68	0	15	15	J29C7N	3	9	6	MKCGZ3	>0	3	3
FDZNB	3	6	3	J8CFU2	3	12	9	MP7BX4	6	15	9
FF3RF8	6	18	12	JCVBXU	0	9	9	MQ2Z2W	3	9	6

TABLE 1 (Distance in Inches)

WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range
MQF6XA	3	18	15	RC3MNV	3	18	15	VD3RXL	3	12	9
MQG34Y	15	21	6	RJLTK3	3	15	12	VDYATV	2	12	10
MQKK9P	6	12	6	RLR7D3	3	9	6	VEVTWV	15	18	3
MRT2Y8	3	9	6	RRD4Y6	3	15	12	VMVZKX	0	9	9
N36JCW	3	12	9	RRFU7M	3	15	12	WAGBF2	3	15	12
ND3JPZ	6	15	9	RT9M27	3	12	9	WALREZ	0	15	15
NNBRV3	3	15	12	TDT4JP	3	9	6	WKJMEF	1	24	23
NQDTVY	0	15	15	THKDUN	0	12	12	WX66ZT	3	12	9
NRNYTZ	3	21	18	TJGVPX	3	12	9	X9KATA	6	12	6
NTYJW4	3	12	9	TL466Q	9	15	6	XWRPDJ	3	12	9
NVAGBK	0	15	15	TQ3KU2	3	12	9	Y3P2LL	6	12	6
NXCJUV	6	9	3	TQH3BR	3	12	9	YAAZCU	0	21	21
P9BEVV	6	15	9	TW4WQX	3	12	9	YERZWF	3	9	6
P9QYFU	6	12	6	U9CXMV	3	12	9	YNUKWM	6	12	6
PGK9KX	12	21	9	UCEWZT	3	15	12	YYTFRX	0	12	12
PV2294	0	6	6	UVRGWW	0	9	9	Z2EJZU	3	15	12
QJRJG2	0	12	12	UYN6AX	3	12	9	Z4Z2HF	3	15	12
QM4QG7	0	12	12	V34UET	3	15	12	Z6T2FQ	3	9	6
R8NR9Y	6	12	6	V8D8WR	3	18	15	Z6VJKG	0	21	21
R8T6VV	3	9	6	VAZYXV	3	18	15	ZAUXAR	3	21	18
R93AAJ	3	9	6	VBDJRR	3	12	9	ZFFVVU	0	12	12

TABLE 1 (Distance in Inches)

WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range	WebCode	Min	Max	Calc. Range
ZFQ3TV	3	9	6								
ZKAWVM	6	9	3								

Response Summary				Participants: 185			
Minimum Distance Determination Result <b>(Total Participants Responding = 185)</b>				Maximum Distance Determination Result <b>(Total Participants Responding = 185)</b>			
<u>Minimum Distance (Inches)</u>		<u>Participants (Percentage)</u>		<u>Maximum Distance (Inches)</u>		<u>Participants (Percentage)</u>	
Contact / 0		32 (17.30%)		Contact / 0		0 (0.00%)	
3		104 (56.22%)		3		1 (0.54%)	
6		30 (16.22%)		6		4 (2.16%)	
9		6 (3.24%)		9		29 (15.68%)	
12		1 (0.54%)		12		64 (34.59%)	
15		4 (2.16%)		15		51 (27.57%)	
18		0 (0.00%)		18		20 (10.81%)	
21		1 (0.54%)		21		12 (6.49%)	
24		0 (0.00%)		24		1 (0.54%)	
27		0 (0.00%)		27		1 (0.54%)	
Other		7 (3.78%)		Other		2 (1.08%)	
No Response		0 (0.00%)		No Response		0 (0.00%)	
<p><i>NOTE- CTS implemented a calculated range based on the participants Minimum/Maximum response</i></p>							

CTS is aware of differing laboratory reporting policies and varying acceptable ranges. It will therefore be at the discretion of the laboratory to evaluate results based on their own policies and ranges. For this test, CTS grouped responses reported by more than 10% of participants to form the provided minimum and maximum ranges.

# Conclusions

TABLE 2

WebCode	Conclusions
26QLNC	The area around the hole in the shirt in Item #Q1 was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of residues was found. Using the recovered firearm and ammunition, this pattern of residues was reproduced at a distance between three and fifteen inches.
2BDGJN	The submitted evidence(Q1)was visually examined and chemically processed for the presence of gun shot residues. The Modified Griess reagent and Sodium Rhodizonate test were performed and the patterns were compared to the photographs of GSR pattern at known distances. The minimum and maximum distance of the muzzle of the firearm could have been between 9 inches and 15 inches.
2CCKDY	The area around the hole in the piece of shirt of Item 1-2 was microscopically examined and chemically processed for the presence of gunshot residues (lead, copper, nitrites and particulate matter). A pattern of residues (vaporous lead, particulate copper, nitrites and particulate matter) was found. Using the identified weapon with ammunition similar to the questioned cartridges, this pattern of residue was reproduced at a distance from the weapon to the target of between <u>6</u> and <u>15</u> inches.
2EDRFN	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 nine (9) inches but less than twenty-one (21) 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. This estimated range is also predicated on the submitted distance standards being an accurate representation of the range of variation exhibited by the entire set of original test standards.
2HDW9V	Item 1.1 is a piece of fabric stated to be a shirt with a 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 eighteen inches.
2JM2MK	Chemical testing detected the presence of nitrates on side 1 around Hole Q1A. Chemical testing detected the presence of a nitrite pattern on side 1 around Hole Q1A with the approximate diameter of 8 3/4". Chemical testing detected the presence of a cloudy pattern of lead residues on side 1 around Hole Q1A. The results from the chemical testing on side 1 around Hold Q1A are consistent with the deposit of gunshot residue after the discharge of a firearm.
2LFYUQ	When a pattern of gunshot residue is found on a victim or a submitted item (clothing) and the questioned firearm and ammunition are known. The bracketing of the muzzle to target distance tests results with a minimum and maximum distance will determine approximate distance. In



TABLE 2

WebCode	Conclusions
	comparing the data, the muzzle to target distance is seen that at 0 (contact shot) distant interval give no deposition of gunshot residues. From 3" to 9" distant intervals deposition appear more considerably and is dense and smaller in diameter. With 12" to 27" the deposition of gunshot residue appear less and is enlarged at diameter of pattern.
2MRENR	During the chemical examination and testing of the bullet hole marked as 335425/16 Q1A, propellant residue was found surrounding the hole. I am therefore of the opinion that the shot was fired at a distance between 6 inches and 15 inches.
2Q796P	The victim's shirt (clothing) Item Q1 with bullet hole examined by optical and chemical examination, propellant residue was found surrounding the hole on Item Q1 and compared with the distance standard prepared (photo's) marked items K1a and K1b. The distance of the muzzle of the firearm from the shirt (clothing) Item Q1 was determined to be from "3" the minimum distance and "9" the maximum distance.
2V6K7G	Muzzle to target distance is approximately six (6) to twelve (12) inches.
3DZBZP	The shirt, item Q1, was visually examined and chemically examined for the presence of gunshot residues. Based on the visual and chemical examination, and comparing item Q1 to the test panels, Griess, and NaRho results, the muzzle of the firearm was from approximately 3 inches to 12 inches from the t-shirt, item Q1, at the time of discharge.
3WFK3B	Results of Examinations: 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 three and less than eighteen inches when using the submitted Item 2 distance standards. No other residues were detected. [Participant included an attachment that could not be reproduced within the report.]
3WV7CC	One hole consistent with a bullet hole was observed in the center of the square of white cloth labeled Q1. The hole and the areas adjacent to the hole were visually examined and chemically tested. After chemical testing, the results were compared to the series of known distance patterns. The known patterns submitted (Exhibit K1a-c) were representative of test fires done at muzzle to target distances of contact out to 27 inches, at 3 inch intervals. Of the three sets of known patterns one is untreated (Exhibit 1a), one is a "Modified Griess Test" transfer (Exhibit 1b) and one is a Sodium Rhodizinate test for lead residue (Exhibit 1c). The gunshot residues on the piece of cloth ( Exhibit Q1) were determined to be most consistent with being fired at a distance of less than 12 inches and greater than 3 inches.
493AFL	Residues consistent with the discharge of a firearm were detected on Laboratory Item (001.D) (Q1) victim's shirt. The firearm discharge distance was determined to be greater than contact but less than 18 inches.
4B74W4	The shirt presents a bullet hole inflected by short distance in a range between 3 and 9 inches.
4BRHLG	Muzzle to Target: minimum distance: 3", maximum distance: 12"
4JLRPK	We realized test fire at 3" increments from contact to 27" with the suspect firearm on shirts like the victim's shirt. Gun exam of comparison, between item Q1 and test fires photographs allow

TABLE 2

WebCode	Conclusions
	to evaluate the distance of the muzzle of firearm from the shirt was from 3" to 6".
4JXJJM	A muzzle-to-target distance determination test was conducted with the square piece of white cloth, item 1.1. The white cloth was examined visually, microscopically, and chemically, and a pattern of gunshot residue was detected around the hole on the white cloth. Photographs of chemically processed test patterns produced at various distances, items 1.3 and 1.4, were compared to the pattern on the white cloth. Based on these test patterns, it was determined that a similar pattern of gunshot residue products to that present on the square piece of white cloth, item 1.1, can be produced at a distance of greater than three inches and less than fifteen inches
4MK4RC	At the time of the discharge, the distance between the muzzle of the firearm and the target (victim's shirt) was between 3 inches and 12 inches.
4NRN9K	I examined the exhibit visually through a stereo microscope and found there was partially burnt and unburnt propellant residue visible around the bullet hole. The spread pattern of the residue measured approximately 3 inches in diameter. I applied the modified Griess test on Item Q1, compared the result with the distance standards mentioned in 3.1 to 3.3 and found the results are consistent with the test results of items K1a and K1b fired at a distance of between 3 and 9 inches away. It is thus my opinion that the muzzle of the barrel was pointed at the T-shirt at a distance of between 3 and 9 inches from the target/t-shirt.
4TN8EP	The cloth was examined microscopically and processed chemically for the presence of Gunshot residues. Residues were detected and the test results were compared to the submitted test patterns. It was determined that the hole in item #1 was made at a muzzle to target distance of greater than contact and less than one foot.
4WMJBP	Examination of Item Q1 revealed a hole A. Visual/microscopic examination and chemical processing of the area around the hole revealed a pattern of gunshot residues. The residue pattern from Item Q1 indicates a muzzle-to-target distance between 3" and 15".
4XH2CQ	Item #2 (shirt with bullet hole) was visually and microscopically examined and then chemically processed for the presence of gunshot residues on 10/05/2016. A pattern of residues was detected that was consistent with the passage of a projectile and discharge of a firearm. Comparison of the patterns on Item #2 (shirt) to Item #1 (known distance standards K1a-c) indicate the muzzle to target distance was between approximately three inches and twelve inches.
4ZA2TA	In my opinion, following a G&R examination of the victim's shirt (sample Q.1) and comparison with test samples (K1a and K1c) supplied, it can be concluded that the shot to the victim's chest was fired from a range of no closer than 3" and no further than 12". GSR pattern would indicate a range between 3" and 9" (most likely 6"), however NaRhod tests indicated a range of 3" to 12".
6AF6GK	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. This pattern was compared to the photos of the submitted distance standards and it is my opinion that the Q1 pattern was produced between a minimum of 6 inches and a maximum of 15 inches.
6BLRPH	Visual and stereoscopic examination of the shirt, Item Q1, reveals the presence of a perforating defect just in the center. Bullet wipe and light sooting are visible around the defect.

