I. Examinations

Firearms identification is the study of the microscopic marks on ammunition components for the purpose of comparing them with each other and/or a particular firearm. It is possible to associate fired bullets, cartridge cases and/or shotshell casings with a particular firearm when a correspondence of class characteristics and individual distinguishing characteristics is determined through comparative analysis. Both fired and unfired ammunition components can be associated with a particular firearm or to each other through comparison of other cycling and manufacturing marks (due to contact with magazines, reloading components, ejectors, extractors, etc.).

In cases for which no firearm is recovered, the firearms examiner may provide valuable information concerning the caliber (including gauge and/or shot size), the manufacturer of the fired ammunition components, and the various makes and models of firearms capable of producing rifling impressions and/or firing marks like those present on the fired ammunition components.

Firearms identification and comparative examination should not be confused with the term “ballistics”, that is more concerned with the study of projectiles in motion.

Additional information may be found in the "Firearms Identification Evidence and Possible Laboratory Determinations" section.

A. Firearms identification also entails various other firearms-related examinations such as:

1. Gunpowder residue examinations for the purpose of making muzzle-to-target distance determinations.
2. Shot pattern spread testing.
3. Firearm function tests.
4. Ejection pattern tests.
5. Trajectory determinations (determined through laboratory examination of items struck by gunfire…crime scene reconstruction is not performed by lab staff).
6. Homemade/unmarked sound suppressor exams.
7. Serial number recovery examinations.
8. Examination of fired ammunition items in the absence of a firearm to develop suspect firearm leads.

B. Firearm evidence is evaluated with use of the following information:

1. Class Characteristics - characteristics that are not unique, and can

be possessed by a group or class of firearms. Examples include:

a. Caliber type/gauge.
b. General rifling characteristics - number, widths, and direction of twist of the rifling impressions.
c. Mechanism marks - their shapes, sizes and relative locations.
d. Similarity of ammunition components - observable physical characteristics, composition, and manufacturing marks.

2. Individual Distinguishing Characteristics - characteristics that are unique and individual to a specific firearm as a result of a particular combination of toolmarks from manufacturing methods, normal use, damage, and other random effects taken on by a specific firearm over the course of its existence. Examples include:

a. Scrapes/striations on fired bullets (within the rifling marks).
b. Impressed and striated microscopic characteristics such as breech face marks, extractor marks, ejector marks, firing pin impressions, chamber marks, and other mechanism marks on cartridge cases/shotshell casings.

Individual microscopic characteristics are imparted by the surfaces of a firearm onto ammunition components due to forcible contact. Even though two firearms may be produced sequentially, and to the unaided eye appear to be identical, their surfaces are different microscopically. These random and unique firearm characteristics are then transferred (all or in part) onto the ammunition components with which they come into contact. These characteristics are analogous to the fingerprints of the firearm.

C. Three possible conclusions may be reached in firearms identification cases that involve microscopic comparison. They are:

1. Identification - The ammunition component (bullet, cartridge case, shotshell casing, cartridge, shotshell, etc.) was associated with the firearm due to the agreement of a combination of class and individual identifying characteristics.
2. Elimination - The ammunition component was disassociated with the firearm due to disagreement of class characteristics and/or significant disagreement of individual characteristics. (Example: different number and direction of twist for rifling marks on bullet vs. firearm.)
3. Inconclusive - The ammunition was neither identified, nor

disassociated, with the firearm. Any class characteristics present on the ammunition component must be in agreement with those of the firearm. The significance of this finding is dependent upon the number and nature of the class characteristics which are in agreement. This conclusion is commonly a result of a lack of sufficient quantity and quality of markings needed to perform a meaningful conclusion. Indicates other possible sources of the fired ammunition components exist.

II. Collection and Packaging of Evidence

Analysis performed by the NSP Crime Laboratory (NSPCL) is limited by the quality and/or quantity of evidence it has to work with. Incomplete evidence collection may yield incomplete results. Improper collection and preservation of evidence may severely limit possible analytical outcomes of laboratory examinations. Evidence that is of poor quality to begin with (badly mutilated bullets, barrels with poor reproducibility of striations from shot to shot, etc.) cannot be helped, but further degradation must be minimized or avoided altogether.

