SCREENING AND RECOVERY TECHNIQUES

A. Post-blast Evidence
   1. The evidence container is opened and any distinctive odors are noted.
   2. A macroscopic (visual) examination is performed as follows:
      a. General appearance of the debris is noted. (e.g. indications of low or high explosive)
      b. Locate obvious fragments/components of the bomb such as pipe or container fragments, blasting cap artifacts, leg wires, wrappers, fuses, timing devices, batteries, etc.
      c. Remove and isolate unconsumed explosives, noting the location where it was found.
      d. Characteristics and location of residues are noted. (e.g. white crystalline material present).
      e. Remove any additional debris that is unidentifiable.
   3. A microscopic (stereomicroscope) examination of the fragment surfaces and debris is performed for the following:
      a. Remove and isolate any unconsumed explosive material.
      b. Note locations of explosive residue.
      c. Characterize any microscopic blast effects. (e.g. pitting, shearing or scorching)
      d. Use sieves the help isolate unconsumed explosive.
      e. Remove and isolate any additional identifiable debris.
   4. Physical characterization of suspected explosive particles
      a. Black Powder or Pyrodex
         i. Morphology: Black Powder (planed lumps)
            Pyrodex (rough spheres)
         ii. Homogeneity: Black Powder (homogenous)
            Pyrodex (non-homogenous)
         iii. Presence of glazing
         iv. Grade Classification (compare with standards)
            a. Black powder has grades of F, FF, FFF, FFFF.
            b. Pyrodex has grades P(pistol), RS(rifle/shotgun), CTG(cartridge).
         v. Ignition characteristics
      b. Flash Powders
         i. Note general appearance
         ii. Note color
         iii. Note the presence of metal (Al or Mg)
         iv. Examine for the presence of crystalline inclusions.
            a. Potassium Chlorate or Potassium Perchlorate
            b. Sulfur
         v. Examine for presence of sawdust
         vi. Check for homogeneity of particles.
         vii. Ignition characteristics (particularly flame color)
      c. Smokeless Powders
         i. Morphology
            a. tube (perforated/nonperforated)
            b. disk (perforated/nonperforated)

c. ball
d. flattened ball
e. rhomboid
f. other

ii. Presence of glazing
iii. Note the color
iv. Note the presence of markers (e.g. red or blue dot)
v. Ignition characteristics.

d. Chlorate/Sugar Mixtures
i. Note the general appearance
ii. Check for homogeneity
iii. Note the ignition characteristics

5. Chemical characterization of suspected explosive particles.
a. Black Powder or Pyrodex
i. Separation is performed by water extraction and filtration
ii. Components to be identified

Black Powder
- Potassium Nitrate (75%)
- Charcoal (15%)
- Sulfur (10%)

Pyrodex
- Potassium Nitrate (45%)
- Potassium Perchlorate (19%)
- Charcoal (9%)
- Sulfur (6%)
- Cyanoguanidine (6%)
- Sodium Benzoate (11%)
- Dextrine (4%)
- Wax + Graphite (-)

Common solid combustion products:

Black Powder
- K_2SO_4 - K_2CO_3
- $KHSO_4$ - K_2S
- KSCN - KHSO
- S - KNO_3 - KNO_2
- $KHCO_3$ - $K_2S_2O_3$
- C & Assoc. Ions

Pyrodex
- K_2SO_4 - K_2CO_3
- K_2S - S - KCl
- $KHSO_3$ - KHSO
- KNO_3 - $KClO_4$
- $KHCO_3$ - KNO_2
- $K_2S_2O_3$ - C & Assoc. Ions
- Cyanoguanidine
- Sodium Benzoate

iii. Methods employed for characterization
a. Polarizing Light Microscopy
b. Spot tests (e.g. anions, cations)
c. FTIR (e.g. KNO_3, $KClO_4$, Cyanoguanidine, Sodium Benzoate)
d. TLC
e. XRD
f. SEM/EDAX

g. CE

b. Flash Powders
   i. Separation is performed by water extraction and filtration.
   ii. Components to be identified.
      a. Flash Powder
         i. Chemical Composition
            a. Potassium Chlorate or Potassium Perchlorate (40-60%)
            b. Aluminum (20-30%)
            c. Sulfur (10-30%)
         ii. Common Solid Combustion Products
            a. K_2SO_4 - $KClO_4$ or $KClO_3$ - $KHSO_3$ - KCl
            b. $KHSO_3$ - Al_2O_3 - $AlCl_3$ - Al_2SO_4
            c. $KAl(SO_4)_2$ - Al & Assoc. Ions
      b. "Military Flash Powder"
         i. Chemical Composition
            a. Aluminum (40%)
            b. Potassium Perchlorate (30%)
            c. $Ba(NO_3)_2$ (30%)
         ii. Common Solid Combustion Products
            a. $KClO_4$ - KCl - Ba_2SO_4 - Al - Al_2O_3
            b. $Ba(NO_3)_2$ - KNO_3 - $BaNO_2$ - $AlCl_3$ & Assoc. Ions
      c. "M-115"
         i. Chemical Composition
            a. Magnesium (34%)
            b. Aluminum (26%)
            c. Potassium Perchlorate (40%)
         ii. Common Solid Combustion Products
            a. KCl - Al_2O_3 - $KClO_4$ - Mg_2O_3 - & Assoc. Ions
      d. "M-117"
         i. Chemical Composition
            a. Magnesium (17%)
            b. Antimony Sulfide (33%)
            c. Potassium Perchlorate (50%)
         ii. Common Solid Combustion Products
            a. KCl - Mg_2O_3 - Sb_2O_3 - $KClO_4$ & Assoc. Ions
      e. "M-119"
         i. Chemical Composition
            a. Potassium Perchlorate (73%)
            b. Gallic Acid (24%)
            c. Red Gum (3%)
         ii. Common Solid Combustion Product
            a. KCl
   iii. Methods employed for characterization:
      a. Polarizing Light Microscopy
      b. Spot tests (e.g. anions, cations)

c. FTIR (e.g. KNO_3, $KClO_4$)
d. TLC
e. XRD
f. SEM/EDAX
g. CE

c. Smokeless Powders
   i. Separation is performed by acetone extraction
   ii. Components to be identified
      a. Chemical Composition
         i. Single-base: Nitrocellulose (85-100%)
         ii. Double-base: Nitrocellulose (50-80%) & Nitroglycerin (15-45%)
      b. Common solid combustion products
         i. Single-based
            a. Nitrocellulose, (K_2SO_4 - KNO_2 weak)
         ii. Double-based
            a. Nitrocellulose, (K_2SO_4 - KNO_2 weak)
            b. Nitroglycerin
   iii. Methods employed for characterization:
      a. Polarizing Light Microscopy
      b. Spot tests (e.g. anions, cations)
      c. FTIR (e.g. KNO_3, $KClO_4$)
      d. TLC
d. Sugar / Chlorate Mixtures
   i. Separation is performed by water extraction.
   ii. Components to be identified
      a. Chemical composition:
         i. Sodium Chlorate (67%)
         ii. Sucrose (33%)
      b. Common solid combustion products:
         i. NaCl - $NaClO_3$ - Sucrose & Assoc. Ions
   iii. Methods employed for characterization:
      a. Polarizing Light Microscopy
      b. Spot tests (e.g. anions, cations)
      c. FTIR (e.g. KNO_3, $KClO_4$)
      d. TLC
      e. XRD
      f. SEM/EDAX
      g. CE