GSR Case Studies, Results and Interpretation

Elana Foster
RJ Lee Group, Inc.
Monroeville, PA
In the Next 25-30 Minutes

- What is GSR
- How is it analyzed
- Issues – areas of discussion
- Case Studies
  - Results, Interpretation, Verdict
What is Gunshot Residue?

- Pb, Sb, Ba - originates from the primer cap.
- Typically, the primer cap is a small round insert found at the bottom of a cartridge case.
How do you analyze GSR?

- SEM – Scanning Electron Microscope
Categories of Particles

- **3 Elements (3 component)**
  - Pb-Ba-Sb

- **2 Elements (2 component)**
  - Pb-Ba or Pb-Sb or Ba-Sb

- **1 Element (single component)**
  - Pb or Ba or Sb
2005 FBI symposium

“was to attempt to establish guidelines for the acceptance, practices, and interpretation of GSR examinations conducted primarily by scanning electron microscopy with energy dispersive X-ray spectrometry detection (SEM / EDS).”

Scientific Working Group
Areas of Discussion

- Term **Unique to** vs. **Characteristic of**

- Pb-Ba-Sb – 3 elements
  - Unique to GSR
  - Characteristic of GSR

- Pb-Ba, Pb-Sb, and Ba-Sb – 2 elements
  - Consistent with GSR
  - Indicative of GSR
Areas of Discussion

- Number of particles required to call a sample “positive.”
  - Is 1 enough? Is 3 enough?

- Number of samplers used.
  - Separate samples for the palms and backs of hands
  - One sample per each hand
Areas of Discussion

- **Number of particles analyzed and/or relocated and reported.**
  - Do you stop once a certain number is reached?
  - Do you need to analyze the entire stub?

- **Number of samples analyzed per kit.**
  - How many samples should be analyzed ... only one sample from dominant hand?
Case Study #1

- Suspect accused of discharging a firearm from the drivers side of his vehicle.
- 2 bystanders were struck by bullets.
- The suspect spoke to police after a few hours.
- The suspect’s hands and vehicle were tested for GSR.
# Case Study #1

**GSR on Suspect’s Hands**

<table>
<thead>
<tr>
<th>Hand Kit</th>
<th>3 Comp</th>
<th>2 Comp</th>
<th>Single Comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Back</td>
<td>3</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Right Palm</td>
<td>1</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Left Back</td>
<td>11</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Left Palm</td>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>
# Case Study #1
GSR in Suspect’s Vehicle

<table>
<thead>
<tr>
<th>Window Frame</th>
<th>3 Comp</th>
<th>2 Comp</th>
<th>Single Comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>1</td>
<td>2</td>
<td>152</td>
</tr>
<tr>
<td>Back</td>
<td>32</td>
<td>23</td>
<td>26</td>
</tr>
<tr>
<td>Bottom</td>
<td>9</td>
<td>4</td>
<td>71</td>
</tr>
<tr>
<td>Top</td>
<td>4</td>
<td>2</td>
<td>21</td>
</tr>
</tbody>
</table>
Interpretation

- Cannot say “suspect fired the gun”.

- Cannot date how long GSR has been on an item.
Verdict

- Guilty!

OTHER EVIDENCE

- Linked suspect to incident
  - Firearm
  - Witnesses

- Case is currently being appealed.
Case Study #2

- Man found shot in the head (he was in bed).
- His wife found him and called the police.
- Victim’s hands sampled prior to autopsy due to suspect’s (wife) claim of suicide.
- Later, gun was found in the house in a motorcycle saddlebag.
## Case Study #2

**GSR on Victim’s Hands**

<table>
<thead>
<tr>
<th>Hand Kit</th>
<th>3 Comp</th>
<th>2 Comp</th>
<th>Single Comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hand</td>
<td>1</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Left Hand</td>
<td>2</td>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>
A test fire was requested by the client due to the presence of very little GSR particulate on victim’s hands.

- Does firearm produce ample amounts of GSR?
- Environmental concerns?
## Case Study #2
### Test Fire

<table>
<thead>
<tr>
<th>Hand Kit</th>
<th>3 comp</th>
<th>2 comp</th>
<th>single comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hand *</td>
<td>≥ 33</td>
<td>≥ 31</td>
<td>≥ 25</td>
</tr>
<tr>
<td>Left Hand</td>
<td>≥ 46</td>
<td>≥ 25</td>
<td>≥ 19</td>
</tr>
</tbody>
</table>

* only analyzed 1/2 of stub
Cannot account for movement of victim’s hands and particle loss between incident and time of collection.

Cannot account for particulate on suspect’s hands.
Verdict

- Guilty!

OTHER EVIDENCE

- Linked suspect (wife) to incident
  - Glove found inside a basket of wet clothing
    - DNA was found on the inside & outside of glove
    - GSR was found on the outside of glove
  - Circumstantial evidence
    - Victim had an affair (wife knew about it)
Case Study #3

- Woman found shot in the basement of a church.

- Police had suspect based on statements from church members.

- Police interview suspect – next day gun found on bank of lake by fishermen.

- Suspect’s wig and vehicle sampled for GSR.
Case Study #3
GSR in Suspect’s Vehicle

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>3 comp</th>
<th>2 comp</th>
<th>single comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door Handle Armrest</td>
<td>1</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Wiper/Turn Signal</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Driver Seat</td>
<td>1</td>
<td>2</td>
<td>13</td>
</tr>
</tbody>
</table>
Interpretation

Cannot say who had access to the vehicle (the vehicle belonged to the suspect’s brother).

Only 3 of 18 samples were positive for GSR.

No GSR found on wig.
Verdict

- Guilty!

OTHER EVIDENCE

- Linked suspect to incident
  - Gun registry
  - Character witnesses from church
    - pastor, other parishioners
Case Study #4

- A vehicle of men shot at another vehicle at a drive-thru window at a fast food restaurant.
  - 2 passengers were shot, 1 survived.

- Police found suspects several hours later.

- ISID kits used to collect samples for GSR from 2 suspects’ hands.
  - Suspect #2 admitted to discharging a firearm.
# Case Study #4

## GSR on Suspects’ Hands

<table>
<thead>
<tr>
<th>Hand Kit</th>
<th>3 comp</th>
<th>2 comp</th>
<th>single comp</th>
</tr>
</thead>
<tbody>
<tr>
<td>suspect #1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>suspect #2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Interpretation

- Type of kit could have effected the results of the analysis.
- Length of time between the shooting and collection can effect the results.
Verdict

- Suspect #2 – Guilty!

OTHER EVIDENCE

- Linked suspect to incident
  - Prior incidents between suspects and victims
  - Suspect #2 confessed!
Summary

- IF GSR is found, suspect could have:
  - Fired a weapon,
  - Been in the vicinity of a fired weapon, or
  - Touched an item with GSR on it.
IF GSR is NOT found on suspect:

- It wasn’t there to begin with,
- It was removed prior to testing due to physical activity,
- Inefficient testing media was used, or
- The ammunition is lacking one or more of the three elements.
Any Questions?

- Summary of the FBI Laboratory's Gunshot Residue Symposium, May 31–June 3, 2005, Forensic Science Communications, July 2005, Volume 8, Number 3

- www.google.image.com