TABLE 2

WebCode	Conclusions
	<p>The shirt 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 test targets. Based on the presence, overall pattern, and density of residues observed between Item Q1 and the provided photographs of the test standards, the questioned bullet hole on Item Q1 appears to have been created by a shot fired at a distance of approximately six (6) to nine (9) inches from the shirt</p>
6ELYBF	<p>The white shirt section, item Q1, was visually examined. There was a circular defect located near the center of the fabric. The area around the defect was microscopically examined and chemically processed for the presence of Nitrites and Lead residues. A positive reaction and visible pattern was developed from these tests. The results of this processing were compared to patterns developed from test fires conducted with the recovered firearm and ammunition. The defect in this shirt was found to be consistent with a gunshot occurring at a distance greater than nine (9) inches and less than twenty one (21) inches from the muzzle of the recovered firearm.</p>
6FGLMJ	<p>After the performance of Gries Test, spread pattern of the propellant indicated that barrel was held between distance of 15" and 18"</p>
6K8WWH	<p>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 .22. From the penetration area possible traces of GSR were transferred to a secondary trace carrier, which was subsequently treated with chemographical colouring 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 spotlike coloured 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 coloured 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 achieved coloured 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).</p>
6QDKGB	<p>The piece of white cloth (Exhibit Q1) was examined visually, microscopically, and processed chemically for the presence of gunshot residues. Residues were observed on the margins of the bullet hole prior to chemical testing, and additional residues were developed as a result of the chemical tests. The residues on the cloth (Exhibit Q1) were photographed. These photographs will be retained at the laboratory. The reference gunshot residue patterns in the photographs (Exhibits K1a - K1c) were visually compared to the pattern developed on the cloth (Exhibit Q1) to determine the muzzle to target distance from which that shot was fired. The bullet hole and associated gunshot residue pattern observed in the cloth (Exhibit Q1) was determined to have been fired at a muzzle to target distance greater than contact (0 inches) but not greater than 12 inches. Due to conflicting observations on the gunshot residue pattern on the cloth (Exhibit Q1) when compared to the three sets of reference photographs (Exhibits K1a - K1c), prior to and after chemical testing of the cloth (Exhibit Q1), a more specific muzzle to target distance</p>

TABLE 2

WebCode	Conclusions
	could not be determined.
78HG8M	The area around the entry bullet hole was macroscopically examined for the presence of unburned, burned and partially burned propellant particles. The area around the entry hole was also subjected to chemical tests for the presence and distribution of nitrites (burned and partially burned propellant) and lead. Based on the distribution of discharged propellant particles and lead the estimated range of fire (between the muzzle and the target) is between 6 and 12 inches.
7B2BAF	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 the hole during a microscopic examination prior to chemical processing. Patterns of nitrite and lead residues were chemically detected on item Q1 compared with test targets. Based on the presence, overall pattern, and density of residues observed between item Q1 and the provided photographs of the test standards, the questioned bullet hole on item Q1 appears to have been created by a shot fired at a distance of approximately Fifteen (15) inches to Twenty one (21) inches from the shirt. This is a conservative estimate based on an evaluation of the untreated and chemically processed residue patterns and assumes there was no intervening objects between the muzzle of the firearm and the shirt at the time the shots were created.
7BKCY4	The pattern of fouling and powder grains for defect A entrance on item 4 is consistent with the pattern of fouling and powder grains observed on item 1, the "photo set of test fire targets", between the distances of 3 inches and 12 inches.
7H3LMZ	The area around Hole 1 was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of residues was found. Using a GSG model 522P caliber .22 LR semi-automatic pistol and Federal 36 grain copper plated hollow point ammunition this pattern of residues was reproduced at a muzzle-to-target distance of greater than 3 inches and less than 15 inches.
7WM2QY	Visual and chemical examination on the Item Q1 indicated that the estimated distance of the muzzle of the firearm from the shirt was between 3 inches and 12 inches.
88XVGH	The area around the hole (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the submitted photographs this pattern of residues were determined to be at a distance of greater than contact and 12 inches.
997ML6	The clothing was treated using the standard Na-Rhodizonate test using a tartrate buffer. 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 more precisely that the shooting took place at a muzzle to target distance between 9 and 12 inches.
9CPGPW	Distance testing conducted with the submitted firearm revealed a muzzle to target distance no closer than 3" and no further than 15".
9R3TE6	Results of Examinations: The area around the hole in the Item 1 shirt was microscopically

TABLE 2

WebCode	Conclusions
	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 shirt was reproduced at a muzzle-to-target range of greater than three and less than eighteen inches. No other residues were detected. [Participant included an attachment that could not be reproduced within the report.]
A2J2AC	As a result of the reactions from the modified Griess, modified Dithiooxamide and modified Sodium Rhodizonate tests and based on the comparisons of the appearance and distribution of powder particles, sooting, lead, cooper, and nitrites between the shirt (Item Q) and the supplied test prints (Items K1a, K1b, K1c), the muzzle to target distance was between 3 and 6 inches. This is based on the assumption that the ammunition and firearm used was the same on the shirt and supplied test prints, and the target was perpendicular to the firearm's barrel at the time of the shooting.
A2MJE3	The minimum distance between the muzzle of the firearms and the cloth was six (6) inches and the maximum distance of eighteen (18) inches.
A4U2DX	[No Conclusions Reported.]
A7FM7K	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 six (6) inches and twelve (12) inches.
A8LAEJ	In the absence of any intervening object (s), the distance the muzzle of the firearm would have been from the shirt (Q1) at the time of discharge would have been between 3 inches to 15 inches inclusive.
A8PPU6	Results of Examinations: 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 shirt was reproduced at a muzzle-to-target range of greater than one and less than twelve inches when using the Item 2 Known distance standards.
AECH66	After stereoscopic examination and chemical testing of the fabric swath (item Q1), the muzzle to target distance was estimated to be between six and fifteen inches based on comparisons to the provided photographs of test panels of powder deposition (item K1a), Griess test results (item K1b), and Sodium Rhodizonate test results (item K1c).
AKC37E	Results of Physical/Microscopic Examination: The area around the hole in the center of Item #Q1 (damaged white cloth) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was observed. Using K1a, K1b, and K1c (photographs of the known distance standards), the observed pattern of gunshot residues is consistent with a muzzle to garment distance of greater than three inches and less than fifteen inches.
AQ2KJQ	The area around the hole in the center of the piece of fabric was microscopically examined and chemically processed for the presence of gunshot residue (lead, copper and nitrites). A

TABLE 2

WebCode	Conclusions
	pattern of residue (vaporous lead, copper and nitrites) was found. Using the identified weapon with ammunition similar to the questioned cartridges, this pattern of residue was reproduced at a distance from the weapon to the target of between 6 and 12 inches.
AXN6TX	The defect on the Item Q1 fabric square is consistent with the passage of a bullet. At the time of firing, the distance between the muzzle of the firearm and the fabric square is most consistent with being greater than 3 inches and less than 15 inches.
B43B2N	Exhibit Q1 was examined and chemically processed for the presence of gunshot residues. The test mediums used during the examination were designated at Q1-T1 and Q1-T2. The chemical tests confirmed the presence of gunshot residues. Exhibit Q1 was compared to the K1a, K1b and K1c distance standards. Based on the results of the examination, the pattern of residues produced a muzzle-to-target distance greater than contact up to twelve (12) inches.
BGRE6E	The item #Q1 shirt was microscopically and chemically processed for the presence of gunshot residue. The hole identified as hole #1 had smoke/soot present. A pattern of residue was found around the hole. Based on this processing and observations, it would indicate the muzzle to garment distance is of close range. Close range is approximately between a few inches to a few feet.
BNRPGY	Fouling was observed visually. Powder grains were observed visually. A griess test was performed on defect A entrance and a nitrite pattern was detected that indicates a close approximate muzzle to target distance. The fouling and powder grain patterns and the nitrite pattern detected on the griess test for defect A entrance on item 4, the section of white shirt, is consistent in diameter and particle population with the fouling and powder grain patterns and nitrite patterns detected from the test fire targets between the distances of 3 inches to 12 inches.
BRRZDY	We observe in the trimmed piece of shirt submitted, the presence of a bullet hole compatible with the entrance of a bullet with a caliber of .22 LR. Shooting distance was higher than 3 inches, but lower than 9 inches.
C2Y2AJ	The submitted evidence (Q1) was visually examined and chemically processed for the presence of gunshot residues> The modified griess test for the presence of nitrites and sodium rhodizonate test for the presence of vaporous lead were performed and the results were compared to known test panels. A pattern of residues was found and indicated a muzzle to target minimum distance of 3" and maximum distance of 15".
CB2CKF	The hole in the t-shirt (Item Q1) is consistent with an entrance bullet hole. Comparison of the hole in Item Q1 to a series of test patterns that were made with the recovered firearm and ammunition consistent with that collected at the scene indicates a muzzle to target distance of greater than 3 inches and less than 21 inches.
CP6HVD	Item 2 was visually examined and found to have a defect consistent with the passage of a bullet (bullet wipe/smoke/particulate surrounding defect). Item 2 was chemically processed for the presence of nitrites (a product from the combustion of propellant) using the Modified Griess test and for the presence of lead using Sodium Rhodizonate. A pattern was obtained from both processes. The pattern obtained from Item 2 after chemical processing was compared to Item 1 (known standards) in order to establish a muzzle-to-target distance. It was determined that the muzzle of the firearm was between 3" and 15" from the target at the time of discharge.

TABLE 2

WebCode	Conclusions
CQCZUA	examined and chemically tested for the presence of gunshot residues. From the examinations and testing performed, a pattern of gunshot residues was found to be present around the defect and as such the defect was determined to be an entrance hole produced by the passage of a bullet. It was determined that the pattern of residues present on Q1 is consistent in size and density with having been produced at a distance of further than 6 inches and closer than 15 inches.
CW6ZCB	Item #Q1: The white cloth sheet was chemically processed using the Modified Griess Test (MGT) and the Sodium Rhodizonate Test (SRT) and the results indicated the presence of nitrites, a component of, but not limited to burnt gunpowder, and lead, a component of, but limited to firearm discharge residue. The processed sheet of photo paper with the MGT pattern was designated as sub-item #Q1a and will be retained with the evidence. The pattern on the untreated white cloth sheet and the chemically processed MGT and SRT patterns were compared to the firearm discharge residue patterns of sub-items #K1a1 to #K1a10, #K1b1 to #K1b10 and #K1C1 to #K1c10, to conclude that the distance between the barrel muzzle of the GSG, model 522P, caliber .22 long rifle, semi-automatic pistol and the shirt was approximately 0 to 15 inches.
CXYQF6	One (1) defect, designated #1, was located in the center of Item Q1. The defect is circular and measures approximately 1/8 inch in diameter. The defect and area surrounding the defect were examined microscopically and processed chemically for the presence of gunshot residues and a pattern of residues was developed. Using the distance standards listed under Items K1a-c, this pattern of residues was reproduced at a muzzle distance of between six (6) and eighteen (18) inches.
CY9VTT	Examination of Item 4 revealed a hole in the center of the submitted cloth. The area surrounding the hole was visually examined and chemically processed. Unburned gunpowder grains and chemical residues that are consistent with the entrance hole produced by a firearm discharge were detected. Using the submitted photographs (Items 1, 2, and 3), test patterns that were produced at the following muzzle-to-target distances were examined: contact, three (3) inches, six (6) inches, nine (9) inches, twelve (12) inches, fifteen (15) inches, eighteen (18) inches, twenty-one (21) inches, twenty-four (24) inches, and twenty-seven (27) inches. The detected pattern surrounding the hole in the center of Item 4 is consistent in size and density to the test patterns produced at muzzle-to-target distances of between three (3) and fifteen (15) inches.
CYQRDF	The defect upon item Q1 if created by the GSG brand semi automatic pistol, model P22P, caliber .22 long rifle loaded with 36 grain copper plated hollow point ammunition, is consistent with having been created at a distance between six (6) inches and eighteen (18) inches based upon Q1 to test targets created at known distances.
D37W9F	A visual comparison of the results obtained from the Test Item Q1 in its original form and after it had 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 target (Q1) and muzzle of the firearm is 9 inches plus or minus 3 inches.
DHFJKV	Examination of the piece of white cloth "shirt", submitted as item #2, revealed the presence of an apparent bullet hole. Microscopic and chemical examination of the fabric surrounding the apparent bullet hole in the white cloth "shirt", item #2, revealed the presence of a distinct pattern of gunshot residue. Comparisons of this pattern with the photographs of the known

