Forensic Firearms Identification Unit

TEST METHODS

FOREWORD

The Forensic Firearms Identification Unit (FFIU) of the Indiana State Police Laboratory Division is responsible for conducting forensic firearm and toolmark examinations, which relate to the examination of and comparative analysis of firearms, ammunition components, tools and the markings they produce. This service is provided to all law enforcement agencies, prosecutors, coroners and criminal justice agencies at no cost to the contributor.

The FFIU is staffed with trained and skilled examiners who have baccalaureate degrees in criminal justice, physical sciences or other related studies. These examiners have successfully completed extensive formalized training programs under the direct control of the Laboratory Division and are directly supervised by the Forensic Firearms Identification Unit Supervisor. During the training program, the new examiner shall successfully complete competency testing made up of written tests, oral examinations, and proficiency sample analyses.

The body of knowledge which compromises forensic science is a compilation of procedures adapted from other disciplines that encompass many of the physical and natural sciences. During the history of forensic science, a multitude of individuals have greatly contributed to the protocols, methods and procedures that have become a routine part of analysis. All noted references contained in this document are a starting point and should not be considered an all-inclusive list.

This document encompasses Firearms Examinations, Toolmark Examinations, Gunshot Residue Testing pertaining to distance, Serial Number Restorations, and NIBIN entries. This document supersedes all previous documents relating to these examinations and is subject to change according to research, study, and laboratory policy.

This test method document is a general approach to the examination of firearm and toolmark evidence and the results as they relate to these examinations. Alternative procedures, other than those listed, may be employed with the approval of the Unit Supervisor.

INDIANA STATE POLICE
FORENSIC FIREARMS IDENTIFICATION UNIT
TEST METHODS

TABLE OF CONTENTS

1. Physical Examination and Classification of Firearms Methods Page 4
2. Safe Firearm Handling Method Page 6
3. Trigger Pull Methods Page 9
4. Barrel and Overall Length Measuring Methods Page 12
5. Rusted Firearm Method Page 16
6. Malfunctioning Firearm Method Page 18
7. Automatic Firing Method Page 23
8. Bore/Chamber Casting Method Page 27
9. Test Firing Methods Page 30
10. Caliber Determination Methods Page 35
11. Ammunition Characterization Methods Page 39
12. Microscopic Comparison Methods Page 45
13. Trace Examination Methods Page 49
14. NIBIN Method Page 53
15. Range Determination Visual and Microscopic Methods Page 56
16. Range Determination Chemical Methods Page 59
17. Range Determination Test Pattern Methods Page 66
18. Physical Examination and Classification of Tools and Toolmark Methods Page 69
19. Toolmark Test Standards and Casting Methods Page 72
20. Serial Number Restoration Methods Page 75

APPENDICES:

1. Worksheets Page 81
2. Abbreviations Page 82
3. Firearm Safety Page 83
4. Range of Conclusions Page 86
5. Firearms Reference Collection Page 91
6. Ammunition Reference Collection Page 94
7. Performance Checks and Maintenance Page 95
8. Verification of Casework Page 99
9. Hazardous Chemical Waste Management Page 101
10. Administrative and Technical Reviews Page 106

INDIANA STATE POLICE
FORENSIC FIREARMS IDENTIFICATION UNIT
TEST METHODS

1. PHYSICAL EXAMINATION AND CLASSIFICATION OF FIREARMS METHOD

1.1. Scope: This method is used for the initial examination and classification of a firearm.

1.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure that it is not loaded. If loaded, immediate steps shall be taken to ensure that the firearm is safely unloaded.

1.3. Related Information:

1.3.1. Safe Firearm Handling Method 2
1.3.2. Worksheet Appendix 1
1.3.3. Firearm Safety Appendix 3
1.3.4. Range of Conclusions Appendix 4
1.3.5. Firearms Reference Collection Appendix 5

1.4. Instruments: None

1.5. Reagents/Materials: None

1.6. Hazards/Safety:

1.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

1.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

1.6.3. Appropriate hearing and eye protection shall be worn when applicable.

1.7. Reference Materials/Controls/Calibration Checks: None

1.8. Procedures/Instructions:

1.8.1. Document the as-received condition of the seals of the evidence.
1.8.2. Mark the outside of the original packaging with the case number, item number and examiners initials.
1.8.3. Remove the firearm from the packaging and perform a 5 step safety check.
1.8.4. A firearm worksheet may be filled out according to minimum standards and controls. This may include determining the following:

1.8.4.1. Trace Evidence
1.8.4.2. Caliber/Gauge

1.8.4.3. Make/Model
1.8.4.4. Serial Number
1.8.4.5. Firing mechanics
1.8.4.6. Type of action
1.8.4.7. Safeties
1.8.4.8. Operating Condition
1.8.4.9. Trigger Pull
1.8.4.10. Rifling Characteristics
1.8.4.11. Barrel length
1.8.4.12. Overall length
1.8.4.13. Any other data deemed relevant by the firearm examiner

1.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

1.10. Interpretations of Results: None

1.11. Report Writing: Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

1.12. References:

1.12.1. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

1.12.2. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

1.12.3. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

1.12.4. “Guidelines for the Documentation of Firearms Examination”, Scientific Working Group for Firearms and Toolmark Examiners, April 13, 2010

1.12.5. “Technical Protocols for the Handling of Firearms and Ammunition”, FBI, June 1992.

2. SAFE FIREARM HANDLING METHOD

2.1. Scope: Firearms evidence in the laboratory environment is not dangerous if handled correctly and treated with respect. Occasionally, loaded firearms are received in evidence for a particular examination. These, of course, need very special handling. **All firearms shall be treated as though they are loaded**. This rule cannot be over stressed and shall be followed at all times, whether it is in the evidence receiving area, firearms section, test firing area or in court. Safe firearm handling within the laboratory environment corresponds with safe firearm handling in general. The only way to prevent accidents is to practice safety at all times.

2.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure that it is not loaded. If loaded, immediate steps shall be taken to ensure that the firearm is safely unloaded.

2.3. Related Information:

2.3.1. Physical Examination and Classification of Firearms Methods 1
2.3.2. Test Firing Methods 9
2.3.3. Worksheet Appendix 1
2.3.4. Firearm Safety Appendix 3
2.3.5. Range of Conclusions Appendix 4

2.4. Instruments: None

2.5. Reagents/Materials: None

2.6. Hazards/Safety:

2.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

2.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

2.6.3. Appropriate hearing and eye protection shall be worn when applicable.

2.7. Reference Materials/Controls/Calibration Checks:

2.7.1. Indiana State Police Firearms Reference Collection

2.8. Procedures/Instructions:

2.8.1. The muzzle of the firearm shall always be pointed in a safe direction.

2.8.2. Prior to any examination, regardless of which section is receiving the firearm, a competent individual shall ascertain the loaded or unloaded condition of the firearm. If found to be loaded, the firearm shall be unloaded and rendered safe before any examination is to continue.

2.8.3. Test firing or any examination of the firearm that utilizes live ammunition, or a live ammunition component, shall only be performed in designated test firing areas.

2.8.4. A firearm shall not be placed in the evidence vault or returned to any agency in either a loaded condition or prior to its loaded or unloaded condition being checked.

2.8.5. Some factors to consider when deciding whether or not a firearm can be safely test fired from the normal hand held position:

2.8.5.1. Is the chamber/bore clear?
2.8.5.2. Are there any signs of cracks or weaknesses in major parts of the firearm such as the frame, slide or barrel?
2.8.5.3. Does the firearm function, lock-up or dry fire as you would expect it to?
2.8.5.4. Is the <u>correct</u> ammunition being utilized?

2.8.6. Some factors to consider when deciding if it is appropriate to utilize evidence ammunition:

2.8.6.1. Are there signs of reloading? If so, reconsider the need to test fire the evidence ammunition.
2.8.6.2. Are there splits in the cartridge case neck and/or other significant damage to the cartridge case?
2.8.6.3. Is the ammunition of the <u>correct</u> caliber? This assessment of caliber should not be solely based on the head stamp.
2.8.6.4. Are there existing toolmarks on pertinent surfaces of the ammunition?
2.8.6.5. Is the ammunition needed for other tests (e.g., range determinations)?

2.8.7. Some factors to consider when a muzzleloader is safe to fire may include:

2.8.7.1. Does the chamber/barrel appear sound?
2.8.7.2. Do the percussion nipples have oversize flash holes?
2.8.7.3. If a black powder firearm is received in the loaded condition, it shall have the projectile and charge removed. It may then be properly loaded prior to test firing.

2.8.7.4. Is this an "original" muzzle loader or a modern reproduction? "Originals" shall always be remotely fired.

2.8.8. If any of the above considerations cannot be answered with a clear "yes" or otherwise rectified and test firing is necessary, that firearm shall be remotely fired.

2.9. **Records:** The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

2.10. **Interpretations of Results:** Not Applicable

2.11. **Report Writing:** Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

2.12. **References:**

2.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

2.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

2.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

2.12.4. “A Guide to Firearms Safety”, A Safety and Educational Publication of the National Rifle Association, May 1994.

2.12.5. “Technical Protocols for the Handling of Firearms and Ammunition”, FBI, June 1992.

2.12.6. “Forensic Examiners Firearms Recall/Safety Warning List”, FBI Laboratory

3. TRIGGER PULL METHODS

3.1. Scope: One of the routine examinations conducted in a firearms identification examination is determining the trigger pull of a firearm. Trigger pull is defined as the amount of force which shall be applied to the trigger of a firearm to cause sear release. This examination can provide vital information regarding the mechanical operating condition of the firearm. The trigger pull of a firearm can be obtained utilizing standard trigger weights, which make contact with the trigger at a point where the trigger finger would normally rest.

3.2. Precautions/Limitations: The trigger pull examination normally is conducted before the firearm has been successfully test fired. There is a remote possibility that the firearm may be damaged during this examination.

3.3. Related Information:

3.3.1. Physical Examination and Classification of Firearms Methods 1
3.3.2. Safe Firearm Handling Method 2
3.3.3. Worksheet Appendix 1
3.3.4. Firearm Safety Appendix 3
3.3.5. Range of Conclusions Appendix 4

3.4. Instruments:

3.4.1. Standard Trigger Weights
3.4.2. Digital Force Gauge/Spring Scale

3.5. Reagents/Materials: None

3.6. Hazards/Safety:

3.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

3.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

3.6.3. Appropriate hearing and eye protection shall be worn when applicable.

3.7. Reference Materials/Controls/Calibration Checks:

3.7.1. If the digital force gauge or spring scale is to be used in this method the firearm examiner shall note the performance of the digital force gauge or

spring scale by using standard trigger weights. This performance check shall be documented in the examiners notes.

3.8. Procedures/Instructions:

3.8.1. Double and Single Action Trigger Pull Utilizing Standard Trigger Weights

3.8.1.1. Ensure that the firearm is unloaded.
3.8.1.2. Cock the firearm (if measuring for single-action).
3.8.1.3. Hold the firearm with the muzzle vertical.
3.8.1.4. Rest the trigger hook of the standard trigger weight hanger on the trigger where the finger would normally rest. Make sure it is not touching any other part of the firearm, with the weights hanging parallel to the bore of the firearm.
3.8.1.5. Add the weights until the sear releases.
3.8.1.6. Test no less than five (5) times, recording all results, and resetting the sear connection after each attempt. Note any revolver cylinder chamber that alters the trigger pull. If a trigger weight is found to vary, the firearm examiner may record a range.

3.8.2. Double and Single Action Trigger Pull Utilizing a Digital Force Gauge or Spring Scale

3.8.2.1. Insure that the firearm is unloaded.
3.8.2.2. Cock the firearm (if measuring for single-action).
3.8.2.3. Hold the firearm with the muzzle parallel to the digital force gauge or spring gauge.
3.8.2.4. Insure the digital force gauge or spring gauge indicator is “zeroed”.
3.8.2.5. Rest the trigger hook of the digital force gauge or spring gauge on the trigger where the finger would normally rest. Make sure it is not touching any other part of the firearm and the digital force gauge or spring gauge is parallel to the bore of the firearm.
3.8.2.6. Apply pressure to the digital force gauge or spring gauge, until the sear releases.
3.8.2.7. Test no less than five (5) times, recording all results, and resetting the sear connection after each attempt. Note any revolver cylinder chamber that alters the trigger pull. If a trigger weight is found to vary, the firearm examiner may record a range.

3.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

3.10. Interpretation of Results: The results acquired are only an approximation and a different technique may lead to a different trigger pull weight. The trigger pull shall

be recorded to the nearest measured increment (.10 or ¼ pound) dependent upon the measuring device used.

3.11. Report Writing: Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

3.12. References:

3.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

3.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

3.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

3.12.4. Gamboe, Tom, "MAFS Firearms Workshop: Trigger Pull Methods," AFTE Journal, July 1986, Vol. 18, No. 3, pg. 77.

3.12.5. Rios, Ferdinand and Thorton, John, "Static vs. Dynamic Determination of Trigger Pull," AFTE Journal, July 1984, Vol. 16, No. 3, pg. 84.

3.12.6. Lomoro, Vincent, “A Statistical Analysis of Trigger Pulls” AFTE Journal, Winter 1986, Volume 18, Number 1,

3.12.7. “Guidelines for the Documentation of Trigger Pull Analysis”, Scientific Working Group for Firearms and Toolmark Examiners, November 14, 2006

3.12.8. “Forensic Examiners Firearms Recall/Safety Warning List”, FBI Laboratory

3.12.9. “A Guide to Firearms Safety”, A Safety and Educational Publication of the National Rifle Association, May 1994.

3.12.10. “Technical Protocols for the Handling of Firearms and Ammunition”, FBI, June 1992.

4. BARREL AND OVERALL LENGTH MEASURING METHODS

4.1. Scope: One of the routine procedures conducted in a firearm examination is determining the barrel length and in some cases the overall length of a firearm. Barrel length is defined as the distance between the end of the barrel and the face of the closed breechblock or bolt for firearms other than revolvers. On revolvers, it is the overall length of the barrel including the threaded portion within the frame. Barrel length normally should include compensators, flash hiders, etc., if affixed. Overall length of a firearm is defined as the dimension measured parallel to the axis of the bore from muzzle to a line at right angles to the axis and at the rearmost point of the butt plate or grip.

4.2. Precautions/Limitations: Accuracy is imperative to this examination. It is vitally important that the firearm examiner use calibrated instrumentation. Also, care shall be taken if any object is placed down the barrel to help expedite the measurement. Only a non-marring item may be placed down the barrel.

4.3. Related Information:

4.3.1. Physical Examination and Classification of Firearms Methods 1
4.3.2. Safe Firearm Handling Method 2
4.3.3. Worksheet Appendix 1
4.3.4. Firearm Safety Appendix 3
4.3.5. Range of Conclusions Appendix 4

4.4. Instruments:

4.4.1. NIST Traceable Rulers
4.4.2. Non-marring Dowel
4.4.3. Overall Length and Barrel Measuring Device

4.5. Reagents/Materials: None

4.6. Hazards/Safety:

4.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

4.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

4.7. Reference Materials/Controls/Calibration Checks:

4.7.1. The firearm examiner shall document in their notes which NIST traceable ruler was used in this method. They shall also document whether the Overall Length and Barrel Measuring Device was used.

4.7.2. If the FFIU purchases new measuring devices or gains new Examiners new studies will be conducted to determine if the changes affect the expanded uncertainty of measurement for the Unit.

4.8. Procedures/Instructions:

4.8.1. Barrel Length-Revolvers

4.8.1.1. Measure the distance from the breech end of the barrel to the muzzle, excluding the cylinder. This measurement can be done directly or by placing a non-marring item down the barrel, marking the distance from the breech end of the barrel to the muzzle and measuring this item.

4.8.1.2. This measurement shall be recorded to the nearest measured inch increment (.10 or 1/8) dependent upon the measuring device used.

4.8.2. Barrel Length-Firearms Other Than Revolvers

4.8.2.1. Measure the distance from the breech face in a closed and locked position to the muzzle. This measurement can be done directly or by placing a non-marring item down the barrel, marking the distance from the breech end of the barrel to the muzzle and measuring this item.

4.8.2.2. The firearm should be cocked to ensure that the firing pin is not protruding into the breech.

4.8.2.3. This measurement shall be recorded to the nearest measured inch increment (.10 or 1/8) dependent upon the measuring device used.

4.8.3. Overall Length Measurement of Firearms

4.8.3.1. Measure the distance from the butt to the muzzle. Measurement shall be made parallel to the bore and recorded to the nearest measured inch increment (.10 or 1/8) dependent upon the measuring device used.

4.8.4. Use of Overall Length and Barrel Measuring Device for Barrel Measurements

4.8.4.1. The firearm should be cocked to ensure that the firing pin is not protruding into the breech.

4.8.4.2. Place appropriate size rod into the barrel until it rests against the breechface.
4.8.4.3. Lock the collar in place at the end of the muzzle.
4.8.4.4. Remove the rod from the firearm and measure from the appropriate end to the collar by utilizing the ruler affixed to the measuring device. Record the measurement to the nearest eighth of an inch.

4.8.5. Use of Overall Length and Barrel Measuring Device for Barrel Overall Length Measurements

4.8.5.1. Place the firearm in the device so that the barrel is parallel to the NIST traceable ruler.
4.8.5.2. Using the sliding end of the device close it until it comes to rest against the muzzle or the butt of the firearm.
4.8.5.3. Record the measurement directly under the sliding end to the nearest eighth of an inch.

4.9. **Records:** The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

4.10. **Interpretations of Results:**

4.10.1. Measurements obtained should be considered only approximations based on the device used to obtain the measurements.

4.10.2. When necessary the examiner shall always “round up” to nearest eighth or tenth of an inch dependent upon the measuring device used.

4.10.3. When reporting “critical measurements” the firearm examiner shall refer to the FFIU memorandum “Estimation of Uncertainty of Measurement-Firearms Unit” on the network drive and record their measurement and uncertainty in their notes as required by this document.

4.10.4. When reporting “critical measurements” in a Certificate of Analysis the firearm examiner shall include language documenting the uncertainty as a “Remark” and as outlined in Appendix 4.

4.11. **Report Writing:** Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

4.12. References:

4.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

4.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

4.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

4.12.4. Hamby & Shem, "The Proper Method for Measuring Weapons", AFTE Journal, July 1982, Vol.14, No. 3, pg. 10.

4.12.5. "Technical Protocols for the Handling of Firearms and Ammunition", FBI, June 1992.

5. RUSTED FIREARM METHOD

5.1. Scope: Rusty firearms or those found in water, or other wet environments may be submitted for examination. Immediate attention shall be given to these firearms to prevent further damage to the firearm. It should be noted that excessive corrosion or rust might prevent the firearm from being restored to a functional condition.

5.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure that it is not loaded. If loaded, immediate steps shall be taken to ensure that the firearm is safely unloaded.

