SECTION-SPECIFIC REQUIREMENTS

Trace Evidence
Trace Evidence Services

- Fire Debris
- Hairs
- Fibers
- Footwear/Tire Impressions
- Paint
- Pressure Sensitive Tape
- Gunshot Residue
- Physical Matches
- Glass
- General Unknowns
- Misc. comparisons
Edward Locard’s Principle

- Something is left behind
- Something is altered
- Something is taken away
Impressions

- Footwear
- Tire
- Fabric
Types of Impressions

- Two dimensional
  - Dust
  - Oil
  - Paint
  - Blood

- Three dimensional
  - Soil
  - Sand
  - Clay
  - Snow
Always photograph impressions before attempting to collect.

A scale **MUST** be included

- Scale **MUST** be set into same depth as the impression

Use a tripod, with the setup perpendicular to the impression
Photographing the Impression

Equipment:

- Camera
- Tripod
- Flash
- Sync Cord
- Level Finder
- Scale
- Fill Frame
- Capture in **Tiff or Raw**
Scale not to same depth

Due to the placement of the scale, a true and accurate size of the unknown impression cannot be achieved.

Footwear differs only 1/6th of an inch between half sizes.
3-Side Lighting Rule for 3D Impressions

- Take photographs of 3-D impressions using light from three different sides.
- Remember-“Between the legs”
- Keep the flash at a 45 degree angle approximately 3-4 feet away
Dust Impressions - Documentation Lighting
Dust Impressions - Lighting Documentation
Impressions-Collecting

- Collect the whole item
  - Example: door being kicked in
  - If not possible to collect the whole item:
    - Dental stone, gel lifts, mikrosil, Electrostatic lifting

- Do not perform any enhancements

- Submit pictures of impressions on a CD(TIFF or RAW not JPEG)

- Take images of all footwear impressions at the scene
Why Take Images of All Impressions?
Impression Detail Differs
3D- Impression Collection Casting

- Casting: 2lbs dental stone 10oz water.
- Can use other liquid besides water if needed.
- Allow to dry approximately 1 hour prior to removal.
- Remove from inner side NOT ENDS.
- Do not clean cast off. Submit the entire cast with dirt/soil/rocks/leaves attached.
Casting Techniques-Footwear

- Can support very fine particles by spraying them with hairspray prior to casting
  - Impressions in flour, wood shavings
- Can cast a 3D Impression in Snow
  - Must use snow wax to place a “shell” on the snow
  - Dental stone will get warm when it is being processed
  - If you don’t add snow wax—the impression will melt
Packaging the Cast

- Allow cast to fully harden prior to packaging.
  - Cast will take 72 hours to fully harden.
- Don’t clean cast
- Need to protect cast from breaking
  - Use bubble wrap/boxes/paper towels
Casting Techniques - Footwear
2D- Impressions Collections

- **Electrostatic Dust Lifter**
  - Good for only dry impressions
  - Can cover a large area
  - **Cons**
    - wipes away easily
    - picks up everything
Packaging Impression Evidence

- Electrostatic Dust Lifter
  - Place in a manila folder and envelope.
  - Write on package
    - Do not Bend
    - Electrostatic Dust Lifter Impression Inside
2D Impression Collection-Gel Lifts

Gel Lifts
- Great for curved surfaces
- Dried bloody impressions
- Impressions on doors
Gel Lifts-Collection

- Place cover on
  - Use roller to smooth out air bubbles
- Air bubbles will hinder examination
- Do not take cover off even if you didn’t get the cover to align
  - If you do take the cover off you can create a double impression
Gel Lift- Package

- Cover off
  - use a pizza box
- Tape the edges of the gel lift to the box
- **Do Not** use a cardboard box
  - Cardboard fibers will attach to exposed gel lift
Recovered Shoes

- Do not put the exemplar shoes back into the impression or next to the impression!!

- **Do not** put any ink or fingerprint powder on the exemplar samples (shoes) to make test impressions

- Consider the possibility of the presence of other evidence:
  - Glass, paint, soil, hairs, fibers

- **Shoes**
  - Package each shoe separately (do not clean)
  - Paper
  - Box
  - DO NOT PLACE IN PLASTIC!
Do Not Do This!!!
The Examination

- If we are doing a comparison
  - **NEED** to have suspect shoes
- will make exemplars of the shoes to compare with unknown
- look at class characteristics first
  - size, tread pattern
- look for individualizing characteristics
  - cuts, breaks
Class Characteristics

Footwear impression created on vinyl chair at crime scene.