TABLE 2

WebCode	Conclusions
	distance standards, submitted as item #1, revealed that the muzzle of the firearm was held at a distance of greater than contact but less than fifteen (15) inches from the fabric of the white cloth "shirt", item #2, at the time of discharge. The paper generated during testing will be returned with the other items of evidence.
DLBGZA	Microscopic and chemical examination of the victim's shirt, Item Q1, reveals a gunpowder pattern. Images of test patterns, Items K1a-c, were submitted from a known firearm and analyzed. Using the test images, the pattern was duplicated at a muzzle to target distance between 21 and 27 inches.
DVP2Q2	Item 002-001-001 (CTS Item Q1) was examined for the presence of bullet defects and gunshot residue utilizing visual, microscopic, and chemical techniques. A single bullet entry defect (Hole A) was observed to the center of item 002-001-001. Gunshot residue in the form of gunpowder, nitrite residue, vaporous lead residue, and lead particulate residue was observed surrounding Hole A. Photographs of test targets shot at known distances, as well as photographs of both modified Griess and sodium rhodizonate test results were submitted. The residue observed in those photographs was compared to the residue observed on item 002-001-001. Based on residue observed, the muzzle of the suspected firearm was determined to have been at some distance greater than contact and less than 18 inches away from the item 002-001-001 fabric at the time the shot was fired. This range of fire assumes no interposed target was present when the shot was fired.
DXTZK7	Positive reaction. That means an GSR presence, basically lead. Short range shot in accordance with the characteristic coloration, intensity and distribution of residues.
EAEPWG	The Exhibit Q1 white cotton fabric was microscopically examined and chemically processed for the presence of gunshot residues. A pattern of gunshot residues was found around a suspect bullet entrance hole located approximately in the center of the white cotton fabric. Comparisons of the Exhibit Q1 pattern of residues to the Exhibit K1A, K1B and K1C photographs indicate that the pattern of residues could be reproduced at a distance of greater than contact up to twelve (12) inches.
ENWK98	WE apply color test technique on the shirt sample (Q1) using fresh modified griss and we conclude that there is nitrite anion which give indication on 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 6 to 12 inches.
EP9FUY	CONCLUSIONS: MICROSCOPIC AND CHEMICAL EXAMINATIONS WERE CONDUCTED ON SUBMITTED ITEM Q1 (SWATCH OF VICTIM'S T-SHIRT) OBSERVATION AND EXAMINATION OF Q1 REVEALED WHAT IS CONSISTENT WITH A GUNSHOT RESIDUE PATTERN AROUND THE ENTRANCE OF A SUSPECTED BULLET HOLE. THE GRIESS TEST (PRESENCE OF NITRITES) AND THE SODIUM RHODIZONATE TEST (PRESENCE OF LEAD) WERE PERFORMED, INCLUDING CONTROL SAMPLES PRIOR TO TESTING. EACH OF THE CHEMICAL EXAMINATIONS PRODUCED POSITIVE RESULTS. THE PROVIDED DISTANCE STANDARDS PHOTOGRAPHS (K1a, K1b, K1c) IN COMPARISON TO THE SUSPECTED BULLET HOLE AND GUNSHOT RESIDUE PATTERN ON Q1 DETERMINED THAT THE DISTANCE FROM MUZZLE TO TARGET IS APPROXIMATELY BETWEEN 3" AND 9".
EXQLTR	The area around Hole 1 was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of residues was found. Using a GSG model 522P



TABLE 2

WebCode	Conclusions
	caliber .22 LR semiautomatic pistol with Federal 36 grain copper plated hollow point ammunition, this pattern of residues was reproduced at a muzzle-to-target distance of greater than 3 inches and less than 15 inches.
EYL4VT	The hole in the shirt, item 2, was produced at a distance greater than 3 inches but less than 21 inches.
F26J2E	I compared the patterns of the soot and propellant deposition on the fabric of item Q.1 against the patterns of the soot and propellant deposition on fabric shot at known distances using the suspect's firearm and Federal-brand cartridges loaded with 36 grain, copper-coated, hollow-point bullets. These patterns were compared visually and after chemical enhancement with Griess reagent and sodium rhodizonate. Based on these examinations, it is my opinion, that the muzzle of the firearm could not have been as close as 3 inches nor as far as 12 inches from the victim's T-shirt when the shot was fired.
F4B2YA	The exhibit displayed a hole in the approximate center. The hole and the area around the hole were examined and chemically processed for the presences of firearm discharge residues. Residues consistent with the passage of a projectile were found. The area around the bullet entrance hole in the Exhibit Q1 displays firearm discharge residues consistent with greater than 3 inches and less than 12 inches.
F6ZA66	The following results were formed using the supplied Distance Standards: Based on information supplied by Collaborative Testing Services of a known firearm and ammunition, it was determined that the minimum distance is 6 inches and the maximum distance is 15 inches.
FB3NJE	Photographs were supplied of test patterns fired at 3 inch intervals from contact to twenty-seven 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 contact but less than eighteen inches.
FC2L68	The square white cloth panel was chemically processed using the Modified Greiss Test (MGT) and Sodium Rhodizonate Test (SRT) to test the presence of nitrites and lead. The chemical processing using the MGT resulted in patterns indicating the presence of nitrites and the SRT indicated the presence of lead. The untreated and chemically treated patterns of the square white cloth panel were compared to the untreated and chemically treated firearm discharge residue patterns, Items K1a, K1b and K1c to conclude that the muzzle end of the firearm was at a distance approximately 0 to 15 inches from the square white cloth panel when it was discharged.
PDFZNB	By the optical examination of the shirt marked Q1. I am therefore of the opinion that the shot was fired at a distance of between 3 inches and 6 inches.
FF3RF8	The hole in Item Q1 was examined visually and processed chemically for the presence of gunshot residues. These tests indicated that the muzzle of the firearm was greater than 6 inches and less than 18 inches from the shirt when discharged.
FFKLG6	Firearms Examination Results: CTS Test No. 16-530 (GSR) - [Name] Proficiency Test: The area around the hole in the cloth marked Q1 was visually, chemically and microscopically examined for the presence of gunshot residues and a pattern of gunshot residues were found. Patterns like the pattern found on item Q1 were produced at a distance greater than contact inches and less than 12 inches.

TABLE 2

WebCode	Conclusions
FGYBH9	The area around the hole in the cloth square (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the distance standards supplied, the pattern of residues was reproduced at a distance between greater than contact and 15 inches.
FHPAXR	In the portion of the t-shirt is established the presence of an bullet hole caused by the passage of projectile fire from a firearm, being determined as distance short, with a range of 3 to 12 inches approximately between the muzzle of the weapon and impact site, that based on the comparison of the results found between the distance of standars and the sample.
FJKRZT	I compared the powder, Griess, and Sodium Rhodizonate patterns obtained from Q1 to the provided known powder, Griess and Sodium Rhodizonate test patterns K1a, K1b and K1c. Based on the comparison I determined the minimum muzzle to target distance to be 3", and the maximum muzzle to target distance to be 12".
FLQEBD	Patterns of nitrites and lead were confirmed on Item 2 using the direct application technique of both the Modified Griess Test and the sodium rhodizonate test. The patterns were compared to the sealed photographs of test patterns at know distances that were chemically processed using both of the above tests in the same manner. A muzzle-to-target range was developed based on those comparisons. The Item 2 garment was separated from the barrel of the firearm at a distance between 3 to 15 inches at the time of discharge.
FNFJ8Q	The area around the hole in Q1 was microscopically examined and chemically processed for gunshot residues and a pattern of residues was found. Using a GSG model 522 caliber .22LR semiautomatic pistol with a 9 inch barrel and Federal 36 grain copper plated hollow point ammunition, the pattern of residues around the hole on the swatch was reproduced at a muzzle to target distance of greater than 3 inches and less than 15 inches.
FNV6GR	The shot fired in the fragment of fabric consistent with a short distance range, between three and nine inches from the muzzle of the weapon and the targer.
G467T9	The area around the hole in the victim's shirt (Laboratory Item 001.A, Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the evidence firearm and submitted ammunition, this pattern of residues was reproduced at a distance of greater than contact but less than 15 inches.
G6YYNR	Examination of Item #2 revealed it to be one piece of white cotton like material approximately 8 inches by 8 1/2 inches with a bullet entrance hole near the middle. The area around the hole was microscopically examined and chemically processed for the presence of lead and nitrites and a pattern of residues was found. Lead and Nitrites are common components of gunshot residue. Comparisons of these patterns with the submitted exemplars, Item #1 (patterns made by firing the suspect firearm at known distances) revealed the muzzle of the firearm was held at a distance greater than contact but less than twelve inches when the shot was fired.
G8N66H	The Item Q1 shirt was microscopically examined and chemically processed for the presence of gunshot residues. A pattern of gunshot residue was observed around a bullet hole. The Q1 shirt was compared to the test fired patterns, Modified Griess patterns and NaRh (Sodium Rhodizonate) patterns (Items (K1A-K1C). The distance between the muzzle of the fireeam to the Q1 shirt was 3 to 15 inches.

TABLE 2

WebCode	Conclusions
GABRX7	1. Examination of Exhibit 2 (shirt) disclosed a perforating defect near the center of the fabric. The area around the hole was visually examined and chemically processed. Physical characteristics and a pattern of gunshot residues associated with the discharge of a firearm were located. 2. The pattern of gunshot residues on Exhibit 2 was compared to Exhibit 1 (photographs of known-distance test-patterns). The pattern of gunshot residues on Exhibit 2 was reproduced at a muzzle-to-target distance between approximately 3 inches and 15 inches.
GAF6K2	One (1) white in color cloth sample measuring 8 1/2" x 8 1/2". Markings on cloth are consistent with a bullet hole. Gunshot residue, soot, and powder particles noted around approximate small hole showing bullet wipe. A distance determination was conducted. A distance determination was conducted with following results: Based on information received from Collaborative Testing Services using known firearm and ammunition, distance determination concluded that the minimum distance is (3") and maximum distance would be (12").
GCUYYD	The area around the hole in Item 2 (said to be a piece of a shirt) was visually examined and chemically processed for the presence of gunshot residues. Based on comparisons against Item 1 (distance standards), the pattern of residues was reproduced at a distance of between 3 and 18 inches.
GG9GEA	The garment has one (1) hole, with the appearance of an entrance bullet hole. During the optical and chemical examination burnt and potentially burnt propellant residue was found around the hole. Shot range determination was performed on the garment by means of chemical examination and compared with the known distance standard received. I am therefore of the opinion that the hole was a result of a shot fired between a distance of 3" (76,2mm) and 12" (304,8mm)
GV9DHU	Garment (colth) received for study physical chemistri, was with by gun fire at close range from an approximate range of 3" a 9"
GW34N9	The GSR pattern as evident on Q1, when compared to the provided K1 a-c Distance Standards, is consistent with a muzzle-to-target distance of 3 inches (minimum distance) and 15 inches (maximum distance).
H2GY67	The pattern of gunshot residues around defect A on Item Q1 is consistent with a muzzle to target distance of 3 inches to 18 inches.
HPLT82	The muzzle-to-target distance of the gunshot that caused the bullet hole in the shirt, Item Q1, using the provided distance standards, Item K1 a-c, was determined to be greater than Contact (0 inches) and less than 12 inches.
J29C7N	The portion of fabric shirt victim has a consistent entry hole caused by the passage of projectile fired in firearms single charge; based on the physical study, the results of the chemical test and comparison with standard photographs taken at different distances from the dispersion of waste shooting tests Griess and sodium nitrate; it follows that the shot was fired in a distance range between at least three (3) inches and maximum nine (9) inches from the muzzle of the gun and shirt . In addition, it appears that the projectile had lead in their constitution.
J8CFU2	Deposits with characteristics of gunshot residue were detected. The hole has characteristics observed in entrance holes caused by the passage of a projectile. The residue pattern indicates

TABLE 2

WebCode	Conclusions
	a muzzle-to-target distance between three (3) and twelve (12) inches.
JCVBXU	The damage and residue patterns on Q1 are consistent with it having been shot by K1 at a distance greater than contact but less than nine (9) inches.
JEX99M	The area around Hole #1 in the center of the fabric (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the GSG model 522P caliber .22LR semiautomatic pistol and Federal 36 grain copper plated hollow point ammunition, this pattern of residues was reproduced at a muzzle-to-target distance of greater than 3 inches and less than 12 inches.
JQAJVC	The submitted evidence (Q1) was visually examined and chemically processed for the presence of gunshot residues. The Modified Griess (nitrites) and Sodium Rhodizonate (vaporous lead) tests were performed and the results were compared to known test panels. A pattern of residues was found and indicated a muzzle to target distance of greater than 3" but less than 15".
JXDHB9	Exhibits listing: 1 - (K1a) Distance Standards at 3" increments from Contact to 27" provided as photographs of GSR patterns on untreated white cotton cloths. 2 - (K1b) Distance Standards at 3" increments from Contact to 27" provided as photographs of GSR patterns of Modified Greiss Test. 3 - (K1c) Distance Standards at 3" increments from Contact to 27" provided as photographs of GSR patterns of Sodium Rhodizonate chemical treatment. 4 - (Q1) One shirt with bullet hole. Findings: Examinations were conducted on the evidence listed above. The findings of this examiner are the following: 1. Exhibit 4, the submitted shirt, was found to have one hole in the center. 2. Microscopic and chemical examination of Exhibit 4 revealed gunpowder and gunshot residue around the hole. 3. The pattern of residues around the hole was reproduced with test patterns fired at distances between 3 inches and 15 inches using the submitted pistol and ammunition consistent with the projectile recovered in this case. Only those items discussed in the results above were examined for this report. This report represents the opinions and interpretations of the undersigned analyst.
K3ZVLV	One hole consistent with a bullet hole was observed in the center of the square of white cloth labeled Q1. The hole and the areas adjacent to the hole were visually examined and chemically tested. After chemical testing, the results were compared to the series of known distance patterns submitted. The known patterns submitted were representative of test fires done at muzzle to target distances of contact out to 27 inches, at 3 inch intervals. The gunshot residues on the piece of cloth ( Exhibit Q1) were determined to be most consistent being fired at a distance of less than 12 inches and greater than 3 inches.
KA26U9	Chemical testing indicated a pattern of residues was produced consistent with the discharge of the firearm in question at a distance of between 3 inches and 12 inches from the point of contact.
KBU6PY	The muzzle-to-target distance of the gunshot that caused the bullet hole in the shirt, Item Q1, using the provided distance standards, Item K1a-c, was determined to be greater than Contact (0 inches) and less than 12 inches.
KRGH6C	A comparison of the gunshot residue pattern on Item Q1 with those in Items K1a, K1b and K1c revealed a muzzle to target range of 3 to 15 inches.
KVHLXY	One (1) white colored cloth square (8 1/2" x 8 1/2") consistent with bullet wipe, soot and

