

# Sample Collection of Fire Debris from Burned Cadavers for Ignitable Liquid Analysis

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# PURPOSE

Determine backgrounds of various burned cadaver remains such as hair, skin, clothing, and skin swabs to conclude the best substrate for a successful identification of ignitable liquid residues in order to develop a standard sampling protocol of victims remains found in fire scenes for ignitable liquid analysis.



# METHODS & MATERIALS

- 3 cadavers laid prone with 5 feet of distance between each.
- 1 liter of 87 octane gasoline was poured over the central mass.
- Each cadaver was lit with a propane torch within 10 seconds of being doused.

Cadavers	Clothing	Burning Condition	Samples	Burn Time
<b>Female # 1</b>	Polyester	1 liter of Gasoline poured on dorsal side of body. Ignited with a propane torch	Clothing, Skin, Hair	~45 Minutes
<b>Female # 2</b>	Cotton		Clothing, Skin, Hair	~8 Hours
<b>Female # 3</b>	Cotton		Clothing, Skin, Hair	~1 Hour



# METHODS & MATERIALS

- 4 types of samples were collected
  - Hair
    - 6cm patch (or what remained) was taken.
  - Skin
    - Taken from the right arm, right armpit, right groin, and chest.
    - Approximately 3x3cm squares.
  - Skin Swabs
    - Taken from the left arm, left armpit, left groin, and chest.
    - Medical gauze was used for cadavers 1 & 3.
    - Tissue wipes were used for cadaver 2.
  - Clothing
    - Shirts and bras were packaged in one can.
    - Pants and underwear in a second can.
- 56 samples collected in total.



# METHODS & MATERIALS

- Skin and skin swab samples were stored at  $-15^{\circ}\text{C}$  to prevent microbial degradation and decomposition.
- Hair and clothing samples were stored at room temperature.
- Unburned skin, hair, and clothing were collected as control samples.
  - 1/3 of each was unaltered. 1/3 was set on fire without the use of accelerant. 1/3 was set on fire with 0.5 mL of gasoline and allowed to burn until half consumed or self-extinguished.
- Passive headspace extraction
  - 12 hours at  $65^{\circ}\text{C}$
  - Elution using  $\text{CS}_2$







# METHODS & MATERIALS

## GC/MS Parameters

Injection Temperature - 250°C

Split Ratio - 20:1

Flow Rate - 0.5 ml/min

### Gas Chromatography

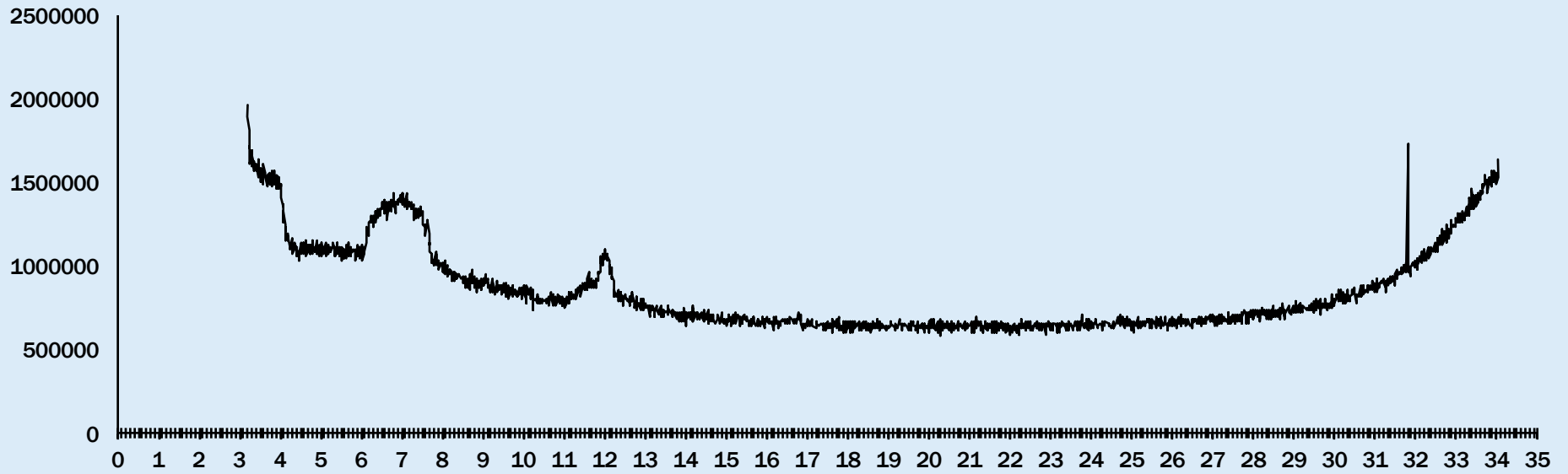
Initial Temperature	40°C
Ramp 1	5°C/min
Interim Temperature	120°C
Ramp 2	12°C/min
Final Temperature	300°C
Final Hold Time	1 min