Exemplar footwear impression from suspect’s boots.

Both impressions displayed the same size and pattern.

Brand name
Individual Characteristics

Both impressions displayed the same individual characteristics.

Footwear impression created on vinyl chair at crime scene.

Exemplar footwear impression from suspect’s boots.
Individual Characteristics

Exemplar footwear impression from suspect’s boots.

Footwear impression created on vinyl chair at crime scene.
Footwear Database-No Shoes

- FBI
- Regional Labs
- European Databases
What Can Tire Tracks Tell You?

- Determine number of vehicles involved
- Enter or Exit
- Can help to ID:
  - brand of tire
  - manufacturer of tire
- Size of tire
- Type of tire
- Make, model, and year of vehicle
- Problems with vehicle
  - front end alignment etc.
Documentation of Tire Impressions

- To document a full circumference of a tire impression - it is recommended to photograph at least 8 feet of the tire impression

- This is tricky ............
  - You need to link all photographs together ............
  - By using 2 scales and overlapping photographs
- Place “L” shaped ruler at the beginning of your impression
- Place “steel” ruler at the bottom of the impression
- Fill Frame- 14 inches of impression
- Move “L” scale ruler to top of the impression
- Overlap photo 2 inches
- Fill the Frame-Start at 10 inches end at 24 inches
Place “L” shaped ruler at the end of your impression
Overlap photo 2 inches
Fill the Frame-Start at 20 inches end at 34 inches
Overlap Photos
Individualized
Tire Impressions
Found Suspect Vehicle

- If you realize the tire tread design is not consistent
  .....DOCUMENT with a photograph as an ELIMINATION photo
DOCUMENTATION-Exemplar Tires

- Document all information on sidewall of tires
- Document on all 4 tires on the vehicle and the spare tire
- Most Important information is the DOT # and brand
  - Tells you week and year the tire was made
DOT Number
What you bring to the Lab

- Need test impressions of all tires while on the vehicle
- Do not drive vehicle
  - You do not want to cause any damage to the tread design
- Tow vehicle to impound
- Submit tires for full comparison
  - Or submit test exemplar of the exemplar tires
- Submit all casts, lifts, photos
Prepare Test Impressions

- Inkless method
- Place foam board in path of tire
- Number the sections of the tire according to location of wear bar indicators
- Gently rub car tire with paper towel to gently remove some of the dirt and debris that is not embedded into the tire.
  - Collect that debris (best ability)
- Use clear shoe polish or Vaseline and rub over car tire immediately before you roll the car forward or backward
- Once the entire circumference is recorded dust foam board with magnetic powder
- Can apply 2-3 coatings of clear acrylic spray over the impression to keep it from smearing.
- Repeat for each tire
Tire Tread Search

- Tire Tread Design Guide
- No Suspect vehicle to compare
Fabric Pattern Impression

Noted in hit and runs.

Photograph first—scale included.

Try to collect impression with gel lift.

Or remove vehicle part and send to lab.
Large Items With Impression Evidence

- Bring entire item to lab
  - Protect area of interest (use placards and butcher paper)
  - Mark on packaging area to protect (ex. This side up)
  - Tape down inside a box (glass fragments)
Paint-Importance in Forensic Science

- **Types of paint**
  - House
  - Decorative
  - Automotive
    - Hit and Run
    - Willful Damage
    - Homicide Incidents
      - Important for paint color, layer sequence, and elemental composition
Paint Collection

- Need to get all the layers
  - Go down to metal/bumper substrate
- Collect exemplar sample from a clean area near the impact site(s)
- Items to consider:
  - Two toned cars
  - Repaints-esp. older cars
  - Detailed areas
  - Bumpers
Paint Collection-Techniques

- Use a clean razor blade
- Use tweezers to peel paint from area of damage
- Hammer-Screwdriver method
  - Cut at an angle down to the metal
Paint Layer Structure

This is really small!