TABLE 2

WebCode	Conclusions
	powder particles submitted. A distance determination test was requested. A distance determination test was conducted with the following results: Based on info supplied by Collaborative Testing Services of a known firearm and ammunition, it was determined that the minimum distance is (3") and the maximum distance is (9").
KWAMUA	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 zero inches (hard contact is discarded) and less nine inches approximately, based in the results from the gunshot residues testing of the received fabric and their comparison with the received distance standards.
L3FBE3	The shirt, Item Q1, was visually and chemically examined for the presence of gunshot residues. Lead and gunshot residue patterns were detected around a defect, designated Defect 1. These patterns were compared to the known patterns K1a, K1b, and K1c. The gunshot residue pattern observed on the shirt, Item Q1, was consistent with a muzzle to target distance between three and fifteen inches.
LAVAN8	I compared the material with bullet hole (Q1) with the images of distance standards Items K1a - K1c; before and after treatment with the modified Griess and Sodium Rhodizonate tests. I measured the results and in my opinion the distance between muzzle and target at the time of discharge is conservatively estimated to have been not less than near contact (0 inches) and no greater than 9 inches.
LMYK99	The hole located on the cloth, was produced by the entry of a ballistic projectile fired at a distance ranging from 3 inches to 9 inches approximately.
LNC644	The 0001-AA section of white cloth (Q1) was visually examined for holes and defects. One hole was observed. The area around the hole was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found that are consistent with passage of a bullet. The pattern of residues around the hole in the 0001-AA section of cloth (Q1) was compared to the 0001-AB, 0001-AC, and 0001-AD photographs of known muzzle to target distance patterns submitted by CTS (K1a-c). The pattern is consistent with having been fired at a muzzle to target distance greater than 3 inches and less than 15 inches.
LVWCG3	Test shots fired with the pistol & with ammunition with the same specifications indicate that the shot was fired at a distance of between 3 inches & 12 inches.
LYGZH3	The item Q1 square white cloth has a single bullet hole in it, designated as Hole 1. Hole 1 is located in the approximate center of the cloth. Gunshot residue patterns were found around Hole 1. Based on these residues, Hole 1 was fired at a distance greater than contact, but less than 15 inches.
LYWJ3Z	Based on information and a cloth sample (8 3/4" x 8 3/8") supplied by Collaborative Testing Services of a known fire arm and ammunition, it was determined that the minimum distance is 3" and the maximum distance is 10".
MF23H4	The Q1 piece of white fabric was visually examined and chemically processed for gunshot residue. A pattern of residue was developed. Using the provided photographs K1a, K1b, and K1c of muzzle to target patterns, the pattern on the Q1 piece of white fabric was determined to have been made at a muzzle to target distance of greater than six (6) inches and less than twenty-one (21) inches.

TABLE 2

WebCode	Conclusions
MJK3UD	for the presence of gunshot residues (lead, nitrites, and particulate matter). A pattern of residues (vaporous lead, nitrites, and particulate matter) was found. Using the identified weapon with ammunition similar to the questioned cartridges, this pattern of residues was reproduced at a distance from the weapon to the target of between 3 and 12 inches.
MKCGZ3	Based on comparison of the appearance & distribution of powder particles, sooting, nitrates, and lead between the shirt (Item Q1) & the supplied test targets (Items K1a, K1b, & K1c), the muzzle to target distance was most likely less than 3" but was not in contact with the shirt. This is based on the assumptions that the ammunition & firearm were the same for the shirt & supplied test targets, the target was perpendicular to the firearm's muzzle at the time of the shooting, and the supplied test targets accurately reflect "normal" gunshot residue distribution at each distance.
MP7BX4	The area surrounding the defect in the portion of white shirt, Item 1A, was microscopically examined and chemically processed for the presence of gunshot residues. This examination revealed a pattern of gunshot residues. Images of test patterns, Items 1B-1D, were submitted from known firearm and analyzed. Using the test images, the pattern was duplicated at a muzzle to target distance between 6 and 15 inches. The following is a summary of testing performed: Microscopic examination for unburnt/partially burnt gunpowder particles: particles consistent with the morphological (shape & size) properties of gunpowder were found Chemical examination for nitrates that could originate from unburnt/partially burnt gunpowder particles using the Diphenylamine test: positive Chemical examination for nitrite residues that could originate from gunpowder particles using the Modified Griess test: positive Microscopic examination for lead residues: residues consistent with lead found Chemical examination for lead residues using the Sodium Rhodizonate test: positive
MQZ2W	Based on information supplied by Collaborative Testing Services of a known firearm & ammunition, it was determined that minimum distance is 3" and the maximum distance is 9"
MQF6XA	Q1 had one hole that was consistent with the passage of a bullet within a distance between 3" and 18". This was determined by the quantity and density of the powder and lead present on Q1.
MQG34Y	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 test targets. Based on the presence, overall pattern, and density of residues observed between Item Q1 and the provided photographs of the test standards, the questioned bullet hole on Item Q1 appears to have been created by a shot fired at a distance of approximately fifteen and twenty one inches from the shirt. This is a conservative estimate based on an evaluation of the untreated and chemically processed residue patterns and assumes there was no intervening objects between the muzzle of the firearm and the shirt at the time.
MQKK9P	It has 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 6 to 12 inches, which is consistent with short distance.

TABLE 2

WebCode	Conclusions
MRT2Y8	The shooting distance must have been between 3 and 9 inches.
N36JCW	Items 1.1 - 1.4 Item 1.4, a piece of white cloth, was examined for gunshot residue and compared to the Item 1.1-1.3 photographs to determine minimum and maximum muzzle to target distance. The examination revealed that the cloth contained a hole indicative of the passage of a bullet. The presence of Gunshot Residue in the form of sooting, imbedded gunshot particles, and the presence of Nitrites and Lead found on the Item 1.4 cloth is indicative of the discharge of a firearm. The muzzle to target distance was determined to be between 3 and 12 inches.
ND3JPZ	a. It is extremely probable that the hole in the T-shirt (Exhibit Q1) is a bullet entrance hole. b. It is highly likely that this bullet was shot at a distance in the range of 6"-15" (muzzle to shirt). This shooting distance estimation is based on the assumption that this target was the first medium hit by the bullet.
NNBRV3	The area around the Item Q1 hole was examined and chemically processed for the presence of gunshot residues. Residues consistent with the discharge of a firearm and passage of a bullet were found around the hole. The gunshot residue pattern around the hole is consistent with tests fired at a muzzle-to-target distance greater than 3 inches and less than 15 inches using the firearm and evidence ammunition.
NQDTVY	Item #Q1: The irregular-shaped hole and surrounding area was chemically processed for the presence of nitrite and lead residues using the Modified Griess Test (MGT) and Sodium Rhodizonate Test (SRT) and a pattern of residues was observed. The photographs of known firearm discharge residue patterns, Item #K1, were compared to the patterns on the untreated and chemically processed white-colored cloth and the treated photo paper with the nitrite pattern, to conclude that the approximate distance from the muzzle end of the pistol to the white-colored cloth was greater than contact but not more than 15 inches.
NRNYTZ	Item Q1, a white fabric square, supported an area of damage (Hole A) consistent with the passage of a firearms projectile. The area around the Hole A was microscopically examined and chemically processed for the presence of gunshot residues and residue deposits were found. Using the submitted test exemplars (Items K1a, K1b, K1c) the pattern of residues on Q1 was consistent with a muzzle to fabric distance of greater than 3 inches and less than 21 inches.
NTYJW4	The pattern illustrated in Test Q1 appears to represent a shot discharged at a distance greater than 3 inches and less than 12 inches.
NVAGBK	Examination of the submitted shirt (twill cloth), item 2, revealed the presence of a damaged area located in the center of the item. Microscopic and chemical examination of the fabric surrounding the damaged area revealed the presence of a gun powder pattern. The submitted series of test gun powder patterns, item 1, were compared to the gun powder pattern present on the shirt (twill cloth), item 2. These comparisons revealed the gun powder pattern surrounding the damage on the shirt (twill cloth), item 2, is consistent with a muzzle to target distance of greater than contact (zero (0) inches) and less than fifteen (15) inches. The paper sample generated from chemical examination the submitted shirt (twill cloth), item 2, will be returned with the evidence.
NXCJUV	firstly white cotton cloth which has black color around a bullet hole was taken a photo. after

TABLE 2

WebCode	Conclusions
	that, in order to determine gunshot distance was made sodium rhodizonate chemical treatments test. occurring color was reported and taken a photo. Reference photos was compared with tested material photos. the conclusions was reported.
P9BEWW	The shooting distance could be estimated between 6 and 15 inches.
P9QYFU	A Distance Determination of Test No. 16-530 was requested with the following results: The Distance was 6" to 12"
PGK9KX	The area around the hole on exhibit Q1 was microscopically examined and particles of gun powder were observed. The area was then chemically processed for gunshot residues. The distance from the muzzle of the firearm and exhibit Q1 was determined to be between 12 and 21 inches.
PV2294	Visual examination and chemical processing of the submitted item Q1 in comparison to submitted standards put the muzzle of the firearm less than six (6) inches and greater than Contact from the t-shirt at the time of discharge.
QJRJG2	Examination of the Item A1-4 (Q1) piece of fabric revealed the presence of a hole approximately in the middle of the item. The area around this hole was examined microscopically, and processed chemically for the presence of propellant and lead residues (gunshot residues), and a pattern of residues was found. Comparison of the Items A1-1 (K1A), A1-2 (K1B) and A1-3 (K1C) submitted test patterns to the item A1-4 (Q1) submitted piece of fabric showed the Item A1-4 (Q1) residue pattern to be consistent in size and density with patterns observed on the items A1-1 (K1A), A1-2 (K1B) and A1-3 (K1C) submitted standards. Based on this comparison, the bullet hole observed on Item A1-4 (Q1) is not consistent with a contact shot, but fired from a distance between contact, and approximately twelve (12) inches from muzzle to target.
QM4QG7	Firearms Examination Results: CTS Test No. 16-530 (GSR) - [Name] Proficiency Test: The area around the hole in the cloth marked Q1 was visually, chemically and microscopically examined for the presence of gunshot residues and a pattern of gunshot residues were found. Patterns like the pattern found on item Q1 were produced at a distance greater than contact inches and less than 12 inches.
R8NR9Y	We examined this case at two steps. At the first step, we investigated and compared the physical view of bullet hole to the pattern provided. At the second step, we performed the NaRH test to obtain distribution of gunshot residue. We noticed that there exists gunshot residue around the bullet hole on the shirt. We compared the distribution of gunshot to the patterns of NaRH test. As the result, we evaluated it as "Close Shooting" (between 6-12 inches).
R8T6VV	Microscopic examination detected the presence of gunpowder particles around the hole in Item Q1. Microscopic examination also detected the presence of silver colored metallic fragments and copper colored metallic fragments. Chemical testing detected the presence of nitrates in the particles around the hole in Item Q1. Chemical testing detected the presence of nitrite patterns around the hole in Item Q1. Chemical testing detected patterns of lead residues around the hole in Item Q1. The results from the chemical testing on Item Q1 are consistent with the deposit of gunshot residue after the discharge of a firearm. Any further conclusions as to the muzzle to target distance will be reported by the Firearms Identification Unit.



