Main Charge Examinations

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1 INTRODUCTION

An energetic material (EM) is a material that can undergo an exothermic chemical reaction and release thermal energy. This reaction results in a rapid expansion of the reaction products into a volume much greater than that originally occupied by the material. These products can be solids or gases. As the reaction products expand they perform mechanical work on their surroundings.

High explosives (HE) are *designed* to be initiated by shock and function by the specific phenomenon known as detonation. A detonation is a supersonic chemical reaction (relative to the unreacted explosive) that propagates as a shock wave sustained by the energy of the exothermic chemical reaction of the HE. A detonation is often referred to as an instantaneous combustion, however it must be understood that whereas the phenomena of combustion involves thermal transfer processes between particles of explosive (one particle ignites next to another one and causes subsequent ignition), detonation processes involve transfer processes through shock waves. HEs are commonly used in the commercial blasting and military sectors. Examples of HEs include trinitrotoluene (TNT), dynamite, and emulsions.

Low explosives (LE) are *designed* to be initiated by flame and function by the specific phenomenon known as deflagration. A deflagration is a subsonic chemical reaction (relative to the unreacted explosive) that propagates as a pressure wave sustained by the energy of the exothermic chemical reaction of the LE. It is a rapid combustion that propagates by thermal transfer processes between particles of explosive (one particle ignites next to another one and causes subsequent ignition). LEs can be further subdivided into propellants and pyrotechnics. Propellants are EMs *designed* to produce a controlled release of gas that can be used to propel objects. Propellants are commonly used in guns and rockets. An example of a propellant is smokeless powder. Pyrotechnics are EMs designed to mainly produce heat, light, and sound. An example of a pyrotechnic material is flash powder.

Note that the difference between HEs and LEs is functional rather than fundamental. Many HEs can also deflagrate if initiated by flame and many high energy propellants can detonate if initiated by a strong enough stimulus such as a shock. A similar functional difference can be also attributed to some propellants and pyrotechnics; many authors refer to black powder as a pyrotechnic and a propellant. The key point to remember is that an EM is often defined by how it is used in a specific application (often referred to as it's use form) rather than by it's fundamental nature.

EMs can be used as the main charge in improvised explosive devices (IEDs) and improvised incendiary devices (IIDs). Should bulk EM be recovered after the functioning of a main charge, it may be possible to determine manufacturing information. This information can assist the investigator in identifying the subject(s) responsible for constructing the device.

2 SCOPE

These procedures describe the process for main charge examinations and apply to explosives and hazardous devices personnel who examine main charges to determine identifying and functionality information.

3 EQUIPMENT

Below is a list of items that can be used to examine main charges and their post-blast remains. The explosives and hazardous devices individual should choose the most appropriate items based on the nature of the evidence.

- Personal protective equipment (e.g., lab coat, eye protection, full face shield, gloves)
- Hand tools (e.g., tweezers, pliers, utility knife)
- Cleaning materials and disinfectants (e.g., cloths, bleach, rubbing alcohol)
- Stereomicroscope (various magnifications)
- Ruler (e.g., standard 12 inch length)
- Micrometer
- Caliper
- Pillboxes, glass containers, static-proof plastic bags
- FBI Laboratory Explosives Reference Tool (EXPeRT) Database
- Reference texts, manuals, manufacturers' literature, and known materials are maintained in the explosives library. Additional reference information can be obtained from direct contact with manufacturers and distributors.

4 PROCEDURE

These procedures are implemented as part of the overall examination process outlined in the Explosives and Hazardous Devices Examinations Technical Procedure (TP). Refer to the Safety section of this TP before starting any examinations.

Explosives and hazardous devices personnel will:

A. Before any examinations are conducted, ensure that the item(s), as well as its container(s) and packaging, have been appropriately marked in accordance with the FBI Laboratory Operations Manual (LOM) (i.e., item number, initials, and full Laboratory number, when practicable).
B. Ensure care is taken not to obliterate any identifying marks which have been previously placed on the item(s), or obliterate any microscopic marks of value.
C. Visually examine the item for any trace evidence that could be of value. This type of evidence could include, but not limited to the following: hairs, fibers, blood, paint, or other particles.
    1. If the trace evidence is to be examined or preserved, contact the appropriate unit and determine if the material should be removed. Record the presence of the material by means of notes, sketches, or photographs before it is removed.
D. Note the physical characteristics of the main charge through visual/microscopic examination. Physical measurements should be taken as well to aid in determining as many of the following attributes as possible:
    - Construction characteristics
    - Manufacturer
    - Brand
    - Type

- Special properties (e.g., physical condition, modifications, functionality, packaging present, date/plant/shift code, improvised or commercial)

E. If possible, determine the manufacturer, brand, and type by searching the EXPeRT database, explosive reference files, manufacturers' literature, and/or reference or known materials collection. Identifications or associations are made by comparison of observable/measurable physical characteristics with those provided in the above reference/literature materials.

5 LIMITATIONS

Refer to the Limitations section in the Explosives and Hazardous Devices Examinations TP and Appendix A of the Explosives and Hazardous Devices Report Writing Guidelines.

6 SAFETY

Safety protocols, contained within the FBI Laboratory Safety Manual, will be observed at all times.

A. Protective gloves (e.g., latex, nitrile) should be worn when handling evidence.
B. EMs should be protected from sources of heat, impact, shock, friction, and electrostatic discharge (ESD). Should explosives be accidentally initiated, they have the capability of causing personal injury or death. **ALL** EMs should be handled with the utmost care. Personnel will follow the below guidance regarding the handling of EMs:
    1. EMs can be extremely sensitive to heat, impact, shock, friction, and ESD. Ensure that samples of EMs are contained in static-proof, or static-dissipative, plastic bags or other suitable containers.
    2. No more than 5 grams of EMs will be examined by the FBI Laboratory. Extra explosives will be properly stored in approved, explosion-proof containers (e.g., explosive magazine, MK663 containers, as appropriate).
    3. When not under examination, EMs will be stored in approved, explosion-proof containers (e.g., explosive magazine, MK663, as appropriate).
    4. EMs will be shipped in appropriate Department of Transportation (DOT) approved containers (e.g., MK663 containers).
    5. Bulk EMs and initiators will not be examined at the same time or placed in close proximity to each other.
    6. Appropriate facial protection (e.g., eye protection, full face shield) be worn when handling EMS.
C. Items containing blood or other body fluids can be cleaned with a bleach-based solution or other suitable disinfectant following discussions with personnel that may conduct other examinations of the items.

7 REVISION HISTORY

Revision	Issued	Changes
02	06/15/2022	Updated to new document template and updates made throughout for clarity.