- Clear coat
- Color Coat
- Primer Coat
Paint Collection

- Collect in a paper bindle, small canister, gel lift
  - Do not collect samples and place them directly into small envelopes.
  - The small envelopes have holes at each corner.
- Collect each area separately
Hit and Run Evidence

- Point of impact
  - There may be more than one!!!
  - Collect paint samples from each area
  - Package each area separately

- The road
  - Sweep an area 20 feet on either side
  - Any pieces of the automobile, headlights that have broken off

- The windshield
  - Package in butcher paper-protect with cardboard
Hit and Run Potential evidence: victim

- **Clothing**
  - Package each item separately
  - Make sure the clothing is dried prior to packaging
  - Package in paper bags
- **Submit all items found on person**
  - Cell phone case, purse, etc
- **Shoes**
  - Package each separately in paper bags
Paint Clothing Transfer
Suspect Vehicle

- Collect areas of transfer if noted
- Need to collect exemplar (control) samples of suspect’s vehicle paint
  - From each area that the victim may have had contact with
  - Maybe different paint chemistry on different areas of vehicle
Paint transfer from the tool to the door.
DATABASE SEARCHES

No suspect hit and runs
Paint Data Query

- Database maintained by the FBI and the RCMP
- Uses FTIR data to develop a list of possible make/model for unknown paint chips
FIRE DEBRIS ANALYSIS
Types of Samples

- charred debris
- liquids
- containers
- clothing
- furniture
- bedding
- miscellaneous
Packaging

- Lined paint cans
- For large items:
  - Seal opening as best you can
  - Bring to the lab immediately
- Do not dry clothing
- Do not put your gloves in the can
- Make sure the lid is on tight
Seal Cans Properly

- Make sure the lid fits on the can
Do not over-fill the cans when submitting evidence. We need space inside the can to hang the charcoal strip.
Fill the cans with material with enough room for a hanging charcoal strip.
Solid Samples

- visual exam
- note any odors
- process by charcoal adsorption/elution
Liquid Samples

- Visual exam
- Note any odors
- Flame test
- Flammable liquids can be directly injected
- Nonflammable liquids processed by charcoal adsorption/elution
Containers

- Visual exam
- Note any odors
- Small items process by charcoal adsorption/elution
- Larger items process by head space
- Recognize the need for other areas of processing
Heated Headspace

- Used for cases that require extraction of very light products such as ethanol or acetone.
- Need to specify this type of test.
  - It is not done routinely
ASTM Classifications

- Petroleum Distillate
- Gasoline
- Isoparaffinic Products
- De-aromatized distillates
- Normal alkane products
- Naphthenic paraffinic products
- Aromatic products
- Oxygenated products
- Miscellaneous

- Classify according to class characteristics
- Do not identify it
- Report will note the ASTM classification of the flammable liquid
  - Examples will be listed
  - Exception is gasoline
FRIENDLY REQUESTS

- Submit only small sample of liquid
  - Be careful when pouring liquid in container (contamination)
- Notify analyst of evidence in soil
- Make sure lid is on tight
- Do not submit rusted cans
- Request Alcohol testing
Issues: Fire Debris Analysis

- Pyrolysis products
  - volatile components are given off naturally as certain materials burn
  - comparison samples
    - Near the area of interest/in the same room if possible
      - Carpet, wood flooring, decking material
HAIRS AND FIBERS
Hair as Evidence

- See in many different types of cases
  - Sexual Assaults
- Class characteristic
  - Hairs are not a positive means of identification
  - Great elimination tool
  - Durable evidence
Collection of Known Head Hairs

- Need **10** pulled hairs from five sections of the head.
  - Total of **50** head hairs
  - Pubic Hairs (pulled)-**25**
- We do **not** compare body hairs (beard, eyelash, etc.)
- If you do not give us enough hairs to compare then the report will state that the comparison was a limited comparison
Packaging of Hair

- Do not place hair directly into envelope
  - Chance of loosing it with the holes on the ends of the envelope
  - Or getting stuck on adhesive in envelope
- Place hair into druggist fold
  - Canister
  - Then into an envelope
The Cuticle

Figure 5.9.2 Example of a Thin cuticle (less than 2.5 μm, scored L01 in Table 3.1).

Figure 5.9.3 Example of a Thick cuticle (approximately 2.5 μm thick, scored L02 in Table 3.1).
Pigmentation

**Figure 5.4.1** Example of Uniform pigment distribution (scored G01 in Table 3.1).

**Figure 5.4.2** Example of Peripheral pigment distribution (scored G02 in Table 3.1).

**Figure 5.4.3** Example of One-sided pigment distribution (scored G03 in Table 3.1).

**Figure 5.4.4** Example of Central pigment distribution (scored G04 in Table 3.1).
The Medulla
Hair Comparison

- Compare unknown hairs to exemplar hairs
- Gross characteristics
  - color, shape
- Microscopic characteristics
  - Medulla, pigmentation, cuticle
Exemplar Item 1 is included as a possible source of the unknown hairs in Item 2 based on class characteristics.