TABLE 2

WebCode	Conclusions
R93AAJ	established between three (3) inches and nine (9) inches from muzzle of the pun cloth, the above was set by comparison with CTS potographs received with the results of the study physical and chemical test on fabric.
RC3MNV	The area surrounding the hole in the shirt of Item #Q-1 was examined microscopically and processed chemically for the presence of gunshot residues and a pattern of residues was found. Using the previously fired and chemically processed distance tests with both Modified Griess and Sodium Rhodizonate, the pattern of residues were consistent with a shot fired at a distance between 3 inches and 18 inches.
RJLTK3	The GSR pattern observed on the test cloth (Q1) was most consistent with test shots generated from approximately 9 inches away. The range established supports a distance farther than 3 inches but closer than 15 inches.
RLR7D3	The Griess and NaRh tests were conducted and compared along with optical comparisons of the test fire images. The particles of nitrite visualised by the Griess test were not evenly spread around the bullet hole. These particles seemed to have been relocated due to movement. Only the intensity and the total number of particles could be used as a comparator. Overall a distance of 6 inches plus or minus 3inches would fit the three tests.
RRD4Y6	Visual, microscopic and chemical examination on the cut portion of the shirt (Q1) revealed the presence of gunshot residue. The hole on the shirt is consistent with the passage of a bullet with a muzzle to target distance of 3"-15". This determination is based on a comparison of Q1 to known muzzle to target distance utilizing the same firearm and similar ammunition.
RRFU7M	MICROSCOPIC EXAMINATION OF Q1 CUT SQUARE FROM T-SHIRT WITH SUSPECTED BULLET HOLE REVEALED THE PRESENCE OF GUNSHOT RESIDUES AND AFTER CHEMICAL PROCESSING, A GUNSHOT RESIDUE PATTERN WAS OBSERVED. AS A RESULT, THE HOLE WAS DETERMINED TO BE CONSISTENT WITH THE PASSAGE OF A BULLET. THE DISTANCE STANDARDS PROVIDED FROM THE GSG 522P .22 LR CALIBER PISTOL DETERMINED THAT THE PATTERN DEVELOPED IS CONSISTENT WITH A DISTANCE BETWEEN 3" TO 15" FROM MUZZLE TO TARGET.
RT9M27	The defect and the area around the defect on the fabric in Item Q1 were microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Characteristics of this defect area were compared to corresponding characteristics of defect areas contained within images of known distance test patterns in Items K1a, K1b and K1c. The defect in Item Q1 is indicative of being reproduced at a distance of between 3 and 12 inches.
TDT4JP	One (1) white colored cloth square (8 1/4" x 8 1/2") consistent with bullet wipe, soot and powder particles submitted. A distance determination test was requested. A distance determination test was conducted with the following result: Based on information supplied by Collaborative Testing Services of a known firearm and ammunition, it was determined that the minimum distance is (3") and the maximum distance is (9").
THKDUN	The item 001-001-001 fabric square with defect ("Q1: Shirt with bullet hole") was examined for the presence of bullet defects and gunshot residues utilizing visual, microscopic and chemical techniques. A single bullet entry defect (Hole A) was detected centrally in the fabric. Gunpowder, soot, nitrite residues and lead residues were observed surrounding Hole A. The gunshot residue patterns from the provided series of test targets (items 001-002-001 "K1a",

TABLE 2

WebCode	Conclusions
	001-003-001 "K1b", and 001-004-001 "K1c") were evaluated and compared to the gunshot residue patterns detected on item 001-001-001 ("Q1: Shirt with bullet hole"). Based on the gunshot residue patterns on the test targets, the range-of-fire was determined to be at some distance from contact to twelve inches (12") from the gun muzzle to item 001-001-001 at the time the shot was fired provided no interposed target.
TJGV PX	I examined the piece of white cloth mentioned in paragraph 3.1 and found the following: 5.1 One (1) hole with the appearance consistent with that of a bullet hole, marked by me "A". 5.2 During the optical examination of the (alleged) bullet hole mentioned in paragraph 6.1, burnt and partially burnt propellant residue was found around the hole. 5.3 Shot range determination was performed on the piece of white cloth by means of a chemical examination and the result thereof was compared to the known distance standards mentioned in paragraphs 3.1.2.1 and 3.1.3.1. 5.4 From the comparison of my results with the known distance standards, I am of the opinion that the shot which resulted in the hole mentioned in paragraph 6.1 was fired from a distance between 3" (7,6 cm) and 12" (30,4 cm).
TL466Q	Based on the information supplied, it was determined that the minum distance is 9" and the maxium distance is 15".
TQ3KU2	The cloth was visually and chemically examined for gunshot residue patterns. Soot and several powder particles was visible around the damage. A high concentration of particles of nitrite and lead were detected around the damage. The results from the visual and chemical treatment of the item Q1 was compered with test samplings (Item K1a and Item K1b). The result shows that the shooting distance is over 3" but bellow 12".
TQH3BR	A hole with characteristics that are observed in entrance holes caused by the passage of a projectile was observed. Characteristics of gunshot residue were detected. This is observed on surfaces that were within the proximity of a discharging weapon. The residue pattern from Q1 indicates a muzzle-to-target distance between three and twelve inches.
TW4WQX	The area surrounding the defect in the section of the white shirt, Item 1A, was microscopically examined and chemically processed for the presence of gunshot residues. This examination revealed a pattern of gunshot residues. Images of test patterns, Items 1B-1D, were submitted from a known firearm and analyzed. Using the test images, the pattern was duplicated at a muzzle to target distance between 3 and 12 inches. The following is a summary of testing performed: Microscopic examination for unburnt/partially burnt gunpowder particles: particles consistent with the morphological (shape & size) properties of gunpowder were found Chemical examination for nitrates that could originate from unburnt/partially burnt gunpowder particles using the Diphenylamine test: positive Chemical examination for nitrite residues that could originate from gunpowder particles using the Modified Griess test: positive Microscopic examination for lead residues: residues consistent with lead found Chemical examination for lead residues using the Sodium Rhodizonate test: positive
U9CXM F	The presence of dark fouling and the powder grain pattern detected on the section of white fabric labeled "shirt with bullet hole", (item 4), and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled "shirt with bullet hole", (item 4), are consistent in diameter and particle population with the fouling patterns and the powder grain patterns observed on item 1, the photo set of test fire targets, and the nitrite patterns detected on item 2, the photo set of test fire targets treated with griess test, between the distances of 3 inches and 12 inches.

TABLE 2

WebCode	Conclusions
UCEWZT	1) Exhibit 2 (Shirt) was visually, microscopically, and chemically examined for the presence of a pattern of gunpowder residues consistent with the discharge of a firearm. a) A hole of entry with a pattern of gunpowder residues was found near the center of the fabric. 2) Exhibit 1 (Photographs of known distance test patterns - Visual, Modified Griess, and Sodium Rhodizonate) were submitted for comparison to the pattern of gunpowder residues found on Exhibit 2. a) The pattern of gunpowder residues that were found on Exhibit 2 was reproduced at a muzzle-to-target distance between approximately 3 inches and 15 inches. 3) Exhibit 2.1 (Modified Griess Test Paper and Sodium Rhodizonate Controls) was created during chemical examination of Exhibit 2 and is being returned with Exhibit 2.
UVRGWW	The area surrounding the defect in the upper part of the piece of white shirt, Item 1A, was microscopically examined and chemically processed for the presence of gunshot residues. This examination revealed a pattern of gunshot residues. Images of test patterns, Items 1B-1D, were submitted from a known firearm and analyzed. Using the test images, the pattern was duplicated at a muzzle to target distance between Contact and 9 inches. The following is a summary of testing performed: Microscopic examination for unburnt/partially burnt gunpowder particles: particles consistent with the morphological (shape & size) properties of gunpowder were found Chemical examination for nitrates that could originate from unburnt/partially burnt gunpowder particles using the Diphenylamine test: positive Chemical examination for nitrite residues that could originate from gunpowder particles using the Modified Griess test: positive Microscopic examination for lead residues: residues consistent with lead found Chemical examination for lead residues using the Sodium Rhodizonate test: positive
UYN6AX	The area around the hole in item Q1 was microscopically examined and chemically processed for gunpowder and lead residue (gunshot residues). The pattern of residues is consistent in size and density with the muzzle of a firearm having been greater than approximately 3 inches and less than approximately 12 inches from this area at the time of firing. Materials produced from chemically processing item Q1 are being returned as Item Q1m in container gsrD.
V34UET	This report references the following evidence items: Exhibit 1: Gunshot residue visual test patterns, Modified Griess patterns and Sodium Rhodizonate patterns from contact to 27 inches Exhibit 2: One (1) square cloth with hole and residues 1. Exhibit 2 (Cloth) was visually examined and chemically processed and physical effects and gunpowder residues consistent with the discharge of a firearm were located. 2. The residues that were located on Exhibit 2 were compared to the known distance test patterns in Exhibit 1. 3. The pattern of gunpowder residues on Exhibit 2 are analogous to those found in the Exhibit 1 test patterns made at a distance between approximately 3 and 15 inches.
V8D8WR	Visual inspection of the white cotton cloth, Lab Item 4, revealed a single perforating defect which was labeled as Defect A. Defect A displays characteristics consistent with the passage of a bullet. The area around Defect A on Lab Item 4 was visually inspected, microscopically examined, and chemically processed for gunshot residues and a pattern of residues was detected. Using the submitted known distance standards, Lab Items 2 – 4, for comparison, a pattern of residues consistent with what was detected on Lab Item 1 was reproduced at a minimum approximate muzzle-to-garment distance of 3 inches and a maximum distance of 18 inches.
VAZYXV	3. On 2016-09-16 during the performance of my official duties I received a sealed evidence bag with number PW4000461762 from Case Administration of the Ballistics Section,

TABLE 2

WebCode	Conclusions
	containing the following exhibits: 3.1 One (1) piece of white cloth (t-shirt). 3.2 Ten (10) powder patterns photographs of different distances. 3.3 Ten (10) modified griess test photographs of different distances. 3.4 Ten (10) sodium rhodizonate chemical treatment photographs of different distances. 4. The intention and scope of this forensic examination comprise the following: 4.1 Shot range determination. 5. I examined the cloth mentioned in paragraph 3.1 and found the following: 5.1 One (1) hole consistent with a bullet hole on the cloth more to the right marked by me "363349/16 A". 6. Comparison of the alleged bullet hole on the cloth (t-shirt) as well as photographs mentioned in paragraphs 3.2 and 3.3 were done and the following findings were made: 6.1 During the optical and chemical examination of the bullet hole mentioned in paragraph 5.1 propellant residue was found surrounding the holes. 6.2 The shot was fired at a distance that ranges between 3" and 18" of the test mentioned in paragraph 3.3.
VBDJRR	A hole consistent with the passage of a bullet was observed on the fabric of Item Q1. Item Q1 was visually and chemically processed for the presence of gunshot residues. A pattern of residues was observed and/or developed on Item Q1. Based on these patterns an approximate distance from the muzzle of a firearm to the target Item Q1 was established at 3" minimum to 12" maximum based on comparison of Item Q1 to agency supplied standards.
VD3RXL	The distance of firing between the muzzle of firearm and the exhibit marked "Item Q1" was estimated to be between 3 inches and 12 inches.
VDYATV	6. During the optical examination of the bullet hole mentioned in paragraph 5.1, propellant residue was found surrounding the hole. 7. Shot range determination was performed on the shirt mentioned in paragraph 3.1.1 by means of a chemical examination. The result of this was compared with the known distance-standards mentioned in paragraphs 3.1.2 and 3.1.3 respectively. 7.1 I am therefore of the opinion that the hole mentioned in paragraph 5.1 was as a result of a shot fired between a distance of 3" (7,62cm) and 12" (30,48cm).
VEVTWV	After the Griess test performance, the spread pattern of the propellant indicated that the barrel was held between a distance of "15" inches and "18" inches.
VMVZKX	The distance between the muzzle of the pistol and the shirt during discharge was greater than contact and less than 9 inches.
WAGBF2	The area around the hole in the R-1 twill cloth was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the T-1, T-2, and T-3 distance standard photographs submitted, patterns similar to the pattern on the R-1 twill cloth were produced at distances greater than three (3) inches and less than fifteen (15) inches.
WALREZ	Exhibit Q1 is a square-shaped portion of a white cloth shirt with a defect located in the approximate center. Exhibit Q1 was microscopically examined and chemically processed for the presence of gunshot residues. Results of chemical processing indicate the defect observed in Exhibit Q1 is consistent with the passage of a bullet. Additionally, a pattern of residues was detected and visually compared to the known distance standards represented by Exhibit K1. Based on this comparison, the pattern of residues present on Exhibit Q1 is consistent with having been produced at a muzzle-to-target distance of greater than contact and less than fifteen (15) inches.
WKJMEF	Results of Examinations: The item 1 shirt was microscopically examined and chemically