5.3. Related Information:

5.3.1. Physical Examination and Classification of Firearms Method 1
5.3.2. Safe Firearm Handling Method 2
5.3.3. Worksheet Appendix 1
5.3.4. Firearm Safety Appendix 3
5.3.5. Range of Conclusions Appendix 4
5.3.6. Hazardous Chemical Waste Management Appendix 9

5.4. Instruments:

5.4.1. Ultrasonic Cleaner

5.5. Reagents/Materials:

5.5.1. WD-40® or other water-displacing product
5.5.2. Gun oil(s)

5.6. Hazards/Safety:

5.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

5.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

5.7. Reference Materials/Controls/Calibration Checks: None

5.8. Procedures/Instructions:

5.8.1. A firearm examiner shall take all necessary steps to insure that the firearm is unloaded. If it cannot be readily verified to be unloaded it shall be examined in an area designated for the firing of firearms. Determining whether or not a

firearm is unloaded may necessitate a complete disassembly or in some cases, destruction (e.g. cutting).

5.8.2. The examiner shall determine to what extent restoring the firearm is necessary (i.e., for test firing, for recovering manufacturer information, serial number, etc.).

5.8.3. Soak the firearm in penetrating oil, de-rusting solvents or similar material and/or use an ultrasonic cleaner if available.

5.8.4. Periodically check the firearm until the firearm functions, or the desired information is recovered.

5.8.5. Clean the firearm with gun cleaning solvent, cleaning patches and cloth. Care shall be taken if any object is placed down the barrel. Only a non-marring item should be placed down the barrel.

5.8.6. Any and all methods used to clean the firearm shall be documented in the examiner's notes.

5.9. **Records:** The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

5.10. **Interpretations of Results:** None

5.11. **Report Writing:** Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

5.12. **References:**

5.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

5.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

5.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

5.12.4. Denio, Dominic, "Making a Rusted Gun Functional," AFTE Journal, July 1982, Vol. 13, No. 3, pgs. 29-30.

5.12.5. Brown, Cordell, "Rust Removal", AFTE Journal, October 1981, Vol. 13, No. 4, pgs. 85-88.

6. MALFUNCTIONING FIREARM METHOD

6.1. Scope: A firearm examiner may be called upon to examine a firearm to determine if the firearm will malfunction. Many of these cases will deal with the question: "Will the firearm fire without pulling the trigger?" Examinations may include external and internal observations, or striking or dropping the firearm in attempts to duplicate the incident as reported. The examiner should attempt to conduct the examinations in a manner so as not to alter the firearm. However, there may be occasions when damage may occur. Any change to the firearm shall be specifically documented in the examiner's notes.

6.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure that it is not loaded. If loaded, immediate steps should be taken to ensure that the firearm is safely unloaded. Care shall be exercised when the force to be used in testing could alter or damage internal parts and their working relationship(s). Damage caused by the examiner may prevent the examiner from determining the cause of the reported malfunction.

6.3. Related Information:

6.3.1. Physical Examination and Classification of Firearms Method 1
6.3.2. Safe Firearm Handling Method 2
6.3.3. Automatic Firing Method 7
6.3.4. Worksheet Appendix 1
6.3.5. Firearm Safety Appendix 3
6.3.6. Range of Conclusions Appendix 4

6.4. Instruments:

6.4.1. Rubber Mallet or other forensic impact tool
6.4.2. Primed Cartridge Case

6.5. Reagents/Materials: None

6.6. Hazards/Safety:

6.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

6.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

6.6.3. Appropriate hearing and eye protection shall be worn when applicable.

6.7. Reference Materials/Controls/Calibration Checks:

6.7.1. The firearm examiner should consult available manufacturer specification publications as well as disassembly/assembly and exploded diagram manuals.

6.8. Procedures/Instructions:

6.8.1. A firearm examiner shall not routinely disassemble a firearm during this examination. An examiner may disassemble a firearm when:

6.8.1.1. The firearm is damaged upon receipt and incapable of being test fired as received.
6.8.1.2. The firearm is rusted or corroded as such that disassembly is necessary for test firing.
6.8.1.3. The firearm is suspected as having been altered for full automatic fire. If full automatic conversion is suspected the examiner shall test fire the firearm first.

6.8.2. As part of this method, an examiner should perform an “Impact” test on the firearm utilizing a primed cartridge case. An “Impact” test should consist of the of the following steps:

6.8.2.1. Ensure that the firearm is unloaded.
6.8.2.2. Load a primed cartridge case into the chamber of the firearm.
6.8.2.3. Holding the muzzle away, strike the firearm forcibly with a rubber mallet on the top, bottom, right side, left side, back of the firearm.
6.8.2.4. The examiner should strike these areas a minimum of ten (10) times per side.
6.8.2.5. The examiner should repeat these strikes while the firearm is in various operating stages i.e.; single-action, double action, safety on, safety off, and any other possible combinations as such.

6.8.3. No one procedure can sufficiently outline the steps necessary to examine all firearms for any malfunction. However, the following list of examinations should serve as a ***guideline*** for the examiner:

6.8.3.1. Physical Check (Condition of Firearm as Received)

6.8.3.1.1. Cocked/uncocked
6.8.3.1.2. Safety position
6.8.3.1.3. Loaded/unloaded
6.8.3.1.4. Cartridge position
6.8.3.1.5. Stuck cartridges/discharged cartridge cases
6.8.3.1.6. Presence and/or location of flares

6.8.3.2. Visual Abnormalities

6.8.3.2.1. Barrel (loose, etc.)
6.8.3.2.2. Receiver (condition)
6.8.3.2.3. Slide (condition)
6.8.3.2.4. Parts broken or missing
6.8.3.2.5. Screws (loose or missing)
6.8.3.2.6. Alterations or adaptations
6.8.3.2.7. Sights

6.8.3.3. Action (External)

6.8.3.3.1. Relationships of the action parts
6.8.3.3.2. Correct assembly
6.8.3.3.3. The proper locking of the action on closing
6.8.3.3.4. Cylinder rotation (securely locks)
6.8.3.3.5. Hand relationship to the ratchet (worn)
6.8.3.3.6. Trigger (not returning, sticks, broken spring, etc.)
6.8.3.3.7. Trigger pull (single action, double action) and striking of hammer

6.8.3.4. Action (Internal)

6.8.3.4.1. Hammer notch, check for burrs, dirt, wear, or other anomalies
6.8.3.4.2. Check the sear to see if broken, worn, or altered
6.8.3.4.3. Make sure safeties are in correct alignment
6.8.3.4.4. Check to see if springs are broken, worn, or altered
6.8.3.4.5. Check for signs of any tampering or faulty assembly

6.8.3.5. Safeties

6.8.3.5.1. ¼, ½, full cock, seating check (any false seating positions, pull off/push off, etc.)
6.8.3.5.2. Grip, magazine, disconnector
6.8.3.5.3. Thumb/finger - note positions when firearm will fire
6.8.3.5.4. Rebound hammer or inertia firing pin
6.8.3.5.5. Firing pin relationship to primer
6.8.3.5.6. Firing pin condition
6.8.3.5.7. Drop hammer several times to check above safeties.
6.8.3.5.8. Position of the slide or bolt in order to fire
6.8.3.5.9. Condition of safeties

6.8.3.6. Action Check

6.8.3.6.1. Check feeding (magazine, carrier or lifter, feed ramp, magazine lips, etc.)
6.8.3.6.2. Check for the firearms ability to Slamfire
6.8.3.6.3. Check for extractor and/or ejector markings on evidence cartridges/discharged cartridge cases
6.8.3.6.4. Check for unusual marks exhibited on the cartridges/discharged cartridge cases.

6.8.3.7. Check for any inherent "quirks" known about the particular firearm based on literature or case data.

6.8.3.8. Test Fire Firearm

6.8.3.8.1. Note any operational problems (misfires, failure to feed, etc)
6.8.3.8.2. Check the ammunition involved (proper cartridge, type, reloads, etc.)
6.8.3.8.3. Check consistency of the impression on test and evidence

6.9. **Records:** The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. Any and all procedures used to disassemble and/or clean the firearm shall be detailed in the examiner's notes. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy

6.10. **Interpretations of Results:** The firearm examiner should gather all aforementioned material and consult with manufacturers specifications to ascertain the operating condition of the firearm when in question.

6.11. **Report Writing:** Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

6.12. **References:**

6.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

6.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

6.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

6.12.4. Young, Joseph, "Magazine Malfunctions of a SWD Can Cause Double Feeding of Cartridges and Unintentional Discharge," AFTE Journal, Summer 2005 Vol. 37, No. 3, Pgs 201-205

6.12.5. Silverwater, Shoshani, Argman, Hocherman, Schecter, "Accidental Discharge of a FN Browning Hi-Power Pistol," AFTE Journal, October 1996 Vol. 28, No. 4, Pages 233-240.

6.12.6. Jaeger,Kendall, "Another Safety Issue With After-Market Parts," AFTE Journal, Summer 2005, Vol. 37, No. 3, Pages 224-225.

6.12.7. “Forensic Examiners Firearms Recall/Safety Warning List”, FBI Laboratory

6.12.8. American National Standards Institute, Inc., “American National Standard Voluntary Industry Performance Standards Criteria for Evaluation of New Firearms Designs Under Conditions of Abusive Mishandling for the Commercial Manufacturers”. (ANSI/SAAMI Z299.5-1985), November, 1985.

7. AUTOMATIC FIRING METHOD

7.1. Scope: To determine if a firearm is capable of full automatic fire, shows signs of modification and/or fails an external disconnector test. Firearms suspected of the capability of full automatic fire require research and special safety precautions during test firing.

7.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure it is not loaded. If loaded, immediate steps shall be taken to ensure the firearm is safely unloaded.

7.3. Related Information:

7.3.1. Physical Examination and Classification of Firearms Methods 1
7.3.2. Safe Firearm Handling Method 2
7.3.3. Malfunctioning Firearm Method 6
7.3.4. Test Firing Methods 9
7.3.5. Worksheet Appendix 1
7.3.6. Firearm Safety Appendix 3
7.3.7. Range of Conclusions Appendix 4

7.4. Instruments:

7.4.1. Remote Firing Stand
7.4.2. Video Recording Equipment

7.5. Reagents/Materials: None

7.6. Hazards/Safety:

7.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

7.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

7.6.3. Appropriate hearing and eye protection shall be worn when applicable.

7.7. Reference Materials/Controls/Calibration Checks: The firearm examiner should consult available manufacturer specification publications as well as disassembly/assembly and exploded diagram manuals.

7.8. Procedures/Instructions:

7.8.1. Performing an External Disconnector Exam

7.8.1.1. Ensure that the firearm is unloaded then cock the hammer/striker assembly.
7.8.1.2. Pull the trigger and apply constant pressure to the trigger (do not release).
7.8.1.3. Cock the hammer/striker assembly.
7.8.1.4. Release the trigger then pull the trigger again.
7.8.1.5. If the firearm does not dry fire then it has failed this examination.
7.8.1.6. If the firearm has a selector, perform the external disconnector test for each firing position the selector can be moved to which allows the firearm to fire. Keep in mind that a selector position which allows for full automatic fire may not be marked or in a position typical for semi-automatic versions of the examined firearm.
7.8.1.7. If the firearm fires with an open bolt design, cock the bolt to the open position then dry fire the weapon keeping constant pressure on the trigger.
7.8.1.8. Pull back the charging handle to cock the bolt. If the bolt will not cock while the trigger is depressed, then the firearm has failed the exam.
7.8.1.9. Note: the lack of trigger disconnection after firing in some firearms may not lead to full automatic fire.

7.8.2. Examination of Firearm Modification/Conversion

7.8.2.1. The firearm examiner shall research the firearm to determine what parts or modifications are needed to make the firearm capable of full automatic fire. The AFTE Journal, the AFTE Forum, the Duty Officer at the Bureau of Alcohol Tobacco and Firearms Technical Branch, and the Reference Collection are reliable sources of information.
7.8.2.2. Once research is complete, look for external and internal signs of conversion typical for your firearm. Do not field strip the firearm at this point.
7.8.2.3. Pay close attention to firearms that have very light and/or inconsistent trigger pulls. If you have a select-fire firearm that is capable of both semi-automatic and full automatic fire, measure and record the trigger pull in both modes.

7.8.3. Test Firing Suspected Modified/Converted Firearms

7.8.3.1. Poorly converted firearms may be dangerous to shoot by hand. Therefore, the firearm examiner should consider the use of a remote firing device.

7.8.3.2. The test firing procedure should be recorded with a video camera. Make sure to state your name, laboratory case number, item number, and explain the procedure on the video. Place a copy of the video file into the case record.

7.8.3.3. Place only one cartridge in the magazine, load into the chamber, and fire.

7.8.3.4. Inspect the cartridge case to look for cracks, gross bulges, overly flattened primers, blown primers, or any other unusual physical effects.

7.8.3.5. If the cartridge case shows no signs of distress then place two cartridges in the magazine and pull the trigger leaving constant pressure on the trigger.

7.8.3.6. If the firearm is capable of full automatic fire, the firearm should fire both cartridges with one pull of the trigger. Repeat this process to confirm this test.

7.8.3.7. If the firearm has cartridge feeding issues try another brand of cartridges. For best results use only cartridges with full metal jacketed bullets.

7.8.4. Internal Examination of the Firearm

7.8.4.1. Using research and/or experience, field strip the firearm and internally examine the firearm. Try to determine why the firearm is capable of full automatic fire. Keep in mind that some firearms are capable of full automatic fire due to breakage of normal parts or poor maintenance of the firearm. It is recommended that the firearm examiner photograph any and all observations of conversion/modifications. All procedures used to disassemble and examine the firearm shall be recorded in the firearm examiners notes.

7.9. **Records:** The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

7.10. **Interpretations of Results:** The firearm examiner should gather all aforementioned material and consult with manufacturer's specifications to ascertain the operating condition of the firearm.

7.11. **Report Writing:** Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

7.12. References:

7.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001.

7.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001.

7.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

7.12.4. Bartocci, Christopher, "Fire Control Part Variations in Colt M16/AR15 and Sporter Type Rifles", AFTE Journal, Vol. 35, No. 1, pg. 12.

7.12.5. Bartocci, Christopher, "Fire Control Part Variations in AK47/AKM and Civilian Sporter Type Rifles" , AFTE Journal, Vol. 36, No. 1, pg. 99.

7.12.6. French Jr., Mickey, "Full Auto Intratec Caused by Faulty Assembly", AFTE Journal, Vol. 32, No. 1, pg. 51.

7.12.7. McVeigh and Jackson, "Full Automatic Conversion of an S.W.D. M-11/9mm", AFTE Journal, Vol. 36, No. 3, pg. 171.

7.12.8. Monturo, Chris, "Select Fire SKS", AFTE Journal, Vol. 30, No. 1, pg. 120.

7.12.9. Powder Burns, "Full-Auto Conversion of the SKS Rifle", Paladin Press 1994

8. BORE/CHAMBER CASTING METHOD

8.1. Scope: Occasionally, firearms are received for which the caliber may not be known or may be different than is designated on the firearm and in the literature. In order to facilitate firing of test shots of the correct caliber for a particular firearm, it may be necessary to make a bore and/or chamber cast. Then, by measuring the cast, the correct cartridge can be selected for test firing.

8.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure that it is not loaded. If loaded, immediate steps shall be taken to ensure that the firearm is safely unloaded.

8.3. Related Information:

8.3.1. Physical Examination and Classification of Firearms Methods 1
8.3.2. Safe Firearm Handling Method 2
8.3.3. Worksheet Appendix 1
8.3.4. Firearm Safety Appendix 3
8.3.5. Range of Conclusions Appendix 4
8.3.6. Calibration Standards Appendix 7

8.4. Instruments:

8.4.1. Calipers

8.5. Reagents/Materials:

8.5.1. Mikrosil®, or other casting medium

8.6. Hazards/Safety:

8.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

8.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

8.7. Reference Materials/Controls/Calibration Checks:

8.7.1. The firearm examiner shall refer to the Calibration Standards Appendix 7 regarding the calibration and use of calipers.

8.8. Procedures/Instructions:

8.8.1. Casts can be made using various casting materials such as low melting point metals and silicone rubber compounds. The procedure below is for Mikrosil®.

8.8.1.1. Ensure that the firearm is unloaded.
8.8.1.2. Open the action and remove the bolt or bolt assembly.
8.8.1.3. Check the bore to make sure it is clear.
8.8.1.4. Push a cleaning patch in the barrel, from muzzle end, until it is ½ inch to ¼ inch from the beginning of the chamber.
8.8.1.5. Lubricate the chamber with gun oil or a silicone spray or some other similar substance such as WD 40®.
8.8.1.6. Mix Mikrosil® as per manufacture instructions and place the appropriate amount of casting material in the chamber.
8.8.1.7. Do not allow casting material to flow into breech. It will make extraction difficult.
8.8.1.8. When casting material is set, gently tap end of cleaning rod to loosen cast from the chamber and remove from the breech.
8.8.1.9. Mikrosil® has to be pushed or forced out and is not reusable. Therefore, it is undesirable to let any more of the casting material than necessary go into the barrel.
8.8.1.10. The same steps may be used in the casting of the bore. However in bore casting, only the last three (3) inches of the bore need to be cast.
8.8.1.11. The firearm examiner shall then measure either the appropriate areas of the chamber or bore cast to determine caliber and cartridge designation.

8.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

8.10. Interpretations of Results: The correct caliber of the firearm can be determined by measuring the mouth, base, overall length, rim (if pertinent) and shoulder length of the chamber cast, or the diameter of the bore cast.

8.11. Report Writing: Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

8.12. References:

8.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

8.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

8.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

8.12.4. Striupaitis, Peter, "Bore Casting Techniques for Caliber Designation of Rifles", AFTE Journal, April 1983, Vol. 15, No. 2, pgs. 88-90.

8.12.5. Poole, Robert A., "Mikrosil Casting Material Information," AFTE Journal, April 1983, Vol. 15, No. 2, pgs. 80-82.

9. TEST FIRING METHODS

9.1. Scope: To further test the operability of a firearm and to collect ammunition components for later microscopic comparison, a minimum of three (3) test shots should be fired and recovered. Recovery methods include the water recovery tank, the cotton waste recovery box, and the bullet trap. The type of firearm, ammunition used, and the experience of the firearm examiner shall dictate the type of recovery method used.

9.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure it is not loaded. If loaded, immediate steps shall be taken to ensure that the firearm is safely unloaded.