Exemplar Item 1 is excluded as a possible source of the unknown hairs in Item 2 based on class characteristics.

Note: hairs do not serve as a positive means of identification
Fibers as Evidence

- class characteristics
- possibility of individualizing evidence
  - Fracture match
- often overlooked in cases
- can be an investigative aid
Fiber Packaging

- Collect trace of interest to gel lifts
  - Label the back of each lift
- Druggist fold
  - Seal in envelope (careful of coin envelopes-holes)
- Vacuum sweepings
- Tape lifts
- Collect clothing-package each item separately
- Carpet –exemplar samples (vehicle)
Classification of Fibers

- **Natural** - consists of vegetable fibers (flax, hemp) and animal fibers (silkworm, rabbit)
- **Manmade** - consists of chemically produced fibers (polyester, nylon, rayon)
Examination

- Things to look for when examining fibers
  - Cross section, fiber diameter, surface texture, color, fiber length, crimp, lengthwise striations, delusterant, and any other morphological features
Fabric Rub on Car Seat
Blue Jean-Cotton Fibers

This is small!
The distance between two lines is 1mm!
Fiber Analysis

- Determine if something was cut using a scissors, razor, or tearing motion.
Physical Match
Fiber Comparisons

- Compare unknown fibers to exemplar fibers
- Gross Characteristics
  - Color and shape
- Microscopic characteristics
  - Delusterant, striations
- Instrumental analysis for synthetic fibers
DUCT TAPE ANALYSIS

SILENCE
Silence is golden. Duct tape is silver.
Duct Tape

- Found on bodies
- Clothing
- Boxes
- Trash
Duct Tape-Packaging

- If you have to cut the duct tape-mark the ends that you cut
- If Tape is in pieces, place sticky side down gently on plastic cover/evidence bag
  - Place that into an envelope or box
  - Do not expose sticky side to cardboard/envelope
- Careful with handling
  - Possible DNA, Fingerprints, Trace Evidence
- Keep tape wrapped on Item
  - Example- box used to bury evidence
Duct Tape Packaging

- If tape is loose, place gently on a plastic protective cover sheet.
  - Place in manila folder/envelope to protect it.
- DO NOT PLACE DUCT TAPE DIRECTLY ON PAPER/CARDBOARD
Exemplar Duct Tape

- Submit all rolls of duct tape found for comparison
- May look alike, but are different (adhesive color, fiber)
Duct Tape

- Color of backing
- Fibers used for Scrim (weave)
- Adhesive – chemistry
- Color of adhesive-Munsell color charts
Fracture Match – Duct Tape

This tape has also been processed for fingerprints.
GUNSHOT RESIDUE
Gunshot residue status

- Due to lack of funds, currently GSR analysis for primer residue on a suspected shooter is only performed upon a request in writing from the AG’s office.
  - GSR analysis takes several days, so if the case needs to be done by a certain date, give as much notice as possible.
- GSR analysis for distance determination is still available for routine analysis and performed in the firearms section.
Gunshot residue collection

- On hands
  - Use commercial kits that contain adhesive stubs to be used for analysis by Scanning Electron Microscopy (SEM).
    - Two or Four stub kits are available
  - DO NOT use swabs. They cannot be processed at our lab.

- On clothing
  - Upon submission, be sure to state whether clothing is from the suspect or victim and what type of GSR you are looking for.
    - primer residue vs. residue for distance determination
Adhesive stubs

- Aluminum stubs with black carbon double sided sticky tape on top.
- Housed in a protective plastic cover
Friendly reminders

- If the stubs come with a protective white cover over the black tape, remove them before collecting and do not attempt to put them back on.
- Do not attempt to remove the black sticky tape. It is supposed to be there!!
GLASS ANALYSIS
Glass Analysis

- Glass analysis currently available is very limited.
- If glass evidence is a critical part of your case, arrangements can be made to send the evidence to a lab that has the ability to perform a full analysis.
  - Contact the lab for more information.
Thank You

- Any questions?
- Main Office
  - 874-2893
- Call Amy or Kim
  - 874-4114