TABLE 2

WebCode	Conclusions
	processed for gunshot residues. Nitrite and vaporous lead and residues were found near a hole of the shirt but a muzzle-to-target range could not be determined due to the lack of a measurable pattern of deposition. Although a muzzle-to-target distance could not be determined, it should be noted that lead residues like those found on the Item 1 shirt are rarely deposited at a distance of twenty-four inches or greater [Participant included an attachment that could not be reproduced within the report.]
WX66ZT	Distance standards correlate best with the evidence sample in the 6 inch to 9 inch range. Due to variables (uncertainties) associated with gunshot residue deposition and testing, a muzzle to target surface range at the time of discharge is determined to be between 3 and 12 inches.
X9KATA	The area around the hole located on Q1 was microscopically examined and chemically processed for the presence of gunshot residues, and pattern was detected. Using the submitted K1a, K1b, and K1c, the distance of the muzzle of the firearm the shirt is between six (6) and twelve (12) inches.
XWRPDJ	The distance of firing between the muzzle of the firearm and the shirt marked "Q1" was estimated to be between 3" and 12".
Y3P2LL	Test for nitrates: Chemical testing detect the presence of nitrates on the particles collected from around surface hole Q1. Chemical testing detected the presence of a nitrite pattern on the outside surface around hole Q1 w/ ~ diameter of 1". Chemical testing detected the presence of cloudy patter of lead residue on the outside hole Q1 w/ ~ diameter of 2". The results from the chemical testing on the outside surface around hole Q1 are consistent with the deposit of gunshot residue after the discharge of a firearm.
YAAZCU	The area surrounding the hole in the shirt (Q1) was examined microscopically and processed chemically for the presence of gunshot residues and a pattern of residues was found. Test patterns were produced at various distances using the suspect firearm and like ammunition. Based on comparisons of these test patterns, it was determined that a pattern of residues like that found on (Q1) could be produced at distances of greater than contact, but less than twenty-one(21)inches.
YERZWF	THE AREA AROUND THE BULLET HOLE ON Q1 WAS MICROSCOPICALLY EXAMINED AND CHEMICALLY PROCESSED FOR THE PRESENCE OF GUNSHOT RESIDUES. AS A RESULT OF THESE EXAMINATIONS IT IS CONCLUDED; THE MUZZLE TO TARGET DISTANCE WAS APPROXIMATELY BETWEEN 3" AND 9".
YNUKWM	(Item Q1) one (1) white colored cloth square approx 8 1/2" x 8 1/2" consistent with bullet wipe, soot, and powder particles submitted. A distance determination test was requested. A distance determination test was conducted with the following results: Based on information supplied by Collaborative Testing Services of a known firearm and ammunition, it was determined that the minimum distance is 6" and the maximum distance is 12".
YYTRX	The portion of white shirt (Item Q1) was visually and chemically examined for the presence of gunshot residues with the following results: A single defect consistent with the passage of a fired bullet was observed in the approximate middle of Item Q1 surrounded by bullet wipe, soot and gunpowder particles. Chemical testing on Item Q1 resulted in the detection of nitrite and lead surrounding the defect. The patterns of gunpowder particles, nitrite and lead on Item Q1 were compared to the photographs of test panels indicating a minimum muzzle to target distance of greater than contact and a maximum distance of 12 inches.

TABLE 2

WebCode	Conclusions
Z2EJZU	The muzzle of the firearm was a minimum of three inches, and a maximum of 15 inches, from the victim's shirt at the time of discharge.
Z4Z2HF	The muzzle to garment distance was greater than 3 inches and less than 15 inches.
Z6T2FQ	During the optical and chemical examination of the bullet hole in Item Q1, propellant residue was found surrounding the hole. Utilisation of photos supplied as well as the chemical test results concluded that the shot on Item Q1 was fired at a distance of between 3" and 9".
Z6VJKG	Item Q-1 was examined visually and microscopically and processed chemically for the presence of bullet defects and gunshot residue. Hole A, a single bullet entry defect, was located in the center of item Q-1. Hole A was surrounded by bullet wipe, partial soot, gunpowder, apparent copper plating fragments, nitrite residue, lead wipe, vaporous lead, and lead particulate residue. Using data from the provided test targets, the muzzle of the gun that fired the bullet that created Hole A was determined to be at a distance greater than contact but less than twenty-one inches from item Q-1. This range of fire is an estimate, provided there was no interposed target between the muzzle of the gun and item Q-1.
ZAUJAR	The area around the hole in the submission 001 Q1 twill jean was microscopically examined and chemically processed for the presence of gun shot residues and a pattern of residues was found. Using submission 001 K1A, 001 K1B, and 001 K1C known standards as reference, this pattern was reproduced at a distance between 3" & 21".
ZFFVWU	After Modified Griess & Sodium Rhodizonate testing in the lab it was determined that the shot was fired at a distance greater than contact but less than 12 inches.
ZFQ3TV	In the piece of shirt received (Item Q1) there is evidence of a bullet entry hole. The area around the hole in the t-shirt (Item Q1) was visually and chemically examined for the presence of gunshot residues and a pattern of gunshot residues was found. Based on the pattern of gunshot residue observed around the hole in the item Q1 and comparing it to the Known test fired distances (unprocessed, Ka1), it was determined to that the muzzle of the firearm was between 3 and 9 inches from the target at the time of discharge.
ZKAWWM	According to dispersing and density of GSR around bullet entry holl on clothes, shooting distance is evaluated as "CLOSE SHOOTING" Note: By using Sodium Rhodizonate for Short Barreled Weapons; 0-4 cm Contacted Shooting 4-100 cm Close Shooting >100 cm Long Distance Shooting

# Additional Comments

## TABLE 3

WebCode	Additional Comments
26QLNC	The verbiage above is similar to what would be written had the actual firearm and ammunition been submitted for analysis.
2BDGJN	It would be useful if the bullet entrance side of the test cloth is labeled. As we were confused with the entry and exit point of the bullet.
2EDRFN	The pattern of visible residues on the questioned target did not bear a close resemblance to any of the depicted powder patterns on the distance standards. The questioned target was significantly asymmetric, with a "trail" of residues extending from the bullet hole to one edge of the target; this was inconsistent with any of the distance standards. The depicted Modified Griess Test and Sodium Rhodizonate Test results for the distance standards also did not display consistent linearity.
2JM2MK	Upon examination of "Item Q1", no particulate matter was observed. However, a cloudy substance consistent with being lead residue was noted around the bullet entrance hole. Based on information provided by Collaborative Testing Services of a known firearm and ammunition, and the usual examination of the photographed test patterns, it was determined that the minimum distance is approximately 2" and the maximum distance is approximately 10".
2LFYUQ	A contact or near contact gunshot will deposit a very intense ring of residue right around the margins of the bullet hole. Close range gunshot will usually leave very concentrated deposition of residue around the bullet entrance hole that is visible to the eye. An intermediate range gunshot will deposit a significant of particulate residue that is not easily seen with the eye but can detect through microscopic examination and through chemical testing.
2MRENR	The conclusion was made based on both the observations made on the powder pattern photos and the Griess test photos. I am however of the opinion that the exhibit Q1 was shot at more of an angle than the shots fired for which photos have been provided, for comparison purposes.
3WV7CC	I found that the test pattern did not react as expected with the modified Griess Test. The reaction was very faint and after doing the Sodium Rhodizinate test I got good reactions. I had good reactions on my QC and I shot my own test pattern using 22 ammunition at 6 inches and got good reactions confirming that the photo paper and other chemicals were in good working order for Griess. I am concerned that something on the test sample either masked the Griess test or it just didn't react very well with the choice of ammunition used. This has happened before with CTS samples and it is disappointing.
4TN8EP	On page #1 minimum & maximum distance: you ask for a numerical response from the supplied distance standards. I listed "0" for a minimum although I don't believe its a contact shot: The request for #s was a bit confusing.
4ZA2TA	[Laboratory] do not carry out the modified Griess test therefore these samples were not used for comparison purposes. It should also be noted that in 'real' casework, due to additional factors e.g. blood staining, hospital cutting, environmental factors etc. that [Laboratory] would not routinely report range to within 3" increments. Ranges of 'contact' 'near contact' '1-2ft' or

TABLE 3

WebCode	Additional Comments
	'1m' etc. would be reported.
6BLRPH	This is a conservative estimate based on an evaluation of the untreated and chemically processed residues patterns and assumes there was no intervening objects between the muzzle of the firearm and the shirt at the time the shoots were created.
6K8WWH	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 transparency film for the NC verification (following the method of B. Glatstein 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.
6QDKGB	NO option for >0 (greater than contact) so had to select 0 for the lower distance. The pattern on Q1 is clearly not a contact shot, but can not eliminate other distances between 0 and 3 inches as a potential area that should be included in the overall range. Greater than 0 inches to 12 inches. The Modified Griess test failed to produce any significant discoloration which should have been present on any patterns between 3 - 12 inches, but were not. Test paper was verified working with positive control on the corners. Also another sheet of test paper from same lot # of paper gave good color change on a reference test pattern fired at approximately 6 inch distance. The range was expanded to compensate for this lack of detail on the Modified Griess Test.
78HG8M	The nitrite distribution result from the Modified Griess tests was not typical. Some of the particles may have migrated during transit.
7B2BAF	[In response to Table #1 Distance Determination Results: "fifteen" changed to "15" and "twenty one" changed to "21" by CTS.]
7H3LMZ	It would be helpful if the top and/or bottom of the questioned item were marked.
997ML6	Our results for this test are based only on the performance of the Na-Rhodizonate method. The particles on the fabric of the item are transferred to filter paper using a heated press. 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. Because of the buffer used, however, the Ba particles will be colored orange instead of purple and so they can be distinguished from lead particles. 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.
A2J2AC	[In response to Table #1 Distance Determination Results: "three" changed to "3" and "six" changed to "6" by CTS.]
A8PPU6	[Participant included an attachment that could not be reproduced within the report.]



TABLE 3

WebCode	Additional Comments
AQ2KJQ	I suggest that Question 1 be rephrased. When asked for a minimum and a maximum distance, that is a little confusing. The standards provided do not show a maximum distance nor a minimum distance where the residues are not produced. Comparison of the test targets to the questioned item allows an analyst to determine a range that the distance between the muzzle of a firearm and an object when it was shot, not a minimum or maximum distance the firearm could have been from the object shot at the time of discharge.
B43B2N	There were multiple issues with this test: 1. the know test patterns seemed to be mishandled, as the patterns produced were irregular. 2. it did not give an option to report "greater than contact" and this was in fact not a contact shot. 3. multiple samples observed had very different patterns results from the chemical tests.
BRRZDY	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.
CB2CKF	I have multiple issues with this proficiency and I have described them below: 1. No information regarding how the test patterns were made. Without that information, I can only make assumptions that they were made at the muzzle to target distances provided with the muzzle perpendicular to the fabric, no intervening objects present, and the firearm held horizontal. 2. There is no information regarding the orientation of the test patterns. I have no idea if the photos of the test targets and chemical tests are meant to represent the orientation that the test shots were made. Without orientation information, I can't determine the correct orientation for the Griess overlays or what orientation the test shots and patterns are meant to be compared to the questioned pattern (Q1). 3. There is no orientation for Item Q1 (questioned pattern). This is an issue because it is described as a t-shirt. Even if it is supposed to be a portion of a t-shirt, I have no information regarding what is up (toward neck) or down (toward hem). I have no idea how to orient it to the "victim" that was wearing it or to any of the test patterns. 4. Other than saying that the reagents were tested prior to use, there is no information regarding how the tests were performed. I do not have information regarding the type of photo paper (inkjet vs. desensitized), reagents (e.g. age, lot, strength, or how prepared), or the test fabric (e.g. same or similar to Q1, washed or unwashed, fabric content, etc). I also do not have info regarding the ~ pen/sharpie dots placed on the photos of the Griess test. I am assuming they are meant to denote the location of the hole, but there is no mention about what they are. I also have NO information regarding indexing of the test results to the test pattern/target. 5. When I looked up information on the suspect firearm in this case photos on the manufacturer's website had the pistol equipped with a flash suppressor or muzzle brake. No information in the scenario regarding whether or not the submitted firearm had a barrel attachment. 6. The packaging of Item Q1 does not necessarily prevent the fabric from moving between the 2 pieces of cardboard. It is possible that the pattern may have been disrupted or disturbed due to movement. 7. It was mentioned that multiple test fires were made and the "best" was selected to be representative of the distance, BUT there was no mention regarding whether the test shots at a particular distance demonstrated reproducibility. 8. The Griess test results for the test patterns (Item K1b) had a faint orange background. No way to know if it is a result of the paper being stored improperly prior to use, waiting too long to photo after doing the overlay, residues on the fabric, or contamination. 9. The Griess test results also looked smeared – the color development nearest the holes, as well as surrounding particles, have a smeared appearance. I don't know if it is an artifact of the test paper and