9.3. Related Information:

9.3.1. Physical Examination and Classification of Firearms Methods 1
9.3.2. Safe Firearm Handling Method 2
9.3.3. Worksheet Appendix 1
9.3.4. Firearm Safety Appendix 3
9.3.5. Range of Conclusions Appendix 4

9.4. Instruments:

9.4.1. Water Recovery Tank
9.4.2. Cotton Waste Recovery Box
9.4.3. Bullet Trap
9.4.4. Remote Firing Stand

9.5. Reagents/Materials: None

9.6. Hazards/Safety:

9.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

9.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

9.6.3. Appropriate hearing and eye protection shall be worn when applicable.

9.6.4. The examiner shall consider the practicality and/or desirability to wear some form of bullet resistant clothing.

9.7. Reference Materials/Controls/Calibration Checks: None

9.8. Procedures/Instructions:

9.8.1. While using the water recovery tank the examiner shall adhere to the following method:

9.8.1.1. Ensure that the water level is appropriate.
9.8.1.2. Ensure that all lids or doors of the water recovery tank are closed and properly secured.
9.8.1.3. Ensure that the exhaust fans or system is turned on.
9.8.1.4. Ensure all warning systems are activated.
9.8.1.5. The examiner should consider loading no more than two (2) cartridges into the firearm during the initial testing.
9.8.1.6. Fire the firearm through the shooting port. If the firearm is capable of firing both single and double action modes, a minimum of one (1) shot per mode should be obtained.
9.8.1.7. Recover the bullets using a net, pole, or some other appropriate device.
9.8.1.8. Ejected cartridge cases shall be retrieved in a manner dictated by the individual shooting room.
9.8.1.9. When space permits, after test firing, the examiner shall mark the bullet and cartridge case of each test shot with:

9.8.1.9.1. The laboratory case number and/or
9.8.1.9.2. The item number and/or
9.8.1.9.3. The examiner's markings.

9.8.2. While using the cotton waste recovery box the examiner shall adhere to the following method:

9.8.2.1. The examiner should consider wetting the first section of cotton in the box.
9.8.2.2. The examiner should consider the placement of paper partitions at various points in box to ensure tracking of the test shot, as well as ensuring that the cotton is packed down as not to retain previous bullet paths.
9.8.2.3. Ensure that the exhaust fans or system is turned on.
9.8.2.4. Ensure all warning systems are activated.
9.8.2.5. The examiner should consider loading no more than two (2) cartridges into the firearm during the initial testing.
9.8.2.6. Fire the firearm through the shooting port. If the firearm is capable of firing both single and double action modes, a minimum of one (1) shot per mode should be obtained.
9.8.2.7. Bullets should be recovered by searching through cotton, using partitions as guides.
9.8.2.8. Ejected cartridge cases shall be retrieved in a manner dictated by the individual shooting room.

9.8.2.9. When space permits, after test firing, the examiner shall mark the bullet and cartridge case of each test shot with:

9.8.2.9.1. The laboratory case number and/or
9.8.2.9.2. The item number and/or
9.8.2.9.3. The examiner's markings.

9.8.3. While using the bullet trap the examiner shall adhere to the following method:

9.8.3.1. Ensure that the exhaust fans or system is turned on.
9.8.3.2. Ensure all warning systems are activated.
9.8.3.3. The examiner should consider loading no more than two (2) cartridges into the firearm during the initial testing.
9.8.3.4. Fire the firearm into the front of the trap. If the firearm is capable of firing both single and double action modes, a minimum of one (1) shot per mode should be obtained.
9.8.3.5. Ejected cartridge cases shall be retrieved in a manner dictated by the individual shooting room.
9.8.3.6. When space permits, after test firing, the examiner shall mark the cartridge case of each test shot with the:

9.8.3.6.1. The laboratory case number and/or
9.8.3.6.2. The item number and/or
9.8.3.6.3. The examiner's markings.

9.8.4. While using the remote firing stand the examiner shall adhere to the following method:

9.8.4.1. Set up the chosen remote firing device as per manufacturer's guidelines in front of the appropriate recovery system.
9.8.4.2. Place firearm in device. It is recommended that the examiner first dry-fire the firearm in the remote firing device before using live ammunition.
9.8.4.3. Ensure that the exhaust fans or system is turned on.
9.8.4.4. Ensure all warning systems are activated.
9.8.4.5. The examiner should consider loading no more than one (1) cartridge into the firearm during the initial testing.
9.8.4.6. Activate the remote device while standing behind a protective shield or while standing at a safe distance away from the firearm.
9.8.4.7. Obtain the appropriate test fired components.
9.8.4.8. When space permits, after test firing, the examiner shall mark the bullet and cartridge case of each test shot with the:

9.8.4.8.1. The laboratory case number and/or
9.8.4.8.2. The item number and/or
9.8.4.8.3. The examiner's markings.

9.8.5. Test Fire Selection and Handling

9.8.5.1. Whenever practical the firearm examiner should use laboratory stock ammunition that is similar to the unknowns.

9.8.5.2. The firearm examiner may use ammunition submitted with the case or firearm if necessary.

9.8.5.2.1. The ammunition shall be inspected first to ensure it is factory produced ammunition. In general, reloaded ammunition should not be used as test fires.

9.8.5.3. Test fires created with laboratory ammunition shall be considered a “new item”.

9.8.5.3.1. The test fires shall be considered a “new item” generated in the laboratory and numbered as such (e.g. 001T for a firearm submitted as item 001).

9.8.5.3.2. When space permits, mark the test fires with the appropriate laboratory case number, item number, and initials.

9.8.5.3.3. The container shall be readily marked with the laboratory case number, new item number, and “Test Fires” for ease of identification.

9.8.5.3.4. Generate the appropriate notations in the Laboratory Information Management System and print a barcode label. Attach the barcode label to the test fire container.

9.8.5.3.5. The firearm examiner shall document in his/her notes, the disposition of the test fires and the date the test fires were generated.

9.8.5.3.6. The firearm examiner shall document in the Certificate of Analysis the disposition of the test fires (e.g. Returned to contributor).

9.8.5.3.7. Follow all other Laboratory Policy as it pertains to Evidence handling.

9.8.5.4. Test fires created with ammunition submitted by the contributor shall be handled in the following manner.

9.8.5.4.1. When space permits, mark the test fires with the appropriate laboratory case number, item number, and initials.

9.8.5.4.2. The container shall be readily marked with the laboratory case number, and “Test Fires” for ease of identification.

9.8.5.4.3. The firearm examiner shall document in his/her notes, the disposition of the test fires and the date the test fires were generated.

9.8.5.4.4. The firearm examiner shall document in the Certificate of Analysis the disposition of the test fires.(e.g. Three cartridges from Item 001 used as test fires in Item 002 and returned in the original packaging).

9.8.5.4.5. Follow all other Laboratory Policy as it pertains to Evidence handling.

9.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

9.10. Interpretations of Results: Not Applicable

9.11. Report Writing: Most firearm report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

9.12. References:

9.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

9.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

9.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

9.12.4. Angerbrandt, William, "New Ballistics Tank from Detroit-Armor Corporation Allows Fast Recovery Without Projectile Distortion.", AFTE Journal, July 1984, Vol. 16, No. 3, pgs.106-107.

9.12.5. Moyer, Frank, “Horizontal Bullet Recovery Water Chamber”, AFTE Journal, Vol. 9, No. 1, pgs. 32-39.

9.12.6. Newquist, Andrew, “New Bullet Recovery System”, AFTE Journal, February 1973, Vol. 5, No. 1, pg.9.

9.12.7. Love, Ed, “Fifty Caliber Cotton Box Recovery”, AFTE Journal, Winter 2009, Vol. 41, No. 1, pgs. 77-79

9.12.8. "A Guide to Firearms Safety", A Safety and Educational Publication of the National Rifle Association, May 1994.

9.12.9. "Forensic Examiners Firearms Recall/Safety Warning List", FBI Laboratory.

10. CALIBER DETERMINATION METHODS

10.1. Scope: Caliber, or the base diameter of a bullet, is one of the class characteristics of a fired bullet. Determination of caliber can aid the firearm examiner during the identification or elimination of a suspect firearm. If no firearm is submitted, the bullet's caliber may be used in determining the General Rifling Characteristics of the firearm involved.

10.2. Precautions/Limitations: The firearm examiner shall recognize that the measurements taken are estimates and shall use the best available method to obtain these measurements. If the base is mutilated, the examiner may only be able to determine that the evidence is consistent within a range of calibers or that the caliber cannot be determined. Lastly, when utilizing available General Rifling Characteristics file(s) the firearm examiner shall recognize that the data available is not all inclusive.

10.3. Related Information:

10.3.1. Range of Conclusions Appendix 4
10.3.2. Ammunition Reference Collection Appendix 6
10.3.3. Calibration Standards Appendix 7

10.4. Instruments:

10.4.1. Calipers
10.4.2. Micrometer
10.4.3. Stereo Microscope
10.4.4. Comparison Microscope
10.4.5. Balance

10.5. Reagents/Materials: None

10.6. Hazards/Safety:

10.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

10.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

10.7. Reference Materials/Controls/Calibration Checks:

10.7.1. All controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

10.8. Procedures/Instructions:

10.8.1. Caliber determination from base measurement

10.8.1.1. The following may be utilized to determine the caliber of a fired bullet. The condition of the bullet shall determine which steps to be used.

10.8.1.1.1. Check the calibration of the calipers and balance according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

10.8.1.1.2. Compare the base diameter of the evidence bullet directly with known standards contained in the ammunition reference collection.

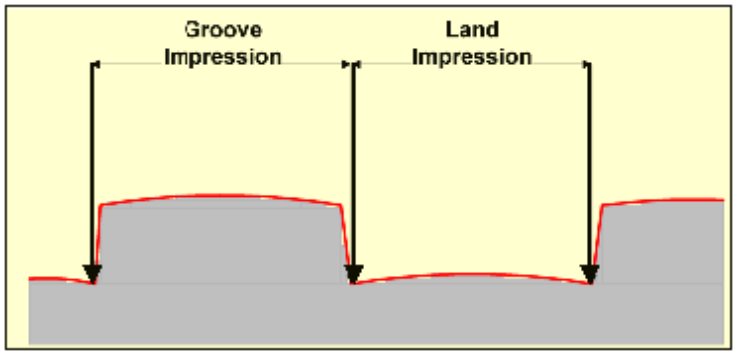
10.8.1.1.3. Measure the approximate base diameter of the evidence bullet using calipers and compare this measurement with known measurements published in reference literature.

10.8.1.1.4. Count the number of lands and grooves and weigh the bullet on a balance.

10.8.1.1.5. Physical characteristics of the evidence bullet, such as weight, bullet shape, composition, nose configuration, and number and placement of cannelures, may aid in caliber determination.

10.8.2. Caliber determination from land and groove measurements utilizing the air gap method:

10.8.2.1. In measuring a fired bullet to determine the width of the land impression or the groove impression, it is paramount that the points used for beginning and ending a measurement comply with the discipline-wide practice. This practice utilizes the anchor points shown below.



10.8.2.2. Check the calibration of the calipers and micrometer according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

10.8.2.3. Mount the fired bullet in question on one stage of the comparison microscope. The digital micrometer or caliper is mounted on the other stage. Both stages shall be used at the same magnification level (objective setting) and be in focus.

10.8.2.4. Align the image of the measurement gap (opening) of the micrometer with the image of the appropriate land impression being measured and record the approximate measurement to the nearest thousandth of an inch.

10.8.2.5. Repeat the above utilizing the groove impression.

10.8.3. Caliber determination from land and groove measurements utilizing the stereo microscope and caliper method:

10.8.3.1. Check the calibration of the calipers according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

10.8.3.2. The fired bullet in question is either held or mounted on a steady surface beneath the stereo microscope.

10.8.3.3. The land impression of the fired bullet is placed in a horizontal position and measured with calipers.

10.8.3.4. The approximate measurement is then recorded to the nearest thousandth of an inch.

10.8.3.5. Repeat the above utilizing the groove impression.

10.9. Records: The firearm examiner shall document their findings in the form of handwritten or computer generated notes. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

10.10. Interpretations of Results: Caliber is written as a numerical term and may be depicted with or without the decimal point. Determination of the number and widths of the lands and grooves and/or caliber may be acquired by comparing available measurements AFTE Glossary 6th Edition, Section13 Appendices, Table 8. The firearm examiner may also utilize the Federal Bureau of Investigation General Rifling Characteristic File or the General Rifling Characteristic File provided by FirearmsID.com.

10.11. Report Writing: Most bullet characterization report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that submitted bullets may be in very poor condition and these Range of Conclusions may not be pertinent.

10.12. References:

10.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

10.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

10.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613.

10.12.4. Haag, Lucien, "Class Characteristics of Rifled Barrels," AFTE Journal, June 1978, Vol. 10, No. 2, pgs. 11-16.

10.12.5. Felix, Kyle, “Using Bullet Weights and Type to Determine Caliber and Brand”, AFTE Journal, Winter 2008, Vol. 4, No. 1, pgs. 64-80.

10.12.6. Murouka, Richard, “.223 Remington Versus 5.56 x 45mm, What’s the Difference?”, AFTE Journal, January 1994, Vol. 26, No. 1, pgs. 50-63.

10.12.7. Mathews, J. Howard, Firearms Identification Vol. I, 1973.

10.12.8. Barnes, Frank C., Cartridges of the World, 12th Edition, 2009.

10.12.9. www.firearmsid.com

11. AMMUNITION CHARACTERIZATION METHODS

11.1. Scope: These methods deal specifically with the examination of fired ammunition components including cartridge cases, bullets, shotshell cartridge cases, shotgun wadding, shot pellets, and other ammunition components. The firearm examiner may be able to determine the caliber, gauge size, manufacturer, and whether the ammunition components have markings suitable for comparison. This method is suitable for use for unfired ammunition component characterization also.

11.2. Precautions/Limitations: The measurements taken are estimates and the firearm examiner shall use the best available method to obtain these measurements. Some manufacturers might duplicate the design of another manufacturer.

11.3. Related Information:

11.3.1. Caliber Determination Method 10
11.3.2. Range of Conclusions Appendix 4
11.3.3. Ammunition Reference Collection Appendix 6
11.3.4. Calibration Standards Appendix 7

11.4. Instruments:

11.4.1. Calipers
11.4.2. Micrometer
11.4.3. Stereo Microscope
11.4.4. Balance

11.5. Reagents/Materials: None

11.6. Hazards/Safety:

11.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

11.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

11.7. Reference Materials/Controls/Calibration Checks:

11.7.1. All controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

11.8. Procedures/Instructions:

11.8.1. Bullet Characterization

11.8.1.1. Check the calibration of the balance and calipers according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

11.8.1.2. To accurately characterize a bullet the firearm examiner shall record the following data whenever possible:

11.8.1.2.1. The approximate bullet weight recorded in grains.
11.8.1.2.2. The base measurement or caliber.
11.8.1.2.3. The bullet design, composition, and possible manufacturer and/or marketer.
11.8.1.2.4. A description of the base of the bullet.
11.8.1.2.5. The number of lands and grooves.
11.8.1.2.6. The direction of twist.
11.8.1.2.7. The measured width of the land and groove impressions.
11.8.1.2.8. The type and number of cannelures present.
11.8.1.2.9. The condition of the fired bullet.
11.8.1.2.10. The presence of skidding, slipping, or misalignment.
11.8.1.2.11. The presence of trace material.
11.8.1.2.12. All extraneous marks (secondary scratching, shaving, etc.)
11.8.1.2.13. Whether the bullet was previously marked for identification.

11.8.1.3. Whenever possible the firearm examiner shall mark the bullet away from important markings with the laboratory case number, item number, and initials.

11.8.2. Cartridge Case Characterization

11.8.2.1. Check the calibration of the balance and calipers according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

11.8.2.2. To accurately characterize a cartridge case the firearm examiner shall record the following data whenever possible:

11.8.2.2.1. The caliber
11.8.2.2.2. Headstamp information and the possible manufacturer and/or marketer.
11.8.2.2.3. Description of case and primer finish.
11.8.2.2.4. Presence and type of sealant

11.8.2.2.5. Description of the ignition system i.e. centerfire, rimfire, or other.
11.8.2.2.6. Shape of cartridge.
11.8.2.2.7. Number and type of cannelures.
11.8.2.2.8. Description of the firing pin impression.
11.8.2.2.9. Description of the breechface marks.
11.8.2.2.10. Description of the extractor and ejector marks.
11.8.2.2.11. Presence and location of any visible trace material.
11.8.2.2.12. Description of other markings, to include: resizing marks, chamber marks, magazine marks, ejection marks, and any other marks of value.
11.8.2.2.13. Whether the cartridge case was previously marked for identification.

11.8.2.3. Whenever possible the firearm examiner shall mark the cartridge case away from important markings with the laboratory case number, item number, and initials.

11.8.3. Shotshell Cartridge Case Characterization

11.8.3.1. Check the calibration of the balance and calipers according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.
11.8.3.2. To accurately characterize a shotshell the firearm examiner shall record the following data whenever possible:

11.8.3.2.1. The caliber or gauge.
11.8.3.2.2. Headstamp information and the possible manufacturer and/or marketer of the item.
11.8.3.2.3. Description of case hull and primer finish.
11.8.3.2.4. Presence and type of sealant.
11.8.3.2.5. Description of the Ignition System: centerfire, rimfire, or other.
11.8.3.2.6. Note high or low brass.
11.8.3.2.7. Presence and descriptions of load markings.
11.8.3.2.8. Chamber length.
11.8.3.2.9. Shotshell crimp type.
11.8.3.2.10. Description of the firing pin impression.
11.8.3.2.11. Description of the breechface marks.
11.8.3.2.12. Description of the extractor and ejector marks.
11.8.3.2.13. Presence and location of any visible trace material.
11.8.3.2.14. Description of other markings, to include: resizing marks, chamber marks, magazine marks, ejection marks, and any other marks of value.
11.8.3.2.15. Whether the cartridge case was previously marked for identification.

11.8.3.3. Whenever possible the firearm examiner shall mark the cartridge case away from important markings with the laboratory case number, item number, and initials.

11.8.4. Shotgun Wadding Characterization

11.8.4.1. Directly compare the evidence to known laboratory standards of similar manufacture or composition by comparing the base of evidence to the bases of the standards until a similar size is found; or:

11.8.4.2. Check the calibration of the calipers or digital micrometer according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

11.8.4.3. Measure the base diameter of the wad and compare these measurements to known measurements listed in manufacturer's indexes.

11.8.4.4. Microscopic examination may reveal striations suitable for comparison.

11.8.4.5. Microscopic examination may reveal manufacturers data stamped into the wad.

11.8.4.6. If evidence shotshells are submitted, it may be necessary to disassemble one for the determination of gauge size or similarity of manufacture.

11.8.5. Determination of shot size may be determined by one or more of the three methods listed below at the discretion of the firearm examiner.

11.8.5.1. Visual and/or Microscopic Determination

11.8.5.1.1. Record the total number of pellets received and note the pellets composition.

11.8.5.1.2. Determine the number of pellets suitable for comparison purposes. Make note if pellet sizes all appear to be similar in size. If several different sizes are present, determine each specific size.