A. The NSPCL is limited by the information it is furnished relative to the case. The circumstances of the incident should be set forth in enough detail to convey the basis for forensic analysis. The NSPCL should be advised of other pertinent information about the case when additional details are critical for determining the probative value of evidence items, the need for specific analyses, or when the relationship between evidence items and/or their relevance in the crime scene would otherwise be unclear. Such details may include:

1. Observations at the scene, especially with respect to the condition of the evidence.
2. Statements of suspects and witnesses (only to the extent that is needed to determine what analysis is needed).
3. Information derived from subsequent investigation.
4. The source/location of all evidence collected and submitted for examination (as is relevant to case exams).

B. Requested examinations should be relevant to the issues of the case and/or applicable statutes. If adequately informed, the firearms examiner may be of greater assistance in connecting or eliminating evidence components, proving or disproving statements regarding a sequence of events, and/or proving an element of the criminal offense.

1. Several areas are important to remember when submitting

evidence to the Crime Lab. These are:

a. Loaded firearms present a serious safety hazard to investigators and Laboratory personnel. Please see the Laboratory Note "Handling Firearms and Ammunition Discovered in the Search" in section IV.
b. As per section “II. A.” above, please prepare the Laboratory Submittal form (NSP 750) as completely as possible.
c. Fired bullets, cartridge cases, and unloaded firearms, but not unfired ammunition, may be submitted by registered or certified mail. It is against federal law to send unfired ammunition by U.S. mail. Private carriers (such as UPS or Federal Express) may permit inclusion of a broader range of ammunition components, but those carriers should be consulted prior to inclusion of unfired ammunition.
d. Make sure that you remove all tissue and biohazard fluids from bullets or shotgun wads so that it does not degrade the surface of the bullet or wad. Failure to do so may greatly impede microscopic exams of those items.
e. Wrap all lead bullets in tissue paper and package in separate containers so that they won't become scraped/damaged in transport to the Lab. Jacketed bullets are typically more resistant to further scraping/damage.
f. Don't package firearms in airtight plastic bags; this practice can promote rust, depending on the condition of the firearm when packaged.
g. Initial the base or nose of bullet only if dictated by policy/procedure, but never mark the sides of a bullet.
h. If possible, cut out the area around where a bullet has entered an object and send this in so that the Laboratory may remove the bullet. Prying the bullet out of a wall, door, etc. can leave behind marks that interfere with microscopic comparison. If removal of the bullet at the scene is the only option, take care to use non-marking items to remove the bullet (plastic, nylon, rubber, etc.)
i. If evidence will require DNA or latent print analysis, ensure that is made clear upon laboratory submission. DNA and latent print processing must be performed prior to firearm-related analysis.
j. When submitting clothing for gunpowder residue examination, please do the following:
    1. Air-dry all clothing before submitting.
    2. Wrap each piece of clothing separately.
    3. Advise the location of the suspected entrance wound

in the victim's body.

k. Package all evidence securely, seal all packages and initial.

III. Bullet and Cartridge Case Exemplars

It is not recommended that submitting officers/agencies create their own test fires for use in forensic analysis by the Crime Lab. The Crime Lab has a wider range of ammunition available for creating test fires, more equipment for capturing undamaged bullets, and a need to evaluate features & characteristics of firearms (and magazines) involved in an investigation.

Failure to submit the actual firearm(s) that are potentially involved in an investigation may severely restrict the type and extent of analysis possible for that case.

Ammunition selected for use in creating exemplars must be of the same or similar style and composition to fired ammunition evidence submitted for analysis. Differences in both the hardness of ammunition components and powder loads used by different manufacturers can result in variance in the quality and quantity of markings available for analysis. For this reason, any unfired ammunition recovered as part of an investigation should also be submitted to the lab (within reason) for use/analysis. If that type of ammunition is obsolete or difficult to obtain, the NSPCL may have to use a small quantity of the unfired ammunition in analytical procedures. Unfired ammunition is also useful for comparing manufacturer characteristics to fired ammunition evidence components.