TABLE 3

WebCode	Additional Comments
	<p>reagents, movement during the overlay, ironing instead of pressing, or photography. I did not have smearing on my Griess test result for Item Q1, so it makes me think there was something different in how the K1b tests were performed compared to our lab tech procedures for the Griess test. 10. There is no information regarding how long after the Griess and Sodium Rhodizonate (NaRho) tests were performed that they were photographed. Since the results fade with time, a delay in photographing the results could affect the pattern that was photographed. Additionally, on most of the NaRho tests there looks like there is possible contamination of the test shot fabric on the corners and/or sides. It looks like it may be the result of handling, but it is difficult to tell. 11. When reporting the conclusions of a distance determination examination, I typically report my range in terms of greater than and less than. I do not use reporting language of a minimum and maximum. I also am reporting a range that is INDICATED or CONSISTENT with my observations and testing, and I am not reporting an absolute range. The reporting form is asking for an absolute range based on a minimum and maximum and this is something I would not do in casework. 12. Lastly, and perhaps most importantly, I would be extremely reluctant to make a distance determination estimate using test patterns and chemical test results that were provided under unknown conditions. Differences in handling, fabric, reagents, and procedure can all have an effect on the results of test. There is no way to know that the documentation and chemical tests that I do on the evidence are done in the same way as the test patterns that were provided. There is no way to know if differences in the perceived patterns and chemical test results are due to true differences or are the result of differences in the methods that were used. In other words, I have no idea if I am comparing apples to apples or apples to oranges. As a result, I am being asked to draw a conclusion regarding a distance estimate when I may not even be comparing the same things to each other. To alleviate this issue, there are a couple of options. The first possible solution is to only provide photographs for both test/known patterns and the questioned item. That way like can be compared to like when making a distance estimate. The second possible solution is much more burdensome and labor intensive option for CTS and the analyst, but it is perhaps the best option. This test would be to provide only the fabric with the test shots and questioned shot. That way all chemical tests can be performed and documented by the analysts under the same conditions and procedure. This would help to minimize differences seen in the chemical tests and to also ensure that like was being compared to like. Both these solutions could lead to a more accurate estimate and less frustrating proficiency test.</p>
CY9VTT	<p>This laboratory normally requires a minimum of 3 test patterns per distance to be made to evaluate reproducibility. It is possible the range could be narrowed further if additional test patterns were available.</p>
D37W9F	<p>The results obtained from the Modified Griess Test and Sodium Rohodizonate Test showed areas displayed possible movement and settling of propellant grains in packaging which may affect the outcome of the test.</p>
DLBGZA	<p>[In response to Table #1 Distance Determination Results: "twenty one" changed to "21" and "twenty seven" changed to "27" by CTS.]</p>
EAEPWG	<p>CTS requires the participant to report a range in increments of 3" ranging from contact (0") to 27". For this particular case, my results should be reported "the suspect bullet hole could be reproduced at a distance of greater than contact up to 12 inches". Based on my training and</p>

TABLE 3

WebCode	Additional Comments
	casework experience, the suspect bullet hole has NO characteristics that would indicate the suspect bullet hole was shot at contact. However, these results contradict with the CTS reporting requirements of contact – 27". CTS does not allow for a response of near contact; therefore, the distance that will be reported directly to CTS will be "contact – 12 inches". These results contradict with all the training that I have received as a firearms examiner. This CTS test in no way simulates casework. Also, my processed evidence does not appear to resemble the test pictures. It looks as if the evidence was shot on angle. If this was the case, then the pictures should have reflected this. From the my understanding, there are three sets of processed pictures from these tests. It would have been helpful to see the three sets.
EYL4VT	If an actual case, multiple shots at the same known distances would have been done to assure the patterns were true and not anomalies, which would help narrow down the range.
FB3NJE	CTS examples: Sodium Rhodizonate - The 18" pattern appears to be more dense than the 15" pattern? Greiss - The 24" pattern appears to be more dense than the 21" pattern? [In response to Table #1 Distance Determination Results: "Contact" changed to "0" by CTS.]
FDFZNB	The testing program and materials are excellent
FF3RF8	Chemically testing of Q1 revealed the appearance of an angled shot. The residues were not evenly distributed around the bullet hole, but appeared elongated.
FFKLGG	[In response to Table #1 Distance Determination Results: "Contact" changed to "0" by CTS.]
FLQEBD	There is no indication of the composition of the questioned material. It appears consistent with a cotton or cotton/polyester blend that the test material reportedly was. Some indication that the questioned material and test material are, at least, consistent would be appropriate.
G6YYNR	I was not able to put greater than contact in the CTS findings so I put the lowest distance possible (three inches).
G8N66H	Visual observations of the MG test results (K1B) show what appears to have been mislabeling of the 21 and 24 inch patterns. Also the (K1C) NaRh chemical treatment photos appear to have been mislabeled at 21-27 inches. Also no orientation of the Q1 shirt to indicate direction. Answer key should be allowed to include greater than and less than for minimum and maximum distance. The answer key requires a number, so putting 0 - 12 would imply that you consider "contact" as a possibility which I do not.
JCVBXU	Chemical testing of Q1 revealed satellite patterns of gunshot residues indicative of residue transfer due to how it was handled after the test fire. A broader, more conservative conclusion was necessary as a result. The field for question 1.) does not allow the symbols for > (greater than) or < (less than) as is a general practice within the discipline.
JEX99M	It appears that during the packaging of the unknown item there may have been some contamination, due to the Griess pattern not being completely consistent throughout the pattern.
KWAMUA	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

TABLE 3

WebCode	Additional Comments
	<p>granules on the fabric. Each adhesive plastic is processed by alkaline hydrolysis of nitrate esters (with heating). Finally, detection is performed with photo paper impregnated with Griess reagent. This procedure was described by the staff of Toolmarks and Materials Laboratory of Division of Identification and Forensic Science Israel National Police Headquarters, in: Glattstein B, Vinokourov, Levin N, Zeichner. Improved method for shooting distance estimation. Part 1. Bullet holes in clothing items. J Forensic Sci 2000; 45 (4): 801-806. That situation influences the comparison of our results with the test distance standards of this proficiency test, principally in the Modified Griess Test 2. I think it's INDISPENSABLE to review all the replicates of test distance standards (unprocessed and their rhodizonate/Griess test results) and not only one of them at each distance, for considerate the variability in the gunshot residues deposition on the fabric or surface. They can be sent as digital images on a DVD, or another option is to develop a controled access to CTS web page for review/to print all the replicates of the distance standards. 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.</p>
LAVAN8	<p>The probable distance is in my estimation approximately 4 inches (+ or - 3 inches). Not having produced the solutions and conducted the testing myself for sample items K1a - K1c, I have reported a relatively broad range of distances. I also noticed when initially removing the protective cardboard backing from Item Q1 that there were two small clusters of GSR located near the edge of the cloth next to where the adhesive tape (x2) was applied to sandwich the cloth within. These areas were isolated from the central shot area so were disregarded during my examination. Could be a quality issue that CTS may need to address.</p>
LMYK99	<p>With respect to photographic standards would require explicit reference mark points of location (for example, up [up arrow graphic]), since only presents a scale (photographic scale). The cloth in this test has no reference mark (eg label) so you can not know what the lower or upper of it. The procedure used in our laboratory is different from that used in the processing of cloths from test firings. We use an additional step that consists in a lifting with adhesive plastic sheet to remove gunpowder granules on the cloth. Each adhesive plastic is processed by alkaline hydrolysis of nitrate esters (with heating). Finally, a detection is performed with photo paper impregnated with Griess reagent. This procedure was described by the staff of Toolmarks and Materials Laboratory of Division of Identification and Forensic Science Israel National Police Headquarters, in: Glattstein B, Vinokourov, Levin N, Zeichner. Improved method for shooting distance estimation. Part 1. Bullet holes in clothing items. J Forensic Sci 2000; 45 (4): 801-806. Unprocessed patterns do not match the patterns revealed. For example, in the 6" unprocessed pattern not as many particles of gunpowder are observed as shown in the 6" pattern of sodium rhodizonate. They should provide access to the three patterns that were performed for each shooting distance. It could be a link accessible to all participants in the study, from the page where the result of the test it's submit. In this way we can see the variability.</p>
MKCGZ3	<p>1) The procedure for the "sodium rhodizonate treatment" is not noted but it is obviously more than applying a sodium rhodizonate solution to the target. Different methods are possible &amp; may produce different results. Method used should be listed. 2) The results on some of the chemically processed targets did not appear linear, directly affecting the determination of muzzle to target distance. This emphasizes the need for more than one target at each distance. 3) If this was an actual case, I definitely would have done some additional distances,</p>

TABLE 3

WebCode	Additional Comments
	since the ones provided seemed to miss some characteristics I observed. [In response to Table #1 Distance Determination Results: "greater than 0" (contact)" changed to ">0" by CTS.]
MQF6XA	**Q1 when received appeared to have been handled in a way that may have disrupted the powder on the item as many of the powder particles were found along the center line of the cloth. This pattern was developed with the Griess test as well. The cloth may have been folded or the powder disturbed in some way to produce this pattern. A slightly larger distance is being reported as a result of this.
MQG34Y	[In response to Table #1 Distance Determination Results: "fifteen" changed to "15" and "twenty one" changed to "21" by CTS.]
MRT2Y8	We can perform this test only according to the photographs of the GSR patterns on untreated white cotton cloths. That is not our standard procedure. We use a sodium rhodizonate chemical treatment of a filter paper that has been moistened with tartaric acid and pressed onto the shirt with the bullet hole. We then compare it to filterpapers treated in the same way but pressed onto the cotton cloths of the distance standards. We would prefer to measure the distances in SI units rather than inches. We didn't find a description of the method used by CTS for the sodium rhodizonate method. Without such a detailed procedure it is not possible to compare the shirt with the bullet hole to the distance standards.
N36JCW	Notes Griess and Sodium pattern testing was performed on the 8.5" X 8.5", Item 1.4 cloth, in an attempt to develop Nitrite and Lead patterns and compare those patterns to the provided photographs of the same. The submitted photographs found in Items 1.1, 1.2, and 1.3 represent patterns distances from contact (0) to 27 inches in 3 inch increments. Item 1.1 are photographs of GSR or shooting patterns, Item 1.2 are photographs of Nitrite points patterns from Griess testing, and Item 1.3 are photographs of Lead patterns from Sodium Rhodizonate testing. All testing was witnessed by Firearms Examiner [Name] from [Laboratory]. A soot pattern indicative of lands and grooves was observed around the small hole in the Item 1.4 cloth indicating a distance from muzzle to target was fairly close. There was no tearing of the cloth that would indicate a contact pattern. The pattern of sooting and possible lead vapor on the untreated material was compared to the Item 1.1 photographs. None of the Item 1.1 photographs contained the same lands and grooves pattern as found on the Item 1.4 cloth but the pattern most closely resembled the 3 inch pattern shown in the photographs. Microscopic examination of the Item 1.4 cloth revealed several black and burned particles imbedded in the weave of the cloth. Just a few unburned propellant particles were visible. Broken fibers were observed within the hole and central to the sooting/lead vapor pattern. Griess testing of the Item 1.4 cloth was perform first and a Nitrite pattern was developed. A control test was performed on each corner of the treated photographic paper resulting in a positive reaction. A mark was placed near the center of the paper. The emulsion side of the paper was wiped with a 15% acetic acid solution and the mark was indexed over the hole in the cloth. Cheese cloth was placed over the paper and an iron was applied to the paper for approximately one minute. The procedure resulted in the paper revealing several nitrite points with a heavier concentration near the index mark. Sodium Rhodizonate testing of the Item 1.4 cloth was performed by direct application of Sodium Rhodizonate, Buffer, and 5% Hydrochloric Acid solutions. With the application of the Sodium Rhodizonate solution positive pink color reaction was observed. The Buffer Solution was followed with the application of a 5 % Hydrochloric Acid Solution. The pink color changed to a dark purple indicating the