11.8.5.1.3. Compare laboratory standards of known shot sizes side by side with the evidence pellets until a known shot size is determined. A stereo microscope may aid in this determination. This can be done one size at a time or several sizes at a time; however, if more than one size is used at a time, care should be taken not to mix up the shot.

11.8.5.2. Determination by Weight

11.8.5.2.1. Record the total number of pellets received and note the pellets composition.

11.8.5.2.2. Determine the number of pellets suitable for weighing. Make note if pellet sizes all appear to be similar in size. If several different sizes are present, determine each specific size.

11.8.5.2.3. Check the calibration of the balance according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

11.8.5.2.4. Weigh the pellets in grains then divide by the number of pellets weighed to determine the average individual pellet weight.

11.8.5.2.5. Consult known pellet weights in Table 1 of Section 13, Appendices of the AFTE Glossary and determine shot size, which corresponds to evidence shot.

11.8.5.3. Determination by Size

11.8.5.3.1. Record the total number of pellets received and note the pellets composition.

11.8.5.3.2. Determine the number of pellets suitable for measuring. Make note if pellet sizes all appear to be similar in size. If several different sizes are present, determine each specific size.

11.8.5.3.3. Check the calibration of the calipers or digital micrometer according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

11.8.5.3.4. Choose the best specimens and measure diameter using a caliper and record in thousandths of an inch or the appropriate measurement.

11.8.5.3.5. Consult known pellet sizes in Table 1 of Section 13, Appendices of the AFTE Glossary and determine shot size, which corresponds to evidence shot.

11.9. Records: The firearm examiner shall document their findings in the form of handwritten or computer generated notes. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

11.10. Interpretations of Results:

11.10.1. Caliber, gauge and shot size are written as numerical terms.

11.11. Report Writing: Most ammunition characterization report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that submitted ammunition may be in very poor condition and these Range of Conclusions may not be pertinent.

11.12. References:

11.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

11.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

11.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

11.12.4. Ernest, Richard, "Exploring the Possibility of Matching Fired Shotgun Ammunition Components to Unaltered Shotguns," AFTE Journal, January 1992, Vol. 24, No. 1, pgs. 28-36.

11.12.5. Prieto, Michael, "Firearms Identification Lesson #4," AFTE Journal, July 1982, Vol. 14, No. 3, pgs. 46-68.

11.12.6. Felix, Kyle, "Using Bullet Weights and Type to Determine Caliber and Brand," AFTE Journal, Winter 2008, Vol. 40, No. 1, pgs. 64-80.

11.12.7. Mann, Espinoza, Ralston,Stroud, Scanlan, and Strauss, “Shot Pellets: An Overview”, AFTE Journal, July 1994, Vol. 26, No. 3, pgs. 223-241.

11.12.8. Barnes, Frank C., Cartridges of the World, 12th Edition, 2009.

12. MICROSCOPIC COMPARISON METHODS

12.1. Scope: In order for a firearm examiner to associate an item of fired evidence back to the firearm that produced it, or a tool to a particular toolmark, a microscopic comparison utilizing a comparison microscope shall be performed. The comparison microscope allows the examiner to place the evidence on one side of the microscope and the known standard on the other side. This procedure may also be used to compare two unknown pieces of fired evidence or unknown toolmarks, together to determine if they were made by the same firearm or tool.

12.2. Precautions/Limitations: Not Applicable

12.3. Related Information:

12.3.1. Range of Conclusions Appendix 4
12.3.2. Calibration Standards Appendix 7
12.3.3. Verification of Casework Appendix 8

12.4. Instruments:

12.4.1. Comparison Microscope

12.5. Reagents/Materials: None

12.6. Hazards/Safety:

12.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

12.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

12.7. Reference Materials/Controls/Calibration Checks:

12.7.1. All controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

12.8. Procedures/Instructions:

12.8.1. Firearm Related Evidence

12.8.1.1. Select the correct objective (magnification) setting and ensure that the objectives are locked in place.
12.8.1.2. Select the correct set of oculars (eyepieces).

12.8.1.3. The illumination must be properly adjusted. Oblique lighting is usually preferred.

12.8.1.4. Check the performance of the comparison microscope according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

12.8.1.5. If a firearm is included as part of the evidence, compare the test shots produced from this firearm to determine what microscopic characteristics are reproducing.

12.8.1.6. Compare unknown fired evidence to either another piece of unknown fired evidence or a known standard by placing the unknown fired evidence on one stage and the other piece of unknown fired evidence or known standard on the opposite stage.

12.8.1.7. The entire unknown should be considered.

12.8.1.8. If an identification is not initially made, the firearm examiner should consider the following factors:

12.8.1.8.1. Angle of lighting.
12.8.1.8.2. Type of lighting.
12.8.1.8.3. The type of ammunition submitted or test fired.
12.8.1.8.4. The need for additional known standards.
12.8.1.8.5. The position of the evidence, the tests or both.
12.8.1.8.6. The possibility of cleaning the firearm.
12.8.1.8.7. The possibility that the firearm itself has changed.

12.8.2. Toolmark Related Evidence

12.8.2.1. Select the correct objective (magnification) setting and ensure that the objectives are locked in place.

12.8.2.2. Select the correct set of oculars (eyepieces).

12.8.2.3. The illumination must be properly adjusted. Oblique lighting is usually preferred.

12.8.2.4. Check the performance of the comparison microscope according to the methods detailed in the Calibration Standards Appendix 7. All results and equipment used shall be recorded in the firearm examiner's notes.

12.8.2.5. Compare unknown toolmark to either another unknown toolmark or a known standard by placing the unknown toolmark on one stage and the other unknown toolmark or known standard on the opposite stage.

12.8.2.6. The entire toolmark must be considered.

12.8.2.7. If an identification is not initially made, the firearm examiner should consider the following factors:

12.8.2.7.1. Angle of lighting.
12.8.2.7.2. Type of lighting.
12.8.2.7.3. The need for additional known standards.
12.8.2.7.4. The position of the evidence, the tests or both.

12.8.2.7.5. The possibility of cleaning the tool.
12.8.2.7.6. The possibility that the tool itself has changed.

12.9. Records: The firearm examiner shall document their findings in the form of handwritten or computer generated notes. If possible, the firearm examiner should consider photographing the microscopic observations made. The condition of the evidence and the availability of equipment may make this impractical. The firearm examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

12.10. Interpretations of Results:

12.10.1. IDENTIFICATIONS: The theory of identification as it pertains to the comparison of toolmarks enables opinions of common origin to be made when the unique surface contours of two toolmarks are in "sufficient agreement."

12.10.1.1. This "sufficient agreement" is related to the significant duplication of random toolmarks as evidenced by the correspondence of a pattern or combination of patterns of surface contours. Significance is determined by the comparative examination of two or more sets of surface contour patterns comprised of individual peaks, ridges and furrows. Specifically, the relative height or depth, width, curvature and spatial relationship of the individual peaks, ridges and furrows within one set of surface contours are defined and compared to the corresponding features in the second set of surface contours. Agreement is significant when it exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool. The statement that "sufficient agreement" exists between two toolmarks means that the agreement is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility.

12.10.1.2. Currently the interpretation of individualization/identification is subjective in nature, founded on scientific principles and based on the examiner's training and experience.

12.10.2. INCONCLUSIVE

12.10.2.1. Some agreement of individual characteristics and all discernible class characteristics, but insufficient for an identification.

12.10.2.2. Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility.

12.10.2.3. Agreement of all discernable class characteristics and disagreement of individual characteristics, but insufficient for an elimination.

12.10.3. **ELIMINATION:** Significant disagreement of discernible class characteristics and/or individual characteristics.

12.10.4. **UNSUITABLE:** Unsuitable for microscopic examination.

12.11. **Report Writing:** Most microscopic comparison report writing can be found in the Range of Conclusions Appendix 4.

12.12. **References:**

12.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

12.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

12.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

12.12.4. Thornton, John, "Some Historical Notes on the Comparison Microscope", AFTE Journal, April 1989, Vol. 21, No. 2, pgs.215-217.

12.12.5. Biasotti, A. A., “Methods Applied to the Comparison of Class and Individual Characteristics in Firearms and Toolmark Identification”, AFTE Journal, April 1989, Vol. 21, No. 2, pgs. 260-263.

12.12.6. Dutton, Gerard, “The Advantage of Co-Axial Lighting in Comparative Microscopy”, AFTE Journal, Fall 1999, Vol. 31, No. 4, pgs. 457-460.

13. TRACE EXAMINATION METHODS

13.1. Scope: Firearm evidence, tools, and toolmarks recovered during an investigation may contain trace material transferred from the crime scene. This trace material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. The firearm examiner needs to evaluate the importance of this evidence and, if further examination of the trace material is necessary, remove and preserve a sample of the trace material present.

13.2. Precautions/Limitations: The firearm examiner shall be aware that their area of expertise in not in trace examination and should consult with the Indiana State Police Laboratory Trace Microanalysis Unit when appropriate.

13.3. Related Information:

13.3.1. Physical Examination and Classification of Firearms Methods 1
13.3.2. Ammunition Characterization Methods 11
13.3.3. Physical Examination and Classification of Tools and Toolmark Methods 18
13.3.4. Range of Conclusions Appendix 4
13.3.5. Hazardous Chemical Waste Management Appendix 9

13.4. Instruments:

13.4.1. Stereomicroscope
13.4.2. Balance

13.5. Reagents/Materials:

13.5.1. Lead Solvent

13.5.1.1. Prepare lead solvent utilizing 10ml of Glacial Acetic Acid, 2ml 30% Hydrogen Peroxide, and 70ml distilled water.
13.5.1.2. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate.

13.5.2. 15% Acetic Acid Solution

13.5.2.1. Prepare a 15% Acetic Acid Solution utilizing Concentrated Glacial Acetic Acid and distilled water.
13.5.2.2. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate.

13.5.3. 10% Bleach Solution

13.5.3.1. Prepare a 10% Bleach Solution utilizing Bleach and distilled water.
13.5.3.2. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate.

13.5.4. 70% Solution of Denatured Ethyl Alcohol

13.5.4.1. Use of a pre-mixed 70% denatured Ethyl Alcohol is to be used at the discretion of the firearm examiner.

13.5.5. Contrex ES Powered Enzymatic Detergent

13.5.5.1. Prepare 1% solution of Contrex ES Powered Enzymatic Detergent (0.009 grams per milliliter of water).
13.5.5.2. The firearm examiner shall dispose of the remaining solution immediately after use.

13.6. Hazards/Safety:

13.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

13.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

13.6.3. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. It is recommended that the firearm examiner consult the appropriate Material Safety Data Sheet (MSDS) for each chemical prior to use.

13.6.4. The examiner shall use eye protection and gloves, and work within a fume hood or utilize a spot vent when mixing all chemicals.

13.6.5. When mixing acid and water the firearm examiner shall add acid to water. Never should water be added to acid!

13.6.6. Acetone is flammable and can pose a **SEVERE FLAMMABILITY HAZARD.** Acetone is also a contact hazard and prolonged inhalation and contact should be avoided.

13.6.7. Glacial Acetic acid is a corrosive and can pose a **SEVERE CONTACT HAZARD**. Glacial Acetic acid is also flammable and can pose a **SEVERE FLAMMABILITY HAZARD.**

13.6.8. Hydrogen peroxide is a powerful oxidizer and in higher concentrations is a corrosive to the skin.

13.6.9. Denatured Ethyl Alcohol is flammable and can pose a **SEVERE FLAMMABILITY HAZARD.**

13.6.10. Contrex ES Powered Enzymatic Detergent is an irritant to eyes, skin, and can cause vomiting and diarrhea.

13.7. Reference Materials/Controls/Calibration Checks: None

13.8. Procedures/Instructions:

13.8.1. Examine the firearm, fired evidence, tool, or toolmark, visually and microscopically for any trace material and record in notes.

13.8.2. If further examination of trace material is necessary:

13.8.2.1. If needed, consult the appropriate unit ***prior*** to the removal of any trace evidence.
13.8.2.2. Remove material being careful not to damage the fired evidence.
13.8.2.3. Place the removed trace material in a suitable container/packaging for submission to the appropriate section for further examination.

13.8.3. If further examination of trace material is not necessary:

13.8.3.1. For evidence containing blood, tissue or other biohazards, soak the evidence for at least one (1) minute in a 10% bleach solution.
13.8.3.2. Remove loose material by rinsing the fired evidence with water.
13.8.3.3. Remove plaster by rinsing the fired evidence in a 15% acetic acid solution.
13.8.3.4. Remove paint by soaking or wiping the fired evidence in acetone.
13.8.3.5. Remove lead/vaporous lead by soaking evidence one (1) minute in a lead solvent solution.

13.9. Records: The firearm examiner shall document their findings in the form of handwritten or computer generated notes. If possible, the firearm examiner should consider photographing the trace material prior to its removal. It is understood that the condition of the evidence and the availability of equipment may make this unrealistic. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

13.10. Interpretations of Results: Not Applicable

13.11. Report Writing: Trace observation report writing is found in the Range of Conclusions Appendix 4.

13.12. References:

13.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

13.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

13.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

13.12.4. Keisler, Mark, "Successful Identification After Lead Smear Removal", AFTE Journal, Winter 1998, Vol. 30, No. 1, pgs.127-128.

13.12.5. Quevillon, J.A., “An Application of DNA Typing to Firearms and Toolmark”, AFTE Journal, Winter 1997, Vol. 29, No. 1, pg. 58.

14. NIBIN METHOD

14.1. Scope: The National Integrated Ballistics Information Network (NIBIN) is a computerized system for acquiring and storing the images of known and unknown bullets and cartridge cases. NIBIN images portions of the primer/firing pin area of fired cartridge cases using state of the art optical and electronic technology. These images are then stored in databases and algorithms are used to correlate the images against each other using filters such as caliber, rifling specifications, date of crime and date of entry. These correlations produce lists of possible matches with the highest score at the top of the list. A firearm examiner can then recall images and compare them side by side on a monitor. If a possible association is found during this screening process then the actual evidence to test or evidence to evidence is compared by an firearm examiner utilizing traditional comparative microscopy techniques

14.2. Precautions/Limitations: The firearm examiner shall visually inspect the firearm to ensure that it is not loaded. If loaded, immediate steps shall be taken to ensure that the firearm is safely unloaded.

14.3. Related Information:

14.3.1. Physical Examination and Classification of Firearms Methods 1
14.3.2. Safe Firearm Handling Method 2
14.3.3. Test Firing Methods 9
14.3.4. Caliber Determination Methods 10
14.3.5. Worksheet Appendix 1
14.3.6. Firearm Safety Appendix 3
14.3.7. Range of Conclusions Appendix 4

14.4. Instruments:

14.4.1. NIBIN Database
14.4.2. Stereomicroscope
14.4.3. Calipers

14.5. Reagents/Materials: None

14.6. Hazards/Safety:

14.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

14.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

14.6.3. Appropriate hearing and eye protection shall be worn when applicable.

14.7. Reference Materials/Controls/Calibration Checks: None

14.8. Procedures/Instructions:

14.8.1. The NIBIN Procedures Manual shall be followed and the firearm examiner shall be certified by the Bureau of Alcohol, Tobacco, and Firearms (BATF) in order to make entries into the system. Latest versions are listed below and shall be utilized.

14.8.1.1. IBIS Matchpoint Version 2.3 (Indianapolis)
14.8.1.2. IBIS Matchpoint Version 3.1.0 (Fort Wayne)
14.8.1.3. IBIS TRAX-3D Version 2.3 (Indianapolis)
14.8.1.4. IBIS Trax-3D Version 3.1.0 (Fort Wayne)

14.8.2. The firearm examiner shall ensure suitability of the items being entered.

14.8.3. Test fired bullets shall not be entered into the NIBIN database.

14.8.4. The firearm examiner shall therefore ensure that:

14.8.4.1. Any evidence cartridge case selected for entry into NIBIN shall have sufficient individual characteristics within the firing pin impression and/or within the breech face marks on the primer to affect a match.
14.8.4.2. If there is more than one matching evidence cartridge case suitable for entry into NIBIN, the firearm examiner should select the best one for entry or, if necessary, more than one if different individual characteristics reproduce better on different tests.
14.8.4.3. Any information about the identification of evidence cartridge cases to each other and the selection of certain specimens for entry into NIBIN shall be documented within the case notes.

14.8.5. If a firearm examiner views a possible “hit” during the correlation process they shall prepare a “High Probability IBIS Hit” notification in memorandum form, notifying the contributor of the potential hit.

14.8.5.1. Hit notifications shall be tracked on a memo log maintained on an ISP network drive.
14.8.5.2. Hit notifications may be sent via US Mail or email.
14.8.5.3. The firearm examiner shall upload into LIMS under the case record(s) the hit notification memorandum.

14.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a firearms worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

14.10. Interpretations of Results: Not Applicable

14.11. Report Writing: Most NIBIN report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that firearms, bullets and cartridge cases, occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

14.12. References:

14.12.1. "IBIS BRASSTRAX-3D Training guide", Forensic Technology, Version 2.3, 2011.

14.12.2. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

14.12.3. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

14.12.4. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

14.12.5. "Technical Protocols for the Handling of Firearms and Ammunition", FBI, June 1992.

14.12.6. "Forensic Examiners Firearms Recall/Safety Warning List", FBI Laboratory

15. RANGE DETERMINATION VISUAL AND MICROSCOPIC METHODS

15.1. Scope: These methods assist the firearm examiner in determining whether an inanimate object with a defect (bullet hole) was in the near proximity of a firearm.

15.2. Precautions/Limitations: The firearm examiner shall handle the evidence as gently as possible, keeping in mind that the residues are very fragile by nature and can be lost if mishandled.

15.3. Related Information:

15.3.1. Range Determination Chemical Methods 16
15.3.2. Worksheet Appendix 1
15.3.3. Range of Conclusions Appendix 4
15.3.4. Ammunition Reference Collection Appendix 6
15.3.5. Verification of Casework Appendix 8

15.4. Instruments:

15.4.1. Stereomicroscope

15.5. Reagents/Materials: None

15.6. Hazards/Safety:

15.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

15.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

15.7. Reference Materials/Controls/Calibration Checks: None

15.8. Procedures/Instructions:

15.8.1. The visual examination of an item for gunshot residue shall include the examination and/or consideration of the following:

15.8.1.1. The presence of vaporous lead (smoke).
15.8.1.2. The presence of particulate metals (shavings of lead, copper, brass).
15.8.1.3. The presence of partially burnt and/or unburnt gunpowder.
15.8.1.4. The presence of melted adhering gunpowder.
15.8.1.5. A hole in the item.

15.8.1.6. The presence of a visible ring around the perimeter of holes.
15.8.1.7. The location of all holes, tears, missing buttons, etc.
15.8.1.8. The presence of burning or singeing or melting.
15.8.1.9. The presence of any possible masking effects.
15.8.1.10. The direction of artifacts surrounding the hole.

