

EXPLOSIVES EXAMINATION INFORMATION

INTRODUCTION

Explosives are chemical substances that can undergo explosion: an extremely rapid reaction resulting in the formation of heat and a sudden increase in pressure. Explosives can be either commercial products or improvised materials and can be initiated by spark, friction, shock, heat or a chemical reaction.

There are two types of examinations performed in explosive cases:

- Intact Explosives Examination
- This is the analysis for and the identification of suspected intact explosives or their key constituents. This examination includes the analysis of both uninitiated bulk explosives as well as unconsumed explosives from post-blast debris.
- Trace Explosives Examination
- This is the examination of post-blast debris for explosive residues, by-products and components associated with an explosive device. This examination can also include trace transfer on objects that have come into contact with bulk explosives.

EXAMINATION

Both intact and trace explosive examinations begin with a visual and microscopic analysis. Depending upon the sample being examined a variety of analytical techniques may be utilized to characterize the sample. In some circumstances, particularly in trace explosive examinations, it may be necessary to perform a solvent extraction. It may also be possible to obtain investigative information from explosive device components.

INTERPRETATION

Intact explosives can usually be identified, however this laboratory cannot normally identify the manufacturer and/or trade name of an explosive.

Identification of residues in trace explosives examinations may give an indication of the energetic material used in the explosive device. In some instances, the results may provide no information or they may be ambiguous. For example, identified nitrates may be explosives residues but are also present in fertilizer.

There are many different types of explosives, therefore specific information will be incorporated into the laboratory report, as appropriate.

INSTRUMENTAL ANALYTICAL TECHNIQUES

Fourier Transform Infrared Spectroscopy (FTIR) is used to identify a material based on its characteristic absorption of infrared radiation.

Gas Chromatography-Mass Spectroscopy (GC-MS) is used to separate (GC) and identify components (MS) of a mixture.

Liquid Chromatography-Mass Spectrometry (LC-MS) is used to separate (LC) and identify components (MS) of a mixture.

Raman Spectroscopy (RS) is used to identify a material based on its characteristic scattering of light.

Scanning Electron Microscope-Energy Dispersive X-Ray Spectroscopy (SEM-EDX) The SEM produces a magnified image of the sample based on the interaction of an electron beam with the sample's surface. The EDX is used to identify some of the elements present based on the x-rays produced through interactions between the sample and the SEM electron beam.

X-Ray Diffraction (XRD) is used to identify material based on its crystal structure.

GLOSSARY

Detonators are devices designed to initiate a high explosive charge. Detonators are also referred to as blasting caps.

Explosives Residues are the chemical remains of an explosive after it explodes. These residues may contain traces of the original explosive and/or the chemical products of the explosive reaction.

High Explosives are characterized by a reaction rate faster than the speed of sound. Most commercial and military explosives are high explosives. In general, initiation of high explosives requires the shock of a detonator. High explosives have a greater shattering effect than low explosives.

Initiate refers to the starting of an explosion or burning of a propellant or pyrotechnic mixture.

Low Explosives / Propellants are characterized by a reaction rate slower than the speed of sound. Low explosives are primarily used as propellants to accelerate a projectile in a firearm or pyrotechnic device. In general low explosives are easier to initiate than high explosives. Low explosives are often used as the explosive filler for pipe bombs. Examples include smokeless powder and black powder.

Pyrotechnics are explosive materials used to produce audible or visual effects. Many chemical formulations are used as energetic material in pyrotechnics. Fireworks and safety flares are examples of pyrotechnics.

Solvent extraction is the washing of selected debris material with a solvent to acquire trace residues for analysis using instrumental analytical techniques.