TABLE 3

WebCode	Additional Comments
	presence of lead. The Griess and Sodium Rhodizonate pattern developed from and on the Item 1.4 cloth was compared to the Item 1.2, and 1.3 photographs. When considering all three patterns a conclusion of the muzzle to target distance of 3 inches to 12 inches was made. Photographs depicting the result of the Griess and Sodium Rhodizonate tests are in the LOR.
ND3JPZ	1 The probability scale used in our laboratory for examinations like this is, (in descending order): A. Extremely probable B. Highly likely C. Probable D. Possible E. Cannot be Ruled Out 2. The procedures used by the manufacturers of this test, as well as the conditions of the test firing used here, are different from those applied routinely by our laboratory. As a result, the figures quoted for the minimum and maximum shooting ranges may be wider, and the probability, therefore lower. 3. In estimating the shooting distance on this test, we used mainly the test shot results supplied with the proficiency test.
NRNYTZ	Max Distance was extended to 21 inches to account for the point in which vaporous lead was no longer exhibited.
NTYJW4	The modified Greiss Test is not carried out at this laboratory and hence was not applied in this trial.[Laboratory] uses the tartaric acid Rhodizonate test rather than the HCl based test used to illustrate the reaction in the distance standards images supplied.
NVAGBK	As stated in my report wording above, I determined the range to be GREATER than contact (0 inches) and less than 15 inches. The data entry field on page 1 would not allow me to express this, therefore I simply entered the distance to be 0 inches. Our agency typically uses the term "greater than contact" when we do not see any of the blast damage typically associated with a contact shot.
R8T6VV	Based on the information supplied by Collaborative Testing Services of a known firearm and ammunition, it was determined that the minimum distance is 3" and the maximum distance is 9".
RT9M27	In the Scenario, it is stated that "For the Distance Standards, multiple shots were taken at the same distance to ensure reproducibility and the best representative shot was chosen for further processing." I believe that this methodology is flawed in that it manipulates the test beyond real world case work. I would suggest that three sets of shots at varying distances be evaluated for quality and that an entire set be chosen as the representative known standards and then further chemically processed as a whole set.
TQ3KU2	The powder pattern and nitrite pattern of Q1 differs from the patterns of K1a and K1b on all distances. There was a vertical belt of particles along the full length of the cloth instead of the normal circular pattern around the damage. The conclusions was therefore based on the present of soot deposit and in some way also the intensity of the particles. The laboratory standard procedures is also not the same as used in the test samplings. Our standard operating procedures for examination of gunshot damages are: IR-detection, Modified Griess test and Modified Sodium Sulphite test for lead.
UVRGWW	[In response to Table #1 Distance Determination Results: "Contact" changed to "0" by CTS.]
VMZKX	Range determination was based to a great extent on soot and vaporous lead deposition. Visible propellant deposition was unable to be relied upon as the particles had obviously been

TABLE 3

WebCode	Additional Comments
	<p>significantly displaced during transport of the test. This was shown by a large concentration of particles on the edge of the cotton, where they had fallen during transport. Both visually, and using the Modified Griess test, this concentration was highlighted as being separate, and not related to the soot pattern/perforation by projectile. Some consideration should be given to altering the design of this test to prevent the random dispersal of particles that are an important factor in determining range.</p>
WALREZ	<p>This test is not an accurate reflection of how GSR/Distance Determination examinations are conducted. As indicated on previous years' tests, if the known distance standards were shot multiple times to ensure reproducibility, then all of these shots (and subsequent chemical processing of these shots) should be included and not just a single representative sample at each distance. Secondly, the known represented at each distance in K1a should be the same cotton twill sample processed through in K1b and K1c - looking at the 3 sets of photographs (i.e. if for 6" Sample Shot A is the 'best representative' of Shots A, B, and C and is used for K1a, then Sample Shot A's Modified Griess and Sodium Rhodizonate results should be used for K1b and K1c. Also, there are some inconsistencies in the chemical processing results at the further distances. Specifically, the 21", 24", and 27" known distance standards for K1c are not illustrating what is, generally, a linear relationship of the amount of reaction observed. Additionally, not being able to examine the untreated known distance standards stereoscopically also hinders the ability to fully document the knowns for comparison to Q1. And perhaps a larger portion of cloth - with some sort of orientation mark or indicator - would be useful for Q1, since some of the chemical processing results went to the edges of the portion provided. Also, please provide the procedures used by whoever produced the known distance standards, specifically for the chemical processing. And finally, the reporting of results required by CTS is extremely limiting and does not accurately reflect how some labs report their results. In this case scenario, I would not report a minimum and maximum distance without shooting additional known distance standards at those distances. Since the test does not allow for such, reporting a "greater than" and "less than" value may be more appropriate. And included in reporting that value should be the ability to choose 'greater than contact' and not 'contact' - these are 2 very different results and it may be prudent for CTS to include a known distance standard at 1-inch as well in future test scenarios. And one final point - CTS choosing to use THE EXACT SAME, IDENTICAL known distance standards as the previous year's test when several test takers commented about potential problems with the standards is pretty disappointing. Labs expect better from a proficiency test company. Because of all the inconsistencies and limitations stated above, the range reported is more conservative than would probably be necessary for actual casework. And the actual results in my report do not include contact as the minimum distance - instead it is reported as 'greater than contact'. But CTS does not allow me to record this conclusion on the answer sheet.</p>
WKJMEF	<p>No discernable patter. Few spots and smears. Lead pattern was all over twill jean. It looked nothing like any K photos. Control tests performed and both reacted. So chemically exam was sound. Just a bizarre lead result</p>
Y3P2LL	<p>Based on information supplied by Collaborative Testing Services of a known firearm and ammunition, it was determined that the minimum distance is 6" and the maximum distance is 12'.</p>
Z6T2FQ	<p>After visual examination, the cloth target bearing GSR were subjected to modified Griess test</p>

TABLE 3

WebCode	Additional Comments
	to visualise the nitrite residues expelled from the firearm. As expected the intensity of the orange colouration (specks) appeared on the filter paper were not too intense and crowded. It shows that the firearm generated little amount of nitrite residues. The results can help to estimate the muzzle to target distance for reconstruction of shooting.
ZFFVU	Instruction on answer a bitt unclear.
ZFQ3TV	<p>1. This proficiency test could be a parameter to measure the performance of the laboratory in gunshot residue analysis on the impact surface, in order to estimate the shooting distance. However, the test could hardly involve other factors different from gun and ammunition, such as: angle of shot, atmospheric conditions of the environment (indoor or outdoor spaces), bleeding, garment manipulation, exposure to adverse weather conditions, influence of washing and immersion in fluids, fragmentation of projectiles, contamination of the victim's clothing by gunpowder in the scenario. Since these factors are not all controllable, the proficiency test would exclude from its design those circumstances that can cause additional complications in the interpretation of results derived from chemographical tests. In other words, the proficiency test would fail to fully cover the reality and complexity of cases received in the laboratory. However, from the point of view of those "ideal" cases, this test is a good evaluation for chemographical methods and comparison techniques applied by the expert.</p> <p>2. Although every photograph has a scale (photographic scale), it would be necessary to explicitly mark reference points (e.g. above [up arrow graphic]) at the start of pattern generation.</p> <p>3. 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 esters (with heating). Finally, a detection is performed with photo paper impregnated with Griess reagent. This procedure was described by the staff of Toolmarks and Materials Laboratory of Division of Identification and Forensic Science Israel National Police Headquarters, in: Glattstein B, Vinokourov, Levin N, Zeichner. Improved method for shooting distance estimation. Part 1. Bullet holes in clothing items. J Forensic Sci 2000; 45 (4): 801-806. One of the advantages of this procedure is that the sheet of photographic paper attached to the adhesive plastic can be checked under the microscope for morphological characterization of particles. These particles can be drawn for chemical confirmation (TLC, FT-IR, GC-MS), which also allows to exclude the possibility of false positive results (e.g. paint traces with nitrocellulose lacquers) and locate other materials that may be of interest (e.g. fragments of metallic lead or copper/nickel from bullets, fragments of glass, asphalt, cement, etc.). After this procedure, the fabric or substrate remains available to perform the rhodizonate test (directly or indirectly). On the other hand, the rhodizonate test for processing fabrics from test firings (in the proficiency test), has several lead sources, namely: vaporous lead that condenses into the fabric and lead from gunpowder granules contamination, as well as from metal fouling. This can cause some difficulties in the interpretation of results. Our procedure allows removal of finely broken material before visualizing lead dispersion pattern. My results were mainly based on the distribution pattern of the granules of gunpowder. Griess patterns and lead were not very useful for me because of the reasons explained above.</p> <p>4. I think that the following aspects should be taken into consideration for the development of proficiency tests for distance determination:</p> <ul style="list-style-type: none"> <li>· Tests should be performed with the same type of fabric as the sample received, to ensure the same thermal effects as well as the same adhesion of gunpowder particles to the fabric.</li> </ul> <p>5. It is required to have multiple patterns to determine shooting distance, so I suggest you send us</p>



TABLE 3

WebCode	Additional Comments
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digital photographs of at least three patterns for each of the standards. In addition, the chemical treatment with Modified Griess and Sodium Rhodizonate should be performed at the same GSR pattern so that there is reproducibility when making comparisons between different distance standards. Also, I think you should send a larger portion of the sample for estimating the shooting distance.

# Appendix: Data Sheet

Collaborative Testing Services ~ Forensic Testing Program

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## Test No. 16-530: GSR - Distance Determination

DATA MUST BE RECEIVED BY October 11, 2016 TO BE INCLUDED IN THE REPORT

Participant Code:

WebCode:

### Accreditation Release Statement

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

- This participant's data is intended for submission to ASCLD/LAB, ANAB, and/or A2LA. (Accreditation Release section on the last page must be completed and submitted.)
- This participant's data is NOT intended for submission to ASCLD/LAB, ANAB, and/or A2LA.

#### Scenario:

Police are investigating a shooting at a casino. The victim's shirt was cut and removed by paramedics. The portion of the shirt with the bullet hole was recovered and is being submitted for examination. The coroner confirmed that no exit hole was present. A suspect was apprehended later that day and the police seized a GSG model 522P caliber .22 LR semiautomatic pistol with a 9" barrel from his possession. The bullet recovered from the victim was identified as having come from the suspect's firearm. Rounds of Federal® 36 grain copper plated hollow point 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:

- For the Distance Standards, multiple shots were taken at the same distance to ensure reproducibility and the best representative shot was chosen for further processing.
- For the Modified Griess treatment, before use the photo paper was tested using chemically treated nitrite swabs which tested positive.
- For the Sodium Rhodizonate treatment, before use the solution was tested on a lead mark on filter paper which tested positive.

#### Items Submitted (Sample Pack GSRD):

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

**Q1:** Shirt with bullet hole.

- 1.) What is the minimum and maximum distance 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".

Minimum distance \_\_\_\_\_ (inches) and Maximum distance \_\_\_\_\_ (inches)

**Please return all pages of this data sheet.**

Page 1 of 3

Participant Code:  
WebCode:

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

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<p><b>Return Instructions:</b> Data must be received via online data entry, fax (please include a cover sheet), or mail by <b>October 11, 2016</b> to be included in the report. Emailed data sheets are not accepted.</p>	Participant Code:
<p>QUESTIONS? TEL: +1-571-434-1925 (8 am - 4:30 pm EST) EMAIL: <a href="mailto:forensics@cts-interlab.com">forensics@cts-interlab.com</a> <a href="http://www.ctsforensics.com">www.ctsforensics.com</a></p>	<p>ONLINE DATA ENTRY: <a href="http://www.cts-portal.com">www.cts-portal.com</a> FAX: +1-571-434-1937 MAIL: Collaborative Testing Services, Inc. P.O. Box 650820 Sterling, VA 20165-0820 USA</p>

Please return all pages of this data sheet.

## Collaborative Testing Services ~ Forensic Testing Program

**RELEASE OF DATA TO ACCREDITATION BODIES**

The following Accreditation Releases will apply only to:

Participant Code:

WebCode:

for Test No. **16-530: GSR - Distance Determination**

This release page must be completed and received by **October 11, 2016** to have this participant's submitted data included in the reports forwarded to the respective Accreditation Bodies.

**ASCLD/LAB** Certificate No. \_\_\_\_\_

**ANAB** Certificate No. \_\_\_\_\_

**A2LA** Certificate No. \_\_\_\_\_

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

Signature and Title \_\_\_\_\_

Laboratory Name \_\_\_\_\_

Location (City/State) \_\_\_\_\_

### Accreditation Release

**Return Instructions**

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

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

**Please return all pages of this data sheet.**

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