15.8.2. All observations regarding these physical effects and visible residues shall be included in the firearm examiners notes or appropriate gunshot residue worksheet.

15.8.3. The microscopic examination of an item for gunshot residue shall include the examination and/or consideration of the following:

15.8.3.1. The presence of vaporous lead (smoke).
15.8.3.2. The presence of particulate metals (shavings of lead, copper, brass.
15.8.3.3. The presence of partially burnt and/or unburnt gunpowder.
15.8.3.4. The presence of melted adhering gunpowder.
15.8.3.5. A hole in the item.
15.8.3.6. The presence of a visible ring around the perimeter of holes.
15.8.3.7. The location of all holes, tears, missing buttons, etc.
15.8.3.8. The presence of burning or singeing or melting.
15.8.3.9. The presence of any possible masking effects.
15.8.3.10. The direction of artifacts surrounding the hole.

15.8.4. All observations regarding these physical effects and visible residues shall be included in the firearm examiners notes or appropriate gunshot residue worksheet

15.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing gunshot residue worksheets. If possible, the firearm examiner should consider photographing the evidence item. It is understood that the condition of the evidence and the availability of equipment may make this unrealistic. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

15.10. Interpretations of Results:

15.10.1. Indications consistent with the Discharge of a Firearm.

15.10.1.1. Vaporous Lead (smoke).
15.10.1.2. Particulate Metals (shavings of lead, copper, brass).
15.10.1.3. Unburned Gunpowder (morphology).
15.10.1.4. Melted Adhering Gunpowder.

15.10.2. Indications consistent with the Passage of a Bullet

15.10.2.1. A hole in the item.

15.10.2.2. Visible ring around the perimeter of holes.

15.10.3. Indications consistent with a Contact Shot

15.10.3.1. Ripping or Tearing.
15.10.3.2. Burning or Singeing.
15.10.3.3. Melted Artificial Fibers.
15.10.3.4. Heavy Vaporous Lead Residues.

15.10.4. Possible Masking Effects

15.10.4.1. Dark Background Color.
15.10.4.2. Blood Staining.
15.10.4.3. Intervening Object.

15.10.5. If the above observations support the findings of a "contact shot" no comparison is necessary.

15.10.6. If the observations do not support a "contact shot" finding, a working hypothesis will be formed based on the above observations. This hypothesis will be utilized during the Range Determination Chemical Methods 16.

15.11. Report Writing: Most range determination report writing can be found in the Range of Conclusions Appendix 4.

15.12. References:

15.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

15.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

15.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

15.12.4. F.B.I., "Gunpowder and Gunshot Residue", Training Manual, 2000 Edition.

15.12.5. Dillon, John, H., "A Protocol for Gunshot Residue Examinations in Muzzle-To-Target Distance Determinations", AFTE Journal, July 1990, Vol.22, No.3, pgs. 243-274.

15.12.6. Rathman, Garry, "Gunpowder/Gunshot Residue Deposition Barrel Length vs. Powder Type", AFTE Journal, July 1990, Vol.22, No.3, pgs. 318-327.

16. RANGE DETERMINATION CHEMICAL METHODS

16.1. Scope: These methods will assist the firearm examiner in determining whether an inanimate object with a defect (bullet hole) was in the near proximity of a firearm. These methods will specifically detail the methods employed pertaining to the use of the Modified Griess Direct and Reverse application methods as well as the Sodium Rhodizonate Direct and Bashinsky Transfer methods.

16.2. Precautions/Limitations: The firearm examiner shall handle the evidence as gently as possible, keeping in mind that the residues are very fragile by nature and can be lost if mishandled. The firearm examiner is reminded that either of the two Griess test methods shall be performed prior to either of the two Sodium Rhodizonate test methods. Lastly, it is the responsibility of the firearm examiner to determine which test is appropriate (direct and/or transfer) as it pertains to the type of evidence submitted.

16.3. Related Information:

16.3.1. Range Determination Visual and Microscopic Methods 15
16.3.2. Worksheet Appendix 1
16.3.3. Range of Conclusions Appendix 4
16.3.4. Verification of Casework Appendix 8
16.3.5. Hazardous Chemical Waste Management Appendix 9

16.4. Instruments:

16.4.1. Stereomicroscope
16.4.2. Balance
16.4.3. Ruler
16.4.4. Transparent Overlays

16.5. Reagents/Materials:

16.5.1. Fixing photo paper (Griess Paper)

16.5.1.1. Make-up fixing solution according to package directions.
16.5.1.2. In a dark room, place a portion of fixing solution in a photo tray.
16.5.1.3. Place water in another photo tray.
16.5.1.4. While in a dark room take photo paper out of package and place in the fixing solution for the appropriate amount of time suggested in package directions on fixing solution.
16.5.1.5. After allotted time in the fixing bath take photo paper out of fixing solution and place the paper the in water tray for approximately 3 to 5 minutes.
16.5.1.6. Take photo paper from water tray and hang it up to dry for several hours.
16.5.1.7. After paper is dry place in a plastic bag that is in a manila envelope.

16.5.1.8. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

16.5.2. Sensitized Blank (Griess Paper)

16.5.2.1. Add 0.75 grams of Sulfanilic Acid to 150 milliliters of distilled water and mix.
16.5.2.2. Add 0.42 grams of Alpha Naphthol to 150 milliliters of methanol and mix.
16.5.2.3. Once both the solutions in step 1 & 2 are prepared mix them together in a clean photo tray.
16.5.2.4. Saturate pieces of filter paper or desensitized photo paper in this solution.
16.5.2.5. Once the now sensitized blanks are dry, store in an airtight plastic container.
16.5.2.6. Utilizing these proportions, mix the quantity desired.
16.5.2.7. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

16.5.3. 15% Acetic Acid Solution:

16.5.3.1. Prepare a 15% Acetic Acid Solution utilizing Concentrated Glacial Acetic Acid and distilled water.
16.5.3.2. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

16.5.4. Nitrite Test Strips

16.5.4.1. Dissolve 0.6 grams of Sodium Nitrite in 100 milliliters of distilled water.
16.5.4.2. Saturate pieces of filter paper or cotton swabs in this mixture.
16.5.4.3. Store in an airtight plastic container.
16.5.4.4. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

16.5.5. Sodium Rhodizonate Solution (#1)

16.5.5.1. Prepare a saturated Sodium Rhodizonate solution using Sodium Rhodizonate and distilled water. Add Sodium Rhodizonate to the distilled water and mix until the solution is the color of a strong tea.

16.5.5.2. If there is surplus of this solution it should be disposed of and not retained.

16.5.6. Buffer Solution for Sodium Rhodizonate test (#2)

16.5.6.1. Dissolve 1.9 grams of Sodium Bitartrate and 1.5 grams of Tartaric Acid in 100 milliliters of distilled water.

16.5.6.2. This usually requires both heat and agitation to dissolve in a reasonable amount of time.

16.5.6.3. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

16.5.7. 5% Hydrochloric Acid Solution for Sodium Rhodizonate Test (#3)

16.5.7.1. Prepare a 5% Hydrochloric Acid solution utilizing Hydrochloric Acid and distilled water.

16.5.7.2. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

16.6. Hazards/Safety:

16.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

16.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

16.6.3. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. It is recommended that the firearm examiner consult the appropriate Material Safety Data Sheet (MSDS) for each chemical prior to use.

16.6.4. The examiner shall use eye protection and gloves, and work within a fume hood or utilize a spot vent when mixing all chemicals.

16.6.5. When mixing acid and water the firearm examiner shall add acid to water. Never should water be added to acid!

16.6.6. Sulfanilic Acid is toxic and can pose a **SEVERE HEALTH HAZARD.** Sulfanilic Acid is a strong corrosive and can pose a **SEVERE CONTACT HAZARD.**

16.6.7. Alpha Naphthol is toxic and can pose a **SEVERE HEALTH HAZARD.**

16.6.8. Methanol is flammable and can pose a **SEVERE FLAMMABILITY HAZARD.** Methanol is also a poison and can pose a severe **CONTACT AND HEALTH HAZARD.**

16.6.9. Glacial Acetic acid is a corrosive and can pose a **SEVERE CONTACT HAZARD**. Glacial Acetic acid is also flammable and can pose a **SEVERE FLAMMABILITY HAZARD.**

16.6.10. Hydrochloric Acid is poison and a corrosive and can pose a **SEVERE HEALTH HAZARD.**

16.7. Reference Materials/Controls/Calibration Checks:

16.7.1. The Minimum Analytical Standards & Controls for the Modified Griess procedure consists of placing a test mark utilizing a Nitrite Test Strip, on the four corners of the sensitized blanks being used. An immediate orange color should appear on the sensitized blank. This color shift indicates that the sensitized blank is sensitive to the presence of nitrites.

16.7.2. The Standards & Controls for the Sodium Rhodizonate test consists of utilizing cotton swabs dampened with a 5% Hydrochloric acid solution. One of the treated swabs is rubbed against a piece of known lead. This swab is then processed with the Sodium Rhodizonate test to insure that the test is reacting properly. Another treated swab is rubbed on the item to be tested. This must be well away from any holes examined. This swab is then processed with the Sodium Rhodizonate test to ensure that the item being tested will not produce a false positive.

16.7.3. The firearm examiner shall document in their notes the reaction of the reagents from the methods listed in 16.7.1 and 16.7.2. They shall also list in their notes the date the reagents were made and the initials of the individual responsible for preparing the reagents.

16.7.4. All other controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

16.7.5. If the firearm examiner is using a transparent overlay, that overlay shall be checked with a NIST Certified ruler.

16.8. Procedures/Instructions:

16.8.1. Modified Griess Direct Application

16.8.1.1. Check the sensitivity of the blank by utilizing the standards and control method listed in 16.7.1.
16.8.1.2. Place the sensitized blank (photo paper - emulsion side down or sensitized filter paper) over the area to be tested.
16.8.1.3. Soak a piece of nitrite free cheesecloth or filter paper with the acetic acid solution, and place this over the reverse side of the evidence.
16.8.1.4. Apply heat and pressure with an iron until the acetic acid solution treated paper is dry.
16.8.1.5. Record all observations in notes.

16.8.2. Modified Griess Reverse Application

16.8.2.1. Check the sensitivity of the blank by utilizing the standards and control method listed in 16.7.1.
16.8.2.2. Wipe the side of the sensitized blank that will be in contact with the questioned area with the acetic acid solution.
16.8.2.3. Place the sensitized blank (photo paper - emulsion side down or filter paper) over the area to be tested.
16.8.2.4. Place a piece of filter paper or nitrite free cheese cloth over either the sensitized blank or evidence depending on what is being used for a blank.
16.8.2.5. Apply heat and pressure with an iron until the acetic acid solution treated paper is dry.
16.8.2.6. Record all observations in notes.

16.8.3. Sodium Rhodizonate Direct Application

16.8.3.1. Check the sensitivity of the chemicals by utilizing the standards and control method listed in 16.7.2.
16.8.3.2. Spray the Sodium Rhodizonate Solution (#1) onto the questioned area.
16.8.3.3. Spray the tested area with the Buffer Solution (#2).
16.8.3.4. Spray the tested area with the Hydrochloric Acid Solution (#3)
16.8.3.5. Repeat this process on all holes/areas to be tested. Both sides of a hole should be tested if there is a question of entrance vs. exit.
16.8.3.6. Record all observations in notes.

16.8.4. Sodium Rhodizonate Bashinsky Transfer Application

16.8.4.1. Check the sensitivity of the chemicals by utilizing the standards and control method listed in 16.7.2.

16.8.4.2. Uniformly dampen a piece of filter paper with the Acetic Acid Solution.
16.8.4.3. Place the treated filter paper over the hole/area to be tested.
16.8.4.4. Place a second piece of filter paper over the first and apply moderate pressure or apply a hot iron for approximately 5 seconds.
16.8.4.5. Remove both pieces of filter paper and spray the Sodium Rhodizonate Solution (#1) on to the tested area of the filter paper.
16.8.4.6. Spray the tested area of the filter paper with the Buffer Solution (#2).
16.8.4.7. Spray the tested area of the filter paper with the Hydrochloric Acid Solution (#3).
16.8.4.8. Repeat this process on all holes/areas to be tested. Both sides of a hole should be tested if there is a question of entrance vs. exit.
16.8.4.9. Record all observations in notes.

16.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing gunshot residue worksheets. If possible, the firearm examiner should consider photographing the evidence item before and after chemical application. The condition of the evidence and the availability of equipment may make this impractical. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

16.10. Interpretations of Results:

16.10.1. Modified Griess Direct and Reverse Application

16.10.1.1. Any orange, orange-red indications on the paper are the results of the chemically indicative test for the presence of nitrite residues.
16.10.1.2. Any pattern of orange, orange red indications shall be measured and documented in either the firearm examiners notes or the appropriate gunshot residue worksheet.

16.10.2. Sodium Rhodizonate Direct and Bashinsky Transfer Application

16.10.2.1. A violet or purple colored ring, corresponding to the margin of the hole, or a violet or purple colored stain, corresponding to the area tested constitutes a positive reaction for lead.
16.10.2.2. Any violet or purple indications shall be documented in either the firearm examiners notes or the appropriate gunshot residue worksheet.

16.11. Report Writing: Most range determination report writing can be found in the Range of Conclusions Appendix 4.

16.12. References:

16.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

16.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

16.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

16.12.4. F.B.I., "Gunpowder and Gunshot Residue", Training Manual, 2000 Edition.

16.12.5. Dillon, John, H., "A Protocol for Gunshot Residue Examinations in Muzzle-To-Target Distance Determinations", AFTE Journal, July 1990, Vol.22, No.3, pgs. 257-274.

16.12.6. Dillon, John, H., "The Modified Griess Test: A Chemically Specific Chromophoric Test For Nitrite Compounds in Gunshot Residues," AFTE Journal, July 1990, Vol. 22, No. 3, pgs. 243-250.

16.12.7. Gamboa, Frances, A., Raymond, Kusmi, "Evaluation of Photographic Paper Alternatives for the Modified Griess Test," AFTE Journal, Fall 2006, Vol. 38, No. 4, pgs. 339-347.

16.12.8. Haag, Lucien, C., (2006). Shooting Incident Reconstruction. Burlington, MA: Elsevier, pp. 76-77.

16.12.9. Rathman, Garry, "Gunpowder/Gunshot Residue Deposition Barrel Length vs. Powder Type", AFTE Journal, July 1990, Vol.22, No.3, pgs. 318-327.

17. RANGE DETERMINATION TEST PATTERN METHODS

17.1. Scope: In order to properly perform a muzzle-to-target range determination examination, it is usually necessary to attempt to reproduce the gunshot residue patterns and or shotgun pattern present on the suspect item. This reproduction is accomplished by shooting tests at varying distances until the gunshot residue pattern and or shotgun pattern present on the suspect item is reproduced.

17.2. Precautions/Limitations: It is an essential prerequisite that the suspect firearm and ammunition consistent with the suspect ammunition be utilized

17.3. Related Information:

17.3.1. Safe Firearm Handling Method 2
17.3.2. Test Firing Methods 9
17.3.3. Range Determination Visual and Microscopic Methods 15
17.3.4. Range Determination Chemical Methods 16
17.3.5. Worksheet Appendix 1
17.3.6. Firearm Safety Appendix 3
17.3.7. Range of Conclusions Appendix 4
17.3.8. Verification of Casework Appendix 8

17.4. Instruments:

17.4.1. Ruler
17.4.2. Transparent Overlays

17.5. Reagents/Materials:

17.5.1. Whenever possible the firearm examiner should attempt to duplicate the evidence material with test target media. Normally, chemically uncontaminated plain white cotton cloth is suitable in most instances. However, there are occasions in which the physical characteristics of the fabric of the evidence or when the questioned surface is something other than fabric, such as drywall, window screen, etc. must be duplicated for the desired results.

17.5.2. Whenever shotgun patterns are duplicated, the use of cardboard target backers or like material is acceptable.

17.6. Hazards/Safety:

17.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

17.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

17.6.3. Appropriate hearing and eye protection must be worn when applicable.

17.7. Reference Materials/Controls/Calibration Checks:

17.7.1. All controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

17.7.2. If the firearm examiner is using a transparent overlay, that overlay shall be checked with a NIST Certified ruler.

17.8. Procedures/Instructions:

17.8.1. Non-Shot Pellet Test Pattern Method

17.8.1.1. Attach appropriate size pieces of cotton twill material or a piece of material similar to the evidence to a nitrite free cardboard backing board.
17.8.1.2. Tests should be shot one per piece of target media.
17.8.1.3. It is essential that the suspect firearm and appropriate ammunition be utilized for these tests.
17.8.1.4. Process test media according to the methods listed in Range Determination Visual and Microscopic Methods 15 and Range Determination Chemical Methods 16.
17.8.1.5. Tests should be shot in increasing or decreasing range increments until a distance is established, both shorter and longer than, that reproduces the gunshot residue patterns on the suspect item.
17.8.1.6. Record all observations in notes.

17.8.2. Shot Pellet Test Pattern Method

17.8.2.1. The test media for shot pellet test patterns is an appropriate sized cardboard target backer, or paper attached to such material.
17.8.2.2. Tests should be shot one per piece of target media.
17.8.2.3. It is essential that the suspect firearm and appropriate ammunition be utilized for these tests.
17.8.2.4. Tests should be shot in increasing or decreasing range increments until a distance is established, both shorter and longer than, that reproduces the shot pellet patterns on the suspect item.
17.8.2.5. Record all observations in notes.

17.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing gunshot residue worksheets. If possible, the firearm examiner should consider photographing the results. The condition of the evidence and the availability of equipment may make this impractical. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

17.10. Interpretations of Results:

17.10.1. By utilizing the suspect firearm and appropriate ammunition it may be possible to duplicate the gunshot residue and/or shot pattern present on a suspect item. Therefore one can ascertain the **approximate bracketed** distance that particular firearm's muzzle was from the suspect item when it was shot.

17.10.1.1. To employ a bracketing technique in distance determination, it is necessary to determine at what distance a smaller known pattern is consistently produced and at what distance a larger known pattern is consistently produced.

17.10.1.2. Whenever possible, at least two (2) confirming shots should be utilized to confirm the bracketed distance.

17.11. Report Writing: Most range determination report writing can be found in the Range of Conclusions Appendix 4.

17.12. References:

17.12.1. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

17.12.2. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

17.12.3. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

17.12.4. F.B.I., "Gunpowder and Gunshot Residue", Training Manual, 2000 Edition.

17.12.5. Dillon, John, H., "A Protocol for Gunshot Residue Examinations in Muzzle-To-Target Distance Determinations", AFTE Journal, July 1990, Vol.22, No.3, pgs. 243-274.