IV. Handling Firearms and Ammunition Discovered in the Search

Wear disposable gloves if firearm evidence must be handled. Firearms are often examined for the presence of DNA and/or latent prints.

Before picking up a firearm, the investigator should note the position of the hammer, if the weapon has one, and record that the hammer is down, half-cocked, or cocked. The position of the safety should also be noted. It may be necessary to pick up the weapon in order to determine this. Photographs (before handling) are the easiest way to record these details.

With revolvers, it is good practice to mark the cylinder with regard to its relationship to other features on the firearm (top strap, breechface, or other obvious areas) in order to record the orientation and order of ammunition components in their respective chambers after the cylinder is opened or rotated in the firearm. Photographs of the cylinder contents, in conjunction with markings made on the cylinder, provide the best documentation of empty/loaded

chambers.

Firearms should be picked up by the edge of the trigger guard or the checkered portion of the grips or stock. These areas will not usually retain identifiable fingerprints. Firearm handling should be kept to a minimum to avoid loss or contamination of potential DNA or fingerprint evidence.

All firearms should be unloaded at this point. When unloading a firearm, the investigator should note the fired or unfired condition of the ammunition under the firing pin together with the position of the other fired or unfired ammunition found in the cylinder or magazine.

Though it is not recommended, loaded firearms can be submitted to the laboratory if the investigator deems it absolutely necessary. To do this, prior arrangements must be made with the firearms examiner and THE FIREARM IS TO BE PERSONALLY DELIVERED TO THE FIREARMS EXAMINER BY THE OFFICER WHO SEIZED IT.

V. Neutron Activation Analysis Kits (Gunshot / primer residues from hands)

The NSPCL does not perform analysis of hand swabs or sticky tabs for the presence of gunshot / primer residues. Several private laboratories offer this service and can provide testimony regarding this type of analysis. The NSPCL can provide the names or one or more private labs offering this service, if requested.

Gunshot residue analysis on victim clothing and other items struck or perforated by projectiles is performed by the NSPCL (see section VI, subsections S, T, and U listed below).

VI. Firearms Identification Evidence and Possible Laboratory Examinations

A. Fired Bullet

Determination of caliber, style and manufacturer; Rifling characteristics of barrel from which fired; List of possible makes and models of firearms from which it could have been fired; Whether sufficient individual microscopic characteristics are present for comparison/ identification with a firearm; Whether any trace evidence is present on the bullet (or in the hollowpoint cavity) that can be compared to a known source; comparison to unfired ammunition submitted for that case. (see also subsection F)

B. Fired Cartridge Case/Shotshell Casing

Determination of caliber type/gauge and original loading and manufacturer; Whether it has been reloaded; Type of firearm in which it could have been fired; List of possible makes and models of firearms in which it could have been fired; Whether sufficient individual microscopic characteristics are present for comparison/ identification with a firearm; comparison to unfired ammunition submitted for that case. (see also subsection G)

C. Shot Pellets and Wads

Shot size and type; Gauge, type and manufacturer of wads. (see also subsection H)

D. Unfired Cartridge/Shotshell

Caliber type and bullet style/gauge and loading; Manufacturer; Whether it has been reloaded, and if so, are microscopic marks present which might be of value for comparison/identification with reloading equipment; Whether it bears mechanism marks (magazine marks, chamber marks, etc.) that might be of value for comparison with the firearm and/or its accessories.

E. Firearm

Caliber/gauge, manufacturer, model and serial number (including recovery of obliterated numbers/location of hidden numbers); Rifling characteristics of the barrel; Whether it is functioning normally; Trigger pull(s); Magazine/cylinder capacity; Whether it has been fired since last cleaned or is unfired due to presence of dust, blockages, etc.; Whether it has been altered in any manner (full auto or select-fire operation); Ejection pattern (to be compared with locations of ejected cases/casings at scene); Trajectory determination (if pertinent to measurements at scene).

F. Two or More Fired Bullets

In addition to subsection A, whether the bullets were, were not, or could have been fired from the same barrel; Whether the observable physical characteristics of the bullets match; Whether the microscopic manufacturing marks were produced by the same source.