17.12.6. Rathman, Garry, "Gunpowder/Gunshot Residue Deposition Barrel Length vs. Powder Type", AFTE Journal, July 1990, Vol.22, No.3, pgs. 318-327.

18. PHYSICAL EXAMINATION AND CLASSIFICATION OF TOOLS AND TOOLMARK METHODS

18.1. Scope: This method is used for the initial examination and classification of tools and toolmarks.

18.2. Precautions/Limitations: The firearm examiner shall be aware that their area of expertise is not in trace examination and should consult with the Indiana State Police Laboratory Trace Microanalysis Unit when appropriate.

18.3. Related Information:

18.3.1. Microscopic Comparison Methods 12
18.3.2. Trace Examination Methods 13
18.3.3. Toolmark Test Standards and Casting Methods 19
18.3.4. Worksheet Appendix 1
18.3.5. Range of Conclusions Appendix 4
18.3.6. Calibration Standards Appendix 7

18.4. Instruments:

18.4.1. Stereomicroscope
18.4.2. Calipers
18.4.3. Ruler

18.5. Reagents/Materials: None

18.6. Hazards/Safety:

18.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

18.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

18.7. Reference Materials/Controls/Calibration Checks:

18.7.1. All controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

18.8. Procedures/Instructions:

18.8.1. Document the as-received condition of the seals of the evidence.

18.8.2. Mark the outside of the original packaging with the case number, item number and examiner's initials.

18.8.3. A tool worksheet may be filled out and include the following:

18.8.3.1. Trace Evidence.
18.8.3.2. The class characteristics of the tool.
18.8.3.3. The type of tool.
18.8.3.4. The brand name of tool.
18.8.3.5. The size of the tool.
18.8.3.6. The condition of the tool.
18.8.3.7. Type of tests conducted (if any).
18.8.3.8. The medium used for testing.
18.8.3.9. Any other data deemed relevant by the examiner.

18.8.4. A toolmark worksheet may be filled out and include the following:

18.8.4.1. The suitability of the toolmark for comparison purposes.
18.8.4.2. Class of tool that made the toolmark.
18.8.4.3. Physical characteristics of the toolmark.
18.8.4.4. Direction of the toolmark.
18.8.4.5. Any other data deemed relevant by the examiner.

18.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a toolmark worksheet. If possible, the firearm examiner should consider photographing the submitted evidence. The condition of the evidence and the availability of equipment may make this impractical. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

18.10. Interpretations of Results:

18.10.1. If the toolmark is suitable for comparison the examination may continue (see Microscopic Comparison Methods 12).
18.10.2. If the toolmark has the same class characteristics as the suspect tool the examination may continue (see Microscopic Comparison Methods 12).

18.11. Report Writing: Most toolmark report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that tools and toolmarks occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

18.12. References:

18.12.1. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

18.12.2. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

18.12.3. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

18.12.4. Cochrane, D.W., "Class Characteristics of Cutting Tools and Surface Design", AFTE Journal, July 1985, Vol. 17, No.3, pgs. 73-82.

18.12.5. Miller, Jerry, "An Introduction to the Forensic Examination of Toolmarks", AFTE Journal, Summer 2001, Vol. 33, No.3, pgs. 233-248.

19. TOOLMARK TEST STANDARDS AND CASTING METHODS

19.1. Scope: This method will detail how toolmark test standards and casting materials are gathered.

19.2. Precautions/Limitations: None

19.3. Related Information:

19.3.1. Microscopic Comparison Methods 12
19.3.2. Physical Examination and Classification of Tools and Toolmark Methods 18
19.3.3. Range of Conclusions Appendix 4
19.3.4. Verification of Casework Appendix 8

19.4. Instruments:

19.4.1. Stereomicroscope
19.4.2. Comparison Microscope

19.5. Reagents/Materials:

19.5.1. Mikrosil® Casting Material

19.6. Hazards/Safety:

19.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

19.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

19.7. Reference Materials/Controls/Calibration Checks:

19.7.1. All controls and calibration checks shall be performed in strict accordance to those listed in the Calibration Standards Appendix 7.

19.8. Procedures/Instructions:

19.8.1. Test Mark or Test Cut Method

19.8.1.1. The initial test media must be soft enough to prevent alterations of the tool's working surface. Lead sheet or lead wire is the preferred media.

19.8.1.2. The firearm examiner may use material submitted by the contributor which was gathered as “test” or “standard” samples.

19.8.1.3. Subsequent tests might require the use of a harder test media to better reproduce the toolmarks.

19.8.1.4. A systematic approach should be used for the production of test marks or standards. Consideration should be given to:

19.8.1.4.1. Areas of recent use on the tool in question

19.8.1.4.2. Direction of use

19.8.1.4.3. Indexing of test standards/marks

19.8.2. Casting Method

19.8.2.1. Prepare the casting material as per manufacturer’s specifications.

19.8.2.2. Place the casting material over the toolmark to be cast.

19.8.2.3. Allow the cast the appropriate amount of time to cure.

19.8.2.4. Gently lift the cast off the toolmark.

19.8.2.5. A systematic approach should be used for the production of test marks or standards. Consideration should be given to:

19.8.2.5.1. Areas of recent use on the tool in question

19.8.2.5.2. Direction of use

19.8.2.5.3. Indexing of test standards/marks

19.8.2.6. Consideration must be given to placing identifying marks as well as orientation marks on the back of the cast.

19.8.3. All test cuts, test marks, or casts will be considered evidence and shall be treated as such.

19.8.3.1. The test cuts, test marks, or casts shall be considered a “new item” generated in the laboratory and numbered as such (e.g. 001T for a test cut or test mark from a tool submitted as item 001).

19.8.3.2. The container will be readily marked with the laboratory case number, new item number, and “toolmark test cuts, test marks, or casts” for ease of identification.

19.8.3.3. Generate the appropriate notations in the Laboratory Information Management System and print a bar code label. Attach the barcode label to the test media container.

19.8.3.4. The firearm examiner shall document in his/her notes, the disposition of the test cuts, test marks, or casts and the date the test cuts, test marks, or casts were made.

19.8.3.5. The firearm examiner shall document in the Certificate of Analysis the disposition of the test cuts, test marks, or casts (e.g. Returned to contributor).

19.8.3.6. Follow all other Laboratory Policy as it pertains to evidence handling.

19.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a toolmark worksheet. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

19.10. Interpretations of Results:

19.10.1. If the toolmark is suitable for comparison the examination may continue (see Microscopic Comparison Methods 12).

19.10.2. If the toolmark has the same class characteristics as the suspect tool the examination may continue (see Microscopic Comparison Methods 12).

19.11. Report Writing: Most toolmark report writing can be found in the Range of Conclusions Appendix 4. However, it is noted that tools and toolmarks occasionally are submitted inoperable or in very poor condition and these Range of Conclusions may not be pertinent.

19.12. References:

19.12.1. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

19.12.2. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

19.12.3. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

19.12.4. Cochrane, D.W., “Class Characteristics of Cutting Tools and Surface Design”, AFTE Journal, July 1985, Vol. 17, No. 3, pgs. 73-82.

19.12.5. Cassidy, Frank, “Replication of Identifying Marks When Using Mikrosil Castings”, AFTE Journal, April 1993, Vol. 25, No. 2, pgs. 130-131.

19.12.6. Wilson, Robert, “Reproduced Impressed Markings for Comparison by Casting with Mikrosil”, AFTE Journal, July 1994, Vol. 26, No. 3, pgs. 181-184

19.12.7. Miller, Jerry, “An Introduction to the Forensic Examination of Toolmarks”, AFTE Journal, Summer 2001, Vol. 33, No. 3, pgs. 233-248.

20. SERIAL NUMBER RESTORATION METHODS

20.1. Scope: This method will detail how a firearm examiner shall complete serial number restorations. This method includes polishing, magnetic particle inspection, chemical etching, chemical etching electrolytic, and barcode decryption which may aid the firearm examiner in the recovery of an obliterated or obscured serial number.

20.2. Precautions/Limitations: The firearm examiner shall proceed slowly and pick the appropriate method which will be most effective for the evidence which is submitted. The firearm examiner should also consult available literature to ascertain whether the submitted evidence has a hidden serial number.

20.3. Related Information:

20.3.1. Physical Examination and Classification of Firearms Methods 1
20.3.2. Safe Firearm Handling Method 2
20.3.3. Worksheet Appendix 1
20.3.4. Range of Conclusions Appendix 4
20.3.5. Firearms Reference Collection Appendix 5
20.3.6. Verification of Casework Appendix 8
20.3.7. Hazardous Chemical Waste Management Appendix 9

20.4. Instruments:

20.4.1. Stereomicroscope
20.4.2. Balance
20.4.3. Horseshoe Type Magnet
20.4.4. Battery Charger and/or battery

20.5. Reagents/Materials:

20.5.1. Fry's Reagent (Ferrous Applications)

20.5.1.1. 90 grams Cupric Chloride
20.5.1.2. 120 ml Hydrochloric Acid
20.5.1.3. 100 ml distilled water

20.5.2. Turners Reagent (Ferrous Applications)

20.5.2.1. 30 ml distilled water
20.5.2.2. 40 ml Hydrochloric Acid
20.5.2.3. 2.5 grams Cupric Chloride
20.5.2.4. 25 ml Ethyl Alcohol

20.5.3. Davis Reagent (Ferrous Applications)

20.5.3.1. 5 grams Cupric Chloride
20.5.3.2. 50 ml Hydrochloric Acid

20.5.3.3. 50 ml Distilled Water

20.5.4. 25% Nitric Acid (Ferrous and Non Ferrous Applications)

20.5.4.1. 25 ml Nitric Acid
20.5.4.2. 75 ml distilled water

20.5.5. Acidic Ferric Chloride (Non-Ferrous Applications)

20.5.5.1. 25 grams Ferric Chloride
20.5.5.2. 25 ml Hydrochloric Acid
20.5.5.3. 100 ml Distilled Water

20.5.6. Ferric Chloride (Non-Ferrous Applications)

20.5.6.1. 25 grams Ferric Chloride
20.5.6.2. 100 ml Distilled Water

20.5.7. 10% Sodium Hydroxide (Non-Ferrous Applications)

20.5.7.1. 10 grams Sodium Hydroxide
20.5.7.2. 90 ml Distilled Water

20.5.8. Phosphoric/Nitric Acid (Non-Ferrous Applications)

20.5.8.1. 98 ml 85% Phosphoric Acid
20.5.8.2. 5 ml Concentrated Nitric Acid

20.5.9. If there is to be surplus material the firearm examiner shall mark the container with their initials, the date, the chemical name, concentration with lot numbers if known and when needed, and affix a safety sticker when appropriate. An entry into the local FFIU chemical log shall reflect the above information.

20.5.10. The firearm examiner shall record in their notes the date the reagent was prepared and the initials of the person responsible for preparing them.

20.6. Hazards/Safety:

20.6.1. This procedure involves materials, operations and equipment that may be hazardous. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the firearm examiner to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered.

20.6.2. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan shall be exercised.

20.6.3. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. It is recommended that the firearm examiner consult the appropriate Material Safety Data Sheet (MSDS) for each chemical prior to use.

20.6.4. The examiner shall use eye protection and gloves, and work within a fume hood or utilize a spot vent when mixing all chemicals.

20.6.5. When mixing acid and water the firearm examiner shall add acid to water. Never should water be added to acid!

20.6.6. Cupric Chloride is an irritant and toxic and can pose a **SEVERE HEALTH HAZARD.**

20.6.7. Hydrochloric Acid is a poison and toxic and can pose a **SEVERE CONTACT AND HEALTH HAZARD.**

20.6.8. Nitric Acid is toxic and a strong solvent possessing oxidizing properties that can pose a **SEVERE CONTACT AND HEALTH HAZARD.**

20.6.9. Ammonium Chloride is an irritant and toxic and can pose a **SEVERE CONTACT HAZARD.**

20.6.10. Ethyl Alcohol is an irritant, poison and toxic that can pose a **SEVERE CONTACT, INHALATION, AND HEALTH HAZARD.**

20.6.11. Ferric Chloride is a corrosive and irritant that can pose **SEVERE CONTACT, INHALATION, AND HEALTH HAZARD.**

20.6.12. Sodium Hydroxide is an irritant, poison and toxic that can pose a **SEVERE CONTACT, INHALATION, AND HEALTH HAZARD.**

20.6.13. Phosphoric Acid is a corrosive and can pose a **SEVERE CONTACT HAZARD.**

20.7. Reference Materials/Controls/Calibration Checks:

20.7.1. When utilizing any chemicals during this process the firearms examiner shall note all observations in their notes in regards to reactivity. Prior to the restoration attempt, the firearms examiner shall test an area near the obliterated serial number for reactivity and note the reaction in the case notes. Such observations can include, “bubbling”, “vapors rising from the surface”, and/or “observed color change of surface”. This will ensure that this particular chemical is working with the metal surface to be restored.

20.8. Procedures/Instructions:

20.8.1. Polishing Method

20.8.1.1. Note and record any visible characters prior to polishing.
20.8.1.2. Polish the area of the obliteration using either a dremel type tool with a sanding or polishing disc, or fine grit sandpaper.
20.8.1.3. Depending on the extent of the obliteration, continue polishing until the surface is mirror-like removing all scratches. If the obliteration is severe it may not be possible or desirable to remove all the scratches.
20.8.1.4. If the serial number has not appeared proceed to the chemical method.

20.8.2. Chemical Etching Method

20.8.2.1. Utilize the appropriate chemical reagent(s) according to the evidence submitted. The examiner should start with the least invasive chemical first.
20.8.2.2. Apply the chemical solution to the area of obliteration utilizing cotton tip applicators or swabs that have been moistened with the chemical solution.

20.8.2.2.1. It is generally best to work the reagents in one direction-either right to left or left to right dependent upon the evidence or preference of the firearm examiner.

20.8.2.3. If the serial number has not appeared it may not be restorable or the firearm examiner may proceed to the chemical etching electrolytic method.
20.8.2.4. Record results.

20.8.3. Chemical Etching Electrolytic Method

20.8.3.1. Attach the specimen to the positive terminal (red wire) of the power supply via an alligator clip.
20.8.3.2. Thoroughly soak the cotton tip of an applicator with the appropriate chemical etching solution and attach this to the negative terminal (black wire) of the power supply via an alligator clip, being certain to attach the moistened area at the base of the cotton tip.
20.8.3.3. Turn on the power supply and adjust the voltage to 4V or 6V.
20.8.3.4. Wipe the area of obliteration, being careful to not touch the surface of the specimen with the alligator clip.
20.8.3.5. If the serial number has not appeared it may not be restorable or the firearm examiner may wish to start over at the polishing method.
20.8.3.6. Record results.

20.8.4. Magnetic Particle Inspection

20.8.4.1. Make sure the surface where the serial number is stamped is magnetic and the surrounding parts are not. Test multiple areas.
20.8.4.2. Choose and apply magnet, centering the serial number between the two poles of the magnet.
20.8.4.3. Spray Magnaflux into a beaker and apply it to the serial number surface area with a dropper.
20.8.4.4. Record results.

20.8.5. Barcode Decryption

20.8.5.1. Inspect barcode to ensure that at least portions of the full barcode are available.
20.8.5.2. Determine if all bars are present.
20.8.5.3. Delineate the bars into character units.

20.8.5.3.1. Use of an enlarged photograph or photocopy is recommended.
20.8.5.3.2. Start at the far left bar and count five bars over then label this as the first character set.
20.8.5.3.3. Repeat this procedure for the remaining bars to identify all character sets. There will be nine (9) character sets visible.

20.8.5.4. Interpret and document the barcode element size patterns.

20.8.5.4.1. Each bar and space from left to right is to be labeled “W” for wide or “N” for narrow.
20.8.5.4.2. Complete this for each character set.
20.8.5.4.3. Using the Bar Code 39 key table below, begin correlating each developed pattern sequence from the individual character sets to determine the character represented by the pattern.
20.8.5.5. Record results.

Bar Code 39 Table					
Character	**Pattern**	**Character**	**Pattern**	**Character**	**Pattern**
0	NNNWWNWNN	F	NNWNWWNNN	U	WWNNNNNNW
1	WNNWNNNNW	G	NNNNNWWNW	V	NWWNNNNNW
2	NNWWNNNNW	H	WNNNNWWNN	W	WWWNNNNNN
3	WNWWNNNNN	I	NNWNNWWNN	X	NWNNWNNNW
4	NNNWWNNNW	J	NNNNWWWNN	Y	WWNNWNNNN
5	WNNWWNNNN	K	WNNNNNNWW	Z	NWWNWNNNN
6	NNWWWNNNN	L	NNWNNNNWW	Space	NWWNNNWNN
7	NNNWNNWNW	M	WNWNNNNWN	*	NWNNWNWNN
8	WNNWNNWNN	N	NNNNWNNWW	$	NWNWNWNNN
9	NNWWNNWNN	O	WNNNWNNWN	/	NWNWNNNWN
A	WNNNNWNNW	P	NNWNWNNWN	+	NWNNNWNWN
B	NNWNNWNNW	Q	NNNNNNWWW	%	NNNWNWNWN
C	WNWNNWNNN	R	WNNNNNWWN	-	NWNNNNWNW
D	NNNNWWNNW	S	NNWNNNWWN	.	WWNNNNWNN
E	WNNNWWNNN	T	NNNNWNWWN	This cell blank	

20.9. Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, or by utilizing a serial number worksheet. If possible, the firearm examiner should consider photographing the submitted evidence before, during, and after the restoration process. The condition of the evidence and the availability of equipment may make this impractical. The examiner shall strictly adhere to all note taking procedures as prescribed by laboratory policy.

20.10. Interpretations of Results:

20.10.1. If any characters become visible note these characters. The firearm examiner shall be absolutely certain as to the characters which are restored.

20.10.2. The firearm examiner may report partial numbers which are restored.

20.10.2.1. The examiner shall use an asterisk (*) to indicate an inconclusive character (e.g. 5 6 * 7 8 asterisk indicating that the number may be a 6 or a 0).

20.10.2.2. The examiner shall use a question mark to indicate an unrestored character (e.g.: 5 6 ? 7 8 ? 9 0).

20.11. Report Writing: Most serial number report writing can be found in the Range of Conclusions Appendix 4.

20.12. References:

20.12.1. Association of Firearms and Toolmark Examiners Glossary, 6th Edition, Version 6.101613

20.12.2. Association of Firearms and Toolmark Examiners Training Manual, March 3, 2001

20.12.3. Association of Firearms and Toolmark Examiners Procedures Manual, July 9, 2001

20.12.4. Treptow, Richard, S., Handbook of Methods for the Restoration of Obliterated Serial Numbers, NASA Contract Report #CR135322, 1978.

20.12.5. Kennington, Robert, "One Swab Serial Number Restoration", AFTE Journal, Summer 1997, Vol. 29, No. 3, pgs. 288-293.

20.12.6. Collins, John, "Modern Markings and Serial Number Methods", AFTE Journal, Summer 199, Vol. 31, No. 3, pgs. 309-317.

APPENDIX 1 WORKSHEETS

1. Laboratory work sheets serve several purposes, and can include; documenting the work done, as a useful aid in guiding the examination, and serving as an archive for future reference.

2. In general, documentation to support conclusions shall be such that in the absence of the examiner, another competent examiner or supervisor could evaluate what was done and interpret the data. Since case notes and records of observation are subject to subpoena or discovery, they shall be of a permanent nature. Handwritten notes and observations shall be in ink, not pencil. Any corrections to notes shall be made by an initialed single strike out. Nothing in the handwritten information should be obliterated or erased. It will be the practice of the FFIU to generate type-written notes using assigned laptop computers. It is recognized that handwritten notes will be prepared when a computer is not available or impractical to use. All worksheets are optional and are used at the firearm examiner's discretion.

3. FIREARM WORK SHEETS:

3.1. Worksheets which are available include:

3.1.1. General Notes Sheet
3.1.2. Firearm Worksheet
3.1.3. Gunshot Residue Examination Worksheet
3.1.4. Modified Griess Worksheet
3.1.5. Reverse Modified Griess Worksheet
3.1.6. Sodium Rhodizonate Worksheet
3.1.7. Bashinsky Transfer Worksheet
3.1.8. Cartridge Examination Worksheet
3.1.9. Cartridge Case Examination Worksheet
3.1.10. Bullet Examination Worksheet
3.1.11. Shotshell Examination Worksheet
3.1.12. Shotshell Wad Examination Worksheet
3.1.13. Pellet Examination Worksheet
3.1.14. Toolmark Examination Worksheet
3.1.15. NIBIN Worksheet
3.1.16. Serial Number Restoration Worksheet

APPENDIX 2 ABBREVIATIONS

1. The Indiana State Police Forensic Firearms Examiner may use abbreviations to streamline and speed the note taking process. These abbreviations are recognized in the Forensic Firearms Identification Discipline and have been authorized by the Unit Supervisor. Other abbreviations may be used at the discretion of the Unit Supervisor.

(Double click on Excel Spread Sheet to view all abbreviations)

NMFI	Not Marked For Identification
NPMFI	Not Previously Marked For Identification
OL/BL MD	Overall Length/Barrel Measuring Device
OOR	Out of round
OXID	Oxidation
P or PARA	Parallel
Pb	Lead
PERF	Performance
PERFCHK	Performance Check
PMFI	Previously Marked For Identification
P/BX	Pill Box
PL or PLS	Plastic
PLA/BG	Plastic Bag
±	Plus or Minus
POS or +	Positive
POSS	Possible
POLY	Polygonal
PRIM	Primer
PROJ	Projectile
Q&Q	Quantity and Quality
?	Questionable
REC	Receiver or Received
REF	Reference
REV	Revolver
RF	Rimfire
RN	Round Nose
R or RR	Rear
RT	Right
S	Smooth
SA	Single Action
SEAL	Sealant

APPENDIX 3 FIREARMS SAFETY

1. INTRODUCTION

1.1. Firearms Safety is absolutely vital in the Forensic Firearms Identification discipline. All members of the FFIU shall observe these practices and educate others whenever possible. The practices shall be adhered to at all times and should not be deviated from for any reason.

2. FIREARMS RANGE/WATER TANK SAFETY PROCEDURES

2.1. Absolutely no one outside the FFIU will shoot on the range or in the water tank without a firearms examiner being present.

2.2. Prior to firing in the range or in the water tank notify an examiner that you will be entering the shooting room to test fire a firearm.

2.3. If you are by yourself and no examiner is available to view the security camera call the Laboratory Manager (during working hours) or the Forensic Firearms Supervisor or his/her designee (after working hours) and let them know you will be firing in the range or water tank.

2.4. Before firing make sure the main door to the gun room is closed.

2.5. Before firing make sure the ventilation for the gun room has been turned on.

2.6. Make note of the warning placard located in the range lane or water tank. The placard notes the maximum velocity, muzzle energy, type of projectiles, and projectile weight that may be fired in the range or water tank.

2.7. When firing on the range or in the water tank, safety glasses and hearing protection is mandatory. Make sure that anyone observing is wearing hearing and eye protection.

2.8. Before firing make sure there is no obstruction in the barrel and do a safety check to determine if the firearm will fire full-auto. If there is any doubt as to the safety of shooting a certain firearm use the remote firing stand.

2.9. Make sure to use the correct ammunition suited for the firearm you are shooting.

2.10. Range-only load the firearm near the firing line with the muzzle pointed downrange.

2.11. Water Tank-only load and charge the firearm while the muzzle is in the shooting port.

2.12. While charging a semi-automatic rifle, pull the bolt back and release the hand at a 90 degree angle away from the gun quickly to avoid being injured in case of a slam fire.

2.13. Keep your finger off the trigger until you are ready to fire the firearm.

2.14. If you pull the trigger when the firearm is charged and nothing happens hold the firearm downrange and count out loud to “20”. This will be done to avoid being injured from a hangfire. Clear the weapon using the five step safety check, assess the problem and start the whole procedure over again.

2.15. If you have a malfunction (e.g. stovepipe, double feed…) do the five step safety check, assess the problem and start the whole procedure over again.

3. FIVE STEP SAFETY CHECK

3.1. Remove the magazine (pistol/rifle) or unlatch the cylinder/open the loading gate.

3.2. Rack the slide (pistol)/charge the bolt (rifle) at least three times with force or manually eject the cartridge case(s).

3.3. Lock or hold open the slide/bolt/cylinder.

3.4. Look to make sure no cartridges are in the chamber.

3.5. Feel to make sure no cartridges are in the chamber.

4. FIVE STEP SAFETY CHECK ILLUSTRATED

4.1. Semi-automatic handguns

Step 1: Remove the Magazine

Step 2: Rack the slide to the rear at least 3 times

Step 3: Lock the slide to the rear

Step 4: Visually inspect the chamber

Step 5: Physically inspect the chamber

4.2 Revolvers

Step 1: Open cylinder

Step 2: Eject any cartridges from chambers

Step 3: Visually and physically check all chambers

APPENDIX 4 RANGE OF CONCLUSIONS

1. INTERPRETATION OF RESULTS

1.1 Range of conclusions contained in this appendix are recognized and used throughout the Forensic Firearms Identification Discipline. It is acknowledged that this is not an all inclusive list of conclusions that a firearm examiner may reach in performance of his/her duties. This appendix shall serve as a guide for the firearm examiner and these Range of Conclusions may be modified by the firearm examiner to meet their need.

2. FIREARMS

2.1 Bullet/Cartridge Case Comparison

2.1.1 The bullet/cartridge case in item __ was identified as having been fired in the firearm in item __, or ;

2.1.2 The bullet/cartridge case in item __ was excluded as having been fired in the firearm in item__, or;

2.1.3 The bullet/cartridge case in item __ could not be identified as having been fired in the firearm in item __. Microscopic examination revealed that the bullet/cartridge case in item __ did not exhibit sufficient individual characteristics for identification. Similar class characteristics indicate the bullet/cartridge case in item __ could have been fired in the firearm in item __ or in any other firearm having similar general rifling characteristics. or;

2.1.4 The bullet/cartridge case in Item ___ could not be identified as having been fired in the firearm in Item ___. Microscopic examination revealed that the bullet/cartridge case in Item ___ revealed insufficient individual characteristics for identification due to the physical effects of damage. Similar class characteristics indicate the bullet/cartridge case in Item ___ could have been fired in the firearm in Item ___ or in any other firearm having similar general rifling characteristics. or;

2.1.5 Examination of item__ found insufficient characteristics for comparison purposes.

2.2 Firearms Function Tests

2.2.1 The firearm in item ___was examined for functional defects and test fired. No functional defects were found. or;

2.2.2 The firearm in item ___ was test fired and functional defects were observed. The functional defect(s) is___.

2.3 Uncertainty of Measurement

2.3.1 Examination of the shotgun in item_____ revealed the overall length to be approximately _____ inches and the barrel length to be approximately _____ inches. (This language shall be included in the Results Section of the Certificate of Analysis.)

2.3.2 Based on a 95% confidence level, the barrel and overall length measurements contain an uncertainty of ± 1/8 of an inch. (This language shall be included in the Remarks Section of the Certificate of Analysis.)

2.4 Muzzle to Target Determinations (All results are approximate measurements)

2.4.1 The area around the hole in the (describe area) of the ___ in item___ was microscopically examined and chemically processed for the presence of gunshot residues. Residues and physical effects consistent with a contact shot were found, or;

2.4.2 The area around the hole in the (describe area) of the ___ in item___ was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the firearm in item ___ with the cartridges in item ___ (or) cartridges like those represented in item ___ this pattern of residues was reproduced at a distance of between ___ and ___, or;

2.4.3 The area around the hole in the (describe area) of the ___ in item ___ was microscopically examined and chemically processed for the presence of gunshot residues, and residues were found. Using the firearm in item ___ with the cartridges in item ___ (or) cartridges like that represented in item ___ this residue was detected to a maximum distance or between ___ X ___, or;

2.4.4 The area around the hole in the (describe area) of the ___ in item ___ was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which are consistent with the passage of a bullet, or;

2.4.5 Examination of the ___ in item ___ revealed ___ hole(s) in ___ area of ____. The area around the hole was microscopically examined and chemically processed for the presence of gunshot residues. No gunpowder residues were found and no vaporous lead residues or other gunshot residues were detected in the area around the holes. Due to the absence of such residues a muzzle-to-garment distance could not be determined.

2.4.6 The (describe area) of the ___ in item ___ was examined and a shot pattern was found. Using the shotgun in item ___ with shotshell cartridges in item ___ (or) shotshell cartridges like those represented in item ___ a similar pattern was produced at a distance of between___ and ___.

2.5 Ammunition Component Characterization

2.5.1 Examination of the bullet in item ___ revealed it to be typical of a ___ caliber bullet fired in a firearm with ___ lands and grooves ___ twist, or;

2.5.2 Examination of the cartridge in item ___ revealed the cartridge to be a ___ caliber/gauge cartridge typical of those manufactured (or) marketed by ___, or;

2.5.3 Examination of the cartridge case in item ___ revealed it to be a ___ caliber/gauge cartridge case typical of those manufactured (or) marketed by ___. Microscopic examination revealed that item ____ was fired in a firearm having a _____ firing pin and _____breechface marks. or,

2.5.4 Firearms having similar class characteristics to the bullet in item ___ are (pistols, revolvers, rifles) manufactured by, or marketed as (list manufacturers). However, this should not be construed as an all-inclusive list of firearms having similar class characteristics. or;

2.5.5 The cartridges in item ___ were submitted for continuity. or,

2.5.6 The cartridges in item ___ were submitted for continuity and used as test fires. or,

2.5.7 Examination of the pieces of metal in item ___ revealed them to be typical of # (size of shot) (type of shot) shot. or;

2.5.8 Examination of item ___ revealed a ___ gauge wad, or typical of a___ wad factory loaded by ___. or;

2.5.9 Examination of item ___ revealed a ___; however, mutilation hindered any further characterization, or;

2.5.10 Examination of item ___ revealed insufficient characteristics for characterization or comparison.

3. SERIAL NUMBER RESTORATION

3.1 Restored/Partially Restored Number

3.1.1 The obliterated serial number on the firearm in item ___ was restored (or partially restored) and found to be ___. or;

3.1.2 The obliterated serial number on the firearm in item ___ was partially restored and found to be ___. The asterisk represents a ___ or a ___. The question mark represents an unrestored character.

3.1.3 Utilizing secondary sources and/or numbers, the serial number on the firearm in item ___ was determined to be ___.

3.1.4 Examination and decryption processing of the barcode of the obliterated serial number on the firearm in item ___ determined the original, complete (or partially restored) number to be ___.

3.2 Unsuccessful Restoration Attempt

3.2.1 The firearm submitted in item ___ was found to have an obliterated serial number. Attempts to restore it were unsuccessful.

4. NIBIN

4.1 Firearm Submitted

4.1.1 The firearm described in item ___ was test fired. A test fired cartridge case was entered into the IBIS database.

4.2 Test Fires Submitted

4.2.1 A test fired cartridge case from item ___was entered into the IBIS database.

4.3 Evidence Cartridge Cases Submitted

4.3.1 The cartridge case in item___was entered into the IBIS database.

5. TOOLMARKS

5.1 Toolmark Comparisons (Tool and item containing toolmark(s) should be described, i.e.; screwdriver, bolt cutters, striker plate…)

5.1.1 The tool in item ___ was identified as having made the toolmarks in item ___, or;

5.1.2 The tool in item ___ was excluded as having made the toolmarks in item ___, or

5.1.3 The tool in item ___ could not be identified as having made the toolmarks in item ___. Microscopic examination revealed that the toolmarks in item __ did not exhibit sufficient individual characteristics for identification.

Similar class characteristics indicate the toolmark in item __ could have been made by the tool in item __ or by any other tool having similar class characteristics. or;

5.1.4 Examination of the toolmarks on item ___revealed insufficient characteristics for comparison.

6. TEST MEDIUM RETURNS AND TRACE MATERIAL

6.1 The test fired bullets (or cartridge cases or test cuts, or Mikrosil casts) from item ___ will be returned to the contributor. It is recommended the test fires (or cartridge cases or test cuts, or Mikrosil casts) be retained for a period of at least five years.

6.2 The test fires in item ____ will be sent to the Indiana State Police Laboratory in Indianapolis for entry into the IBIS Database. An additional report will follow when completed.

6.3 Trace material was collected from Item __, sealed in a separate package, and returned with item __. If further examination is warranted, please contact the reporting laboratory.

7. LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS) NOMENCLATURE

7.1 When uploading documents into LIMS or on a network drive for permanent storage the examiner shall use the following nomenclature if not covered by Indiana State Laboratory Policy General #037:

7.1.1	GRC Reports	FX_11L00123_R0001_GRC_4875_V1
7.1.2	Trigger Pull Reports	FX_11L00123_R0001_TRIGPULL_4875_V1
7.1.3	Reference Material	FX_11L00123_R0001_REFMAT_4875_V1
7.1.4	Examination Request	FX_11L00123_R0001_EXREQ_4875_V1
7.1.5	Email Correspondence	FX_11L00123_R0001_EMAIL_4875_V1
7.1.6	Verifications	FX_11L00123_R0001_VERIFY_4875_V1
7.1.7	Firearm Worksheets	FX_11L00123_R0001_FXWS1_4875_V1
7.1.8	GSR Worksheets	FX_11L00123_R0001_GSRWS1_4875_V1
7.1.9	Toolmark Worksheets	FX_11L00123_R0001_TMWS1_4875_V1
7.1.10	Serial Number Worksheets	FX_11L00123_R0001_SNWS1_4875_V1
7.1.11	NIBIN Worksheets	FX_11L00123_R0001_NIBINWS1_4875_V1
7.1.12	Hit Memos	FX_11L00123_R0001_HITMEMO_4875_V1
7.1.13	Notes	FX_11L00123_R0001_NOTES_4875_V1
7.1.14	Technical Review Worksheets	FX_11L00123_R0001_TECH_4875_V1
7.1.15	Court Critiques	Witness Evaluation_Keisler_Date of Testimony
7.1.16	Proficiency Tests	ExtProf_Case ID_Keisler_Notes ExtProf_Case ID_Keisler_Results IntProf_Case ID_Keisler_Notes IntProf_Case ID_Keisler_Results

APPENDIX 5 FIREARMS REFERENCE COLLECTION

1.0 INTRODUCTION

1.1 All firearms, firearms components, ammunition and ammunition components that come into the custody of the Laboratory Division by virtue of being lost, abandoned, donated, or in instances in which the lawful owner cannot be located may be maintained in a Firearms Reference Collection in the Forensic Firearms Unit of the Laboratory. This reference collection shall be utilized for training, research and comparison purposes. When no longer useful as an aid to the firearms examiners, they shall be destroyed or sold at Indiana State Police Auction pursuant to IC 35-33-5-5. All other firearms in the custody of the Laboratory Division for <u>any</u> other reason shall be disposed of pursuant to IC 35-47-3-(1, 2, 3, or 4).

2.0 PROCEDURE

2.1 These firearms, components or ammunition shall become the responsibility of the Division Commander or designee and shall be handled in the following manner:

2.1.1 Upon receipt the firearm shall be assigned an Inventory Number.
2.1.2 It shall be logged in a permanent electronic file on a network drive with the following information:

2.1.2.1 Make
2.1.2.2 Model
2.1.2.3 Serial Number
2.1.2.4 Contributor
2.1.2.5 Inventory Number

2.2 It shall be stored in a secure area under the direct control of the Division Commander or designee, and shall have limited access.

2.3 Semi-annual inventories shall be conducted by members of the Forensic Firearms Identification Unit utilizing inventory number and/or serial number. The inventories shall be completed by scanning each and every attached bar code tag which are attached to the firearms. The inventory workbooks shall then be checked to make sure all firearms have been accounted for. Any discrepancies in the inventory shall be reported to the Unit Supervisor immediately. These workbooks shall be checked annually by the Unit Supervisor and maintained for at least five years on the laboratory network drive.

2.4 When no longer needed in the Reference Collection or when replaced, the firearm shall be destroyed or sold at Indiana State Police Auction pursuant to

IC 35-33-5-5.

2.5 The uses of the Firearm Reference Collection shall include, but not be limited to the following areas:

2.5.1 To identify the make, model and source of evidence firearms.
2.5.2 To provide exemplar firearms for various testing purposes which might otherwise compromise evidence firearms.
2.5.3 To provide an exemplar resource for training new examiners or in developing new technology for the examination of firearms.
2.5.4 To provide a source of firearms parts for the repair of evidence firearms for test firing purposes.
2.5.5 To provide a resource for the identification of firearms parts recovered at crime scenes.
2.5.6 To provide a resource for the location and style of firearms serial numbers.

2.6 The Firearms Unit Supervisor may authorize a firearm to be loaned to a member of a law enforcement agency for a maximum of sixty days. This loan shall be recorded on a Loan of Indiana State Police Firearms Reference Collection Firearm form (exhibit 1). This form shall be forwarded to the Firearms Unit Supervisor and stored for at least five years on the laboratory network drive.

2.7 This procedure for the Firearms Reference Collection is used in conjunction with Laboratory policy.

LOAN OF INDIANA STATE POLICE FIREARMS REFERENCE COLLECTION FIREARM

The Indiana State Police Laboratory has agreed to lend a firearm from its _____Laboratory for use as a demonstration model. Said firearm for loan is a **_____ with Serial Number _____ and Indiana State Police Laboratory Control Number __ _____**. The aforementioned firearm will be loaned to _____ PE _____ with the agreement that it will be returned as soon as possible after its use. By signing below _____ _____ assumes all responsibility for the firearm until its return to the _____ Laboratory.