G. Two or More Fired Cartridge Casings/Shotshell Casings

In addition to subsection B, whether the cases/casings were, were not, or could have been fired in the same firearm; Whether the cases/casings

were fired in the same chamber; Whether the observable physical characteristics of the cases/casings match; Whether the microscopic manufacturing marks were produced by the same source.

H. Two or More Shot Wads

In addition to subsection C, whether they are of the same gauge, type and manufacture.

Some wads may display individual characteristics from the barrel of the firearm from which it was discharged, and may be of use in comparison to test fired wads from that firearm. This is most commonly encountered when the firearm barrel has been damaged or altered (shortened) or when rifling is present in a shotgun barrel (slug guns).

I. Shot Pellets

In addition to subsection C, whether they are of the same shot size and type.

J. Two or More Unfired Cartridges/Shotshells

In addition to subsection D, whether they are of the same caliber type and bullet style/gauge and loading; Whether their observable physical characteristics match; Whether they bear microscopic manufacturing/reloading marks produced by the same source; Whether they bear mechanism marks produced by the same firearm.

K. Fired Bullet and Suspect Firearm

In addition to subsections A and E, whether the bullet was, was not, or could have been fired from the firearm.

L. Fired Cartridge Case/Shotshell Casing and Suspect Firearm

In addition to subsections B and E, whether the case/casing was, was not, or could have been fired in the firearm; Whether the case/casing was loaded into and extracted from the firearm.

M. Shot Wad and Suspect Firearm

In addition to subsections C, E, and H, whether the wad and firearm are of the same gauge. (Note: a very rough muzzle may impart reproducible individual microscopic marks on the sides of a plastic wad or rifled slug).

N. Unfired Cartridge/Shotshell and Suspect Firearm

In addition to subsections D and E, whether the cartridge/shotshell was loaded into and extracted from the firearm; Whether the cartridge/shotshell bears any mechanism marks which could be associated with the firearm.

O. Fired Bullets/Shot and Unfired Cartridges/Shotshells

In addition to subsections A, C and/or D, whether the observable physical characteristics of the fired and unfired bullets/shot match.

P. Cartridge Cases/Shotshell Casings and Unfired Cartridges/Shotshells

In addition to subsections B and D, whether the observable physical characteristics, microscopic manufacturing marks and/or firearm mechanism marks present on the items can be identified as having been produced by the same source.

Q. Shot Pellets, Wads and Fired Casings/Cartridge Cases

In addition to subsections B and C, whether the pellets and wads could have originally been loaded into and fired from that type of casing/case.

R. Shot Pellets, Wads and Unfired Shotshells/Cartridges

In addition to subsections C and D, whether the pellets and wads are similar to the pellets and wads present in the shotshells/ cartridges.

S. Clothing with Suspected Bullet Holes

Which, if any, of the holes are like those produced by the passage of a bullet; Whether the hole is consistent with a bullet-entrance or bullet-exit hole; Whether there are gunpowder and gunshot residues on the clothing; Determination as to what was the approximate muzzle-to-garment (target) distance.

T. Clothing with Suspected Shotgun Discharge Holes

Which, if any, of the holes are like those produced by the passage of shot pellets, wads or slugs; Whether they are consistent with entrance or exit holes; Whether there are gunpowder and gunshot residues on the clothing; Whether a distinct and measurable shot pattern is present; Determination as to what was the approximate muzzle-to-garment (target)

distance.

U. Other Items with Suspected Bullet or Shotgun Discharge Holes

Same as subsections S and T.

V. Suspected Sound Suppressor

Whether the device functions as a sound suppressor; An analysis of the design features of the device; A measurement of the sound reduction of the device.

W. Reloading Equipment

Manufacturer; Caliber type/gauge of ammunition it can accommodate; If microscopic marks on reloaded ammunition components can be associated with the reloading equipment.

X. Firearm with Obliterated Number(s)

Full or partial recovery of obliterated serial number(s); locate hidden numbers to establish identify of firearm.

Y. Suspected Firearm Parts and Components

Description and function; Type of firearm they originated from; rebuild dismantled firearm and/or insert parts into firearm to determine function.