_____ _____
Loaned To Date

_____ _____
ISP Laboratory Witness Date

Returned to Laboratory on:_____

_____
Returned By

_____
ISP Laboratory Witness

Insert Photograph of Firearm

(exhibit 1)

APPENDIX 6 AMMUNITION REFERENCE COLLECTION

1. INTRODUCTION

1.1. The Ammunition Reference Collection is defined as a collection or catalog of both cartridges and components. This reference collection shall be maintained for identification, comparison, or interpretation purposes and shall be fully documented, uniquely identified, and properly controlled. This reference collection shall be utilized by members of the Forensic Firearms Identification Unit to:

1.1.1. To identify the manufacturer's cartridge designation, source of evidence ammunition or component parts.
1.1.2. To provide an exemplar resource for training.
1.1.3. To provide a resource for the identification of ammunition components.

2. USE

2.1. The nature of each laboratory's ammunition reference collection will be pertinent or limited by the space, storage containers and computer equipment available. However the following should be considered;

2.1.1. Use of architect blue print cabinets or similar style cabinets for storage of the collection.
2.1.2. Use of clear plastic tubes or boxes for storage of each ammunition entry. The entry consisting of at least one whole cartridge and one cartridge broken down into its component parts.
2.1.3. Each container shall be uniquely labeled and include information such as;

2.1.3.1. Manufacturer
2.1.3.2. Bullet style or configuration
2.1.3.3. Manufacturer's Index
2.1.3.4. Headstamp
2.1.3.5. Other pertinent information

2.1.4. Each laboratory shall keep an electronic record on a network drive of items contained in their ammunition reference collection. This reference collection does not have to be inventoried.

APPENDIX 7 PERFORMANCE CHECKS AND MAINTENANCE

1. INTRODUCTION

1.1 It is necessary that all instruments/equipment be properly calibrated and calibration check records shall be maintained for all calibrated instruments.

1.2 If at any time any instrumentation or equipment is found to be out of calibration or fails a performance check, it shall be immediately taken out of service, labeled as such, and the firearms examiner shall notify the Unit Supervisor.

1.2.1 After the instrumentation or equipment is repaired the calibration shall be checked using accepted protocols for that piece of instrumentation or equipment.

1.2.2 A written record of all the aforementioned procedures shall be documented in that particular instrument or equipment maintenance file.

2. COMPARISON MICROSCOPE:

2.1 The comparison microscope shall be cleaned and serviced by a qualified technician, at least every three years.

2.2 Maintenance and repairs shall be documented in the particular instrument's maintenance file.

2.3 The comparison microscope shall be checked prior to use to ensure that it is functioning properly.

2.4 This performance check shall be performed by placing two similar items on each stage (test to test) and observing the agreement between these items.

2.5 This check shall be documented in the firearm examiner's notes.

3. STEREO MICROSCOPES:

3.1 The stereo microscope shall be cleaned and serviced by a qualified technician, at least every three years.

3.2 Maintenance and repairs shall be documented in the particular instrument's maintenance file.

3.3 The stereo microscope shall be checked prior to use to ensure that it is functioning properly.

3.4 This check shall be performed by observing an item under the microscope and utilizing past experience in determining if the instrument appears to be giving a true and accurate representation.

3.4.1 This check does not need to be documented.

4. BALANCES/SCALES

4.1 The balance and check weights shall be cleaned, serviced and certified by a qualified technician, at least every two years. The scope of the vendors accreditation shall be applicable to the calibration requested.

4.1.1 The vendor shall provide calibration certificates that contain the measurement results, measurement uncertantity, and evidence of ISO 17025 accreditation.

4.2 Maintenance and repairs shall be documented in the particular instrument's maintenance file.

4.3 The balance/scale shall be checked prior to use to ensure that it is functioning properly.

4.4 This shall be done by utilizing a single certified check weight.

4.4.1 This check weight shall be kept in close proximity to the balance and remain in the appropriate case when not in use.
4.4.2 This check weight shall be handled with gloves or tweezers.

4.5 The balance/scale shall be considered functional if it is ±0.01g of the standard weight being used for the performance check.

4.6 If multiple balances/scales are available at a laboratory the serial number of the balance/scale and the procedure used for the performance check shall be recorded in the firearm examiner's notes.

5. TRIGGER PULL DEVICES

5.1 STANDARD TRIGGER WEIGHTS

5.1.1 The standard trigger weights shall be performance checked when initially put in service.

5.1.2 A firearm examiner shall check the certification of the weights at least every three years or if he/she notes a significant change (corrosion, damage…) in the weights. This shall be done on a certified balance and be within ±5% of the stated weight value.

5.1.3 Maintenance and repairs shall be documented in the particular equipment's maintenance file.

5.1.4 The standard trigger weights shall be inspected before each use to insure that the weights are not damaged.

5.1.5 This inspection does not need to be documented unless a significant change (corrosion, damage…) is noted.

5.2 SPRING MEASURING DEVICE

5.2.1 The spring measuring device shall be performance checked when initially put in service.

5.2.2 The firearm examiner shall use standard trigger weights to check for accuracy prior to use. The spring scale shall be considered functional only if it is in accordance to the standard trigger weight which is being used for the performance check.

5.2.3 Maintenance and repairs shall be documented in the particular equipment's maintenance file.

5.2.4 The spring measuring device shall be inspected before each use to ensure that the device is not damaged. This inspection does not need to be documented unless a significant change (corrosion, damage…) is noted.

5.2.5 This inspection as well as the weights used, shall be documented in the firearm examiner's notes.

6. GAUGE BLOCKS

6.1 All gauge blocks shall be calibrated externally by a vendor accredited under ISO 17025 prior to being put into service. The scope of the vendors accreditation shall be applicable to the calibration requested.

6.1.1 The vendor shall provide calibration certificates that contain the measurement results, measurement uncertantity, and evidence of ISO 17025 accreditation.

6.2 Gauge blocks shall never be recalibrated. If there exists observable evidence of significant change (corrosion, damage, etc.) the block(s) shall be taken out of service and replaced.

7. MICROMETER/CALIPER

7.1 The performance check of the micrometer/calipers shall be checked when put in service utilizing the appropriate gauge blocks. These gauge blocks shall be either provided by the manufacturer or have a NIST traceable certificate.

7.2 This performance check shall be documented in the particular instrument's maintenance file.

7.3 The performance check of the micrometer/caliper shall be checked with at least two different gauge blocks prior to use to ensure that it is functioning properly.

7.3.1 The gauge blocks shall be kept in the appropriate case when not in use.

7.4 The micrometer/caliper shall be considered functional if it is within ±.0005 inches of the standard gauge block(s) being used for the performance check.

7.5 This check shall be documented in the firearm examiner's notes and detail the gauge blocks used.

8. RULERS

8.1 Steel rulers shall be calibrated externally by a vendor accredited under ISO 17025 prior to being put into service. The scope of the vendors accreditation shall be applicable to the calibration requested.

8.1.1 The vendor shall provide calibration certificates that contain the measurement results, measurement uncertantity, and evidence of ISO 17025 accreditation.

8.2 Any other linear measuring devices such as measuring tapes shall be verified upon purchase by comparing them with the above mentioned traceable rulers. The linear measuring device shall be considered functional if it is ± 1/8 inch of the specified measurement.

8.3 Steel rulers shall never be recalibrated. If there exists observable evidence of significant change (corrosion, damage, etc.) the ruler shall be taken out of service and replaced.

8.4 All records shall be kept and documented in the particular equipment's maintenance file.

8.5 The measuring device shall be inspected before each use to ensure that it is not damaged.

8.6 This inspection does not need to be documented unless a significant change (corrosion, damage…) is noted.

9. WATER TANK

9.1 Prior to use the firearm examiner shall check the level of water to ensure that it is high enough to slow and stop a bullet. Water shall be added as needed.

9.2 Prior to use the firearm examiner shall check that the water is clear enough to see the bottom of the tank to ensure that the bullet can be easily recovered.

APPENDIX 8 VERIFICATIONS

1. INTRODUCTION

1.1 This guideline is intended to provide procedures for the verification of casework performed by members of the Forensic Firearms Identification Unit (FFIU) of the Indiana State Police Laboratory. All verifications shall be performed prior to the issuance of a Certificate of Analysis, or any notification of results outside of the FFIU.

2. DEFINITIONS

2.1 **Verifications**: The rendering of an unbiased, independent evaluation and subsequent opinion of the actual evidence items (where practical) performed by another qualified examiner other than the "primary examiner".

2.2 **Qualified Examiner:** Individuals who have fulfilled the requirements of the ISP Firearm and/or Toolmark Examiner Training Program, or are employed by a recognized forensic science laboratory in the capacity of a court qualified firearm and/or toolmark examiner, or have been trained in the discipline in which they are providing an opinion and are routinely proficiency tested in such discipline.

2.3 **Primary Examiner:** That examiner who has been assigned the case and is the principal examiner evaluating the evidence and issuing the Certificate of Analysis.

3. MICROSCOPIC COMPARISONS

3.1 Identifications

3.1.1 All evidentiary identifications must be verified (i.e. question bullet compared with test bullet, questioned toolmark with test toolmark).

3.1.2 If multiple identifications are made to the same source (i.e. multiple unknown bullets and/or cartridge cases to a particular firearm) it shall be left to the discretion of the qualified examiner performing the verification(s) as to how many samples will be compared and evaluated.

3.2 Eliminations

3.2.1 Eliminations based on differences in class characteristics do not require verification (i.e., 6R bullet compared with a 5R barrel or pinch type cut vs. a shearing action).

3.2.2 In the rare instance that an elimination is based on differences in individual characteristics, verification shall be required (i.e., both bullet and firearm

are 6L but with grossly different individual characteristics or both striated marks, same dimensions with grossly different individual characteristics).

3.3 Inconclusive

3.3.1 In cases where items are not positively identified or eliminated (inconclusive), it is at the discretion of the primary examiner to seek a verification. It is not required but recommended.

4. SERIAL NUMBER RESTORATIONS

4.1 It is recommended that all restorations be verified as processed. If not practical, photographic documentation suitable for later evaluation should be obtained.

5. DISTANCE DETERMINATIONS

5.1 It is recommended that all distance determinations be verified as processed. If not practical, photographic documentation suitable for later evaluation should be obtained.

6. DOCUMENTATION

6.1 All verifications shall be documented in the following manner:

6.1.1 The examiner shall make a notation in their notes the items which were verified, who performed the verification and when it was completed.

6.1.2 The verifier shall complete a Verification Form Version 2, 03/28/2017, listing the items verified and when the verification was completed. The verifier shall upload this document into the Laboratory Information Management System under the appropriate case number in the case images area.

7. DISAGREEMENT RESOLUTION

7.1 All disagreements shall be resolved by all parties according to Indiana State Police Laboratory Quality Assurance Manual.

APPENDIX 9
Hazardous Chemical Waste Management

1. Introduction

1.1. A hazardous waste is defined by the Resource Conservation and Recovery Act (RCRA) as a solid waste that because of its quantity; concentration; or physical, chemical, or infections characteristics may cause or significantly contribute to an increase in serious; irreversible; or incapacitating, reversible illnesses or pose a substantial present or potential hazard to human health, safety or welfare to the environment when improperly treated, stored, transported, used, or disposed of or otherwise managed.

2. Types of Wastes

2.1. Listed Wastes

2.1.1. F-list (non-specific source wastes) – wastes from non-specific sources
2.1.2. K-list (source-specific wastes) – wastes from specific industries, such as oil refining or pesticide manufacturing. The K-list is <u>not-applicable</u> to the Laboratory Division.
2.1.3. P-list and U-list (discarded commercial chemical products) – wastes include specific commercial chemical products in an unused form.

2.2. Characteristic Wastes

2.2.1. Ignitability – ignitable wastes can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 60°C (140°F).
2.2.2. Corrosivity – corrosive wastes include highly acidic and highly alkaline chemicals and those that are capable of corroding metal.
2.2.3. If a waste exhibits ONLY the characteristic of corrosivity and is NOT a listed waste, it may be neutralized to within a pH range of 5 to 9 before disposal to a sanitary sewer.
2.2.4. Reactivity – reactive wastes are unstable under “normal” conditions, but can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water.
2.2.5. Toxicity – a solid waste that fails the Toxicity Characteristic Leaching Procedure (TCLP) because of the presence of certain heavy metals or organic constituents above regulated levels display the characteristic of toxicity and is considered a hazardous waste.

3. Hazardous Chemical Waste Containers

3.1. Hazardous chemical waste containers are commonly referred to as satellite containers.

3.2. Satellite containers must be compatible with the substance they contain. Glass or Nalgene jars are appropriate for most wastes. The amber colored 4 liter or 1 liter solvent bottles are preferred because they are non-recyclable and are compatible with most types of wastes.

3.2.1. All satellite containers must have securely fitting lids or caps and be stored with the lids or caps closed.
3.2.2. Funnels shall be removed and not left in the satellite containers.
3.2.3. Satellite containers shall be marked “Hazardous Waste”.
3.2.4. Depending upon the procedures set forth at the regional laboratories, full satellite containers should be moved to the Central Waste Accumulation Storage Area within three days of being filled to capacity.
3.2.5. The labels affixed to the satellite containers should contain the contents of the container.

4. Storage of Hazardous Chemical Waste Containers (satellite containers)

4.1. Storage area of satellite containers for the individual laboratories will be determined based on the available room, but must be placed next to or near the process that generates the hazardous waste.

5. Hazardous Waste Commonly Found in the Forensic Firearms Identification Unit

5.1. Serial Number Restoration Chemicals

5.1.1. Cupric Chloride
5.1.2. Hydrochloric Acid
5.1.3. Ethyl Alcohol
5.1.4. Nitric Acid
5.1.5. Ferric Chloride
5.1.6. Sodium Hydroxide
5.1.7. Phosperic Acid

5.2. Range Determination Chemicals

5.2.1. Fixing Solution (pre-mixed by vendor)
5.2.2. Glacial Acetic Acid
5.2.3. Sodium Nitrite
5.2.4. Sodium Rhodizonate
5.2.5. Sodium Bitartrate

5.2.6. Alpha Naphthol
5.2.7. Methonol
5.2.8. Tartaric Acid
5.2.9. Hydrochloric Acid

6. Ridding of Hazardous and Non-Hazardous Chemical Wastes and Containers

6.1. Hazardous Chemical Waste

6.1.1. Hazardous Chemical Waste shall not be disposed of by rinsing the chemicals down the drain.
6.1.2. When processing the chemical that has been defined as a Hazardous Chemical Waste, the waste needs to be collected in a catch container and the catch container emptied into the appropriate satellite container.

6.2. Non-Hazardous Chemical Waste

6.2.1. Most liquid chemical wasted will need to be handled as a hazardous chemical waste. However, some non-hazardous waste that can be flushed into the sewer.
6.2.2. Any volume of chemicals poured down a drain must be followed by a minimum of twenty times (20X) volume of water.

6.3. Satellite Containers

6.3.1. When adding waste to a container, do not completely fill the container. Leave space for the contents to expand. Containers and contents may expand or contract due to temperature changes.
6.3.2. Transfer of hazardous chemical waste from one satellite container to another is not recommended.
6.3.3. The date the satellite container is full shall be documented on the bottle.
6.3.4. Depending upon the procedures set forth at the regional laboratories, the full satellite container should be moved from the Satellite Waste Accumulation Area to the Central Waste Accumulation Area within three days of the date documented on the bottle.

APPENDIX 10
Administrative and Technical Reviews

1. INTRODUCTION

1.1. The firearms examiner is responsible for preparing accurate, complete and organized examination records (case notes). The firearms examiner shall review documentation constituting the case file (examination records and administrative records) for compliance with laboratory policy and procedures and technical accuracy prior to submitting the case for administrative or technical review. This appendix will outline the method in which the Unit shall conduct both Administrative and Technical Reviews.

2. ADMINISTRATIVE REVIEWS

2.1. At the completion of a case and prior to returning the evidence to the customer, an administrative review shall be conducted by the Division Commander's designee on all Certificates of Analysis prior to release to the contributing agency and/or officer. The individual completing administrative reviews shall affix their Permanent Employee (PE) number to the final report. Administrative reviews shall not be conducted by the author of the Certificate of Analysis.

2.2. At a minimum, the administrative review shall include:

2.2.1. A review of the Certificate of Analysis for spelling and grammatical accuracy;
2.2.2. A review of all administrative and examination records associated with the Certificate of Analysis to ensure that the records are uniquely identified according to laboratory policy and procedure;
2.2.3. A review of the Certificate of Analysis to ensure that all key information is included.

3. TECHNICAL REVIEWS

3.1. A technical review is an evaluation of examination records which form the basis for a scientific conclusion and the Certificate of Analysis. This review consists of determining whether the appropriate examinations have been performed, the conclusions are consistent with the recorded data and are within the scope of the discipline or category of testing.

3.2. The Quality Assurance Manager shall be notified through channels of any substantive nonconformance related issues identified as a result of a technical review. The severity and significance of the nonconformance issues shall determine the nature of the corrective action taken by the Quality Assurance Manager.

3.3. If the reviewer finds an error in the examination record, the reviewer shall notify the firearms examiner. The firearms examiner shall make the necessary corrections in the electronic examination record. The corrected pages of the electronic examination

record shall be uploaded to the LIMS imaging module. All pages of the original electronic examination record shall be retained.

3.3.1. The reviewer shall ensure all necessary corrections were made by the firearms examiner in the examination record before approving the case.

3.3.2. The reviewer shall document all observations on the FFIU Technical Review Form Version 2, 03/28/2017. The reviewer shall save the completed technical review form in the LIMS imaging module. This shall be uploaded as signified by 7.1.12 as listed under Appendix 4.

3.4. At a minimum, the technical review shall include a review of all examination records and the Certificate of Analysis to ensure:

3.4.1. Conformance with proper test method(s) and applicable Laboratory policies and procedures;

3.4.2. Accuracy of Certificate of Analysis and that the data supports the results, opinions, and interpretations in the Certificate of Analysis;

3.4.3. Associations are properly qualified in the Certificate of Analysis; and

3.4.4. The Certificate of Analysis contains all required information.

3.5. Technical reviews shall be conducted by individuals authorized by the Division Commander and have expertise gained through training and experience in the category of testing being reviewed. In addition, the technical reviewer shall have knowledge of the laboratory's test methods.

3.6. The FFIU shall conduct a technical review on a minimum of 5 cases from each firearms examiner on a quarterly basis. If an firearms examiner completes less than 5 cases in a quarter all cases shall be reviewed.

3.7. Technical reviews shall not be conducted by the firearms examiner issuing the Certificate of Analysis under review.

4. REFERENCES

4.1. FFIU Training Manual Appendix II

4.2. ISP Quality Assurance Manual