### Mass Spectrometry

Transfer Line Temperature	280°C
Acquisition Range	15-300 amu
Solvent Delay	None

# SH RESULTS

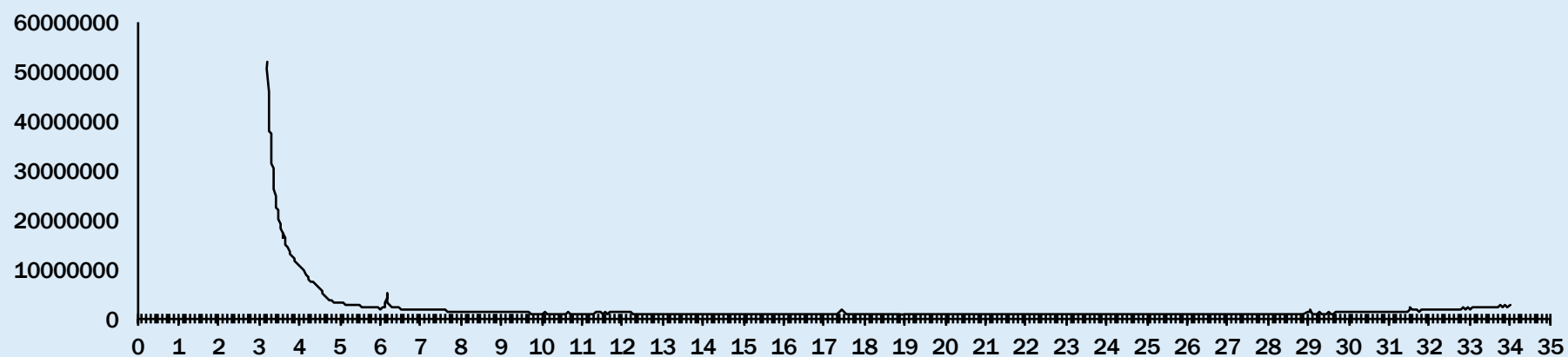
Cadaver 1 Armpit Swab



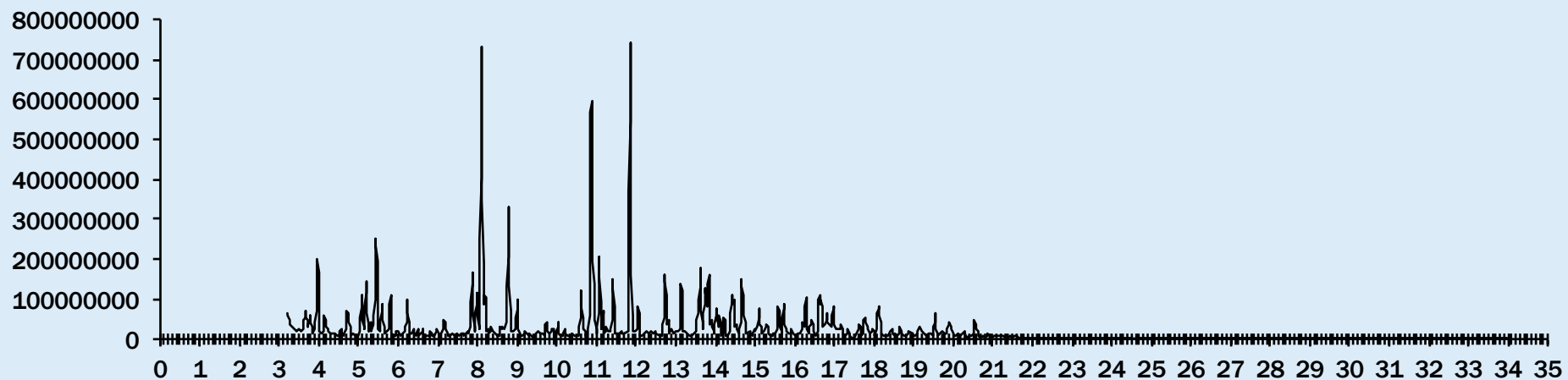
Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Arm Swab	No	Arm Swab	No	Arm Swab	No
Armpit Swab	No	Armpit Swab	No	Armpit Swab	No
Groin Swab	No	Groin Swab	No	Groin Swab	No
Chest Swab	No	Chest Swab	No	Chest Swab	No

# SH RESULTS

Control Test - Skin Burned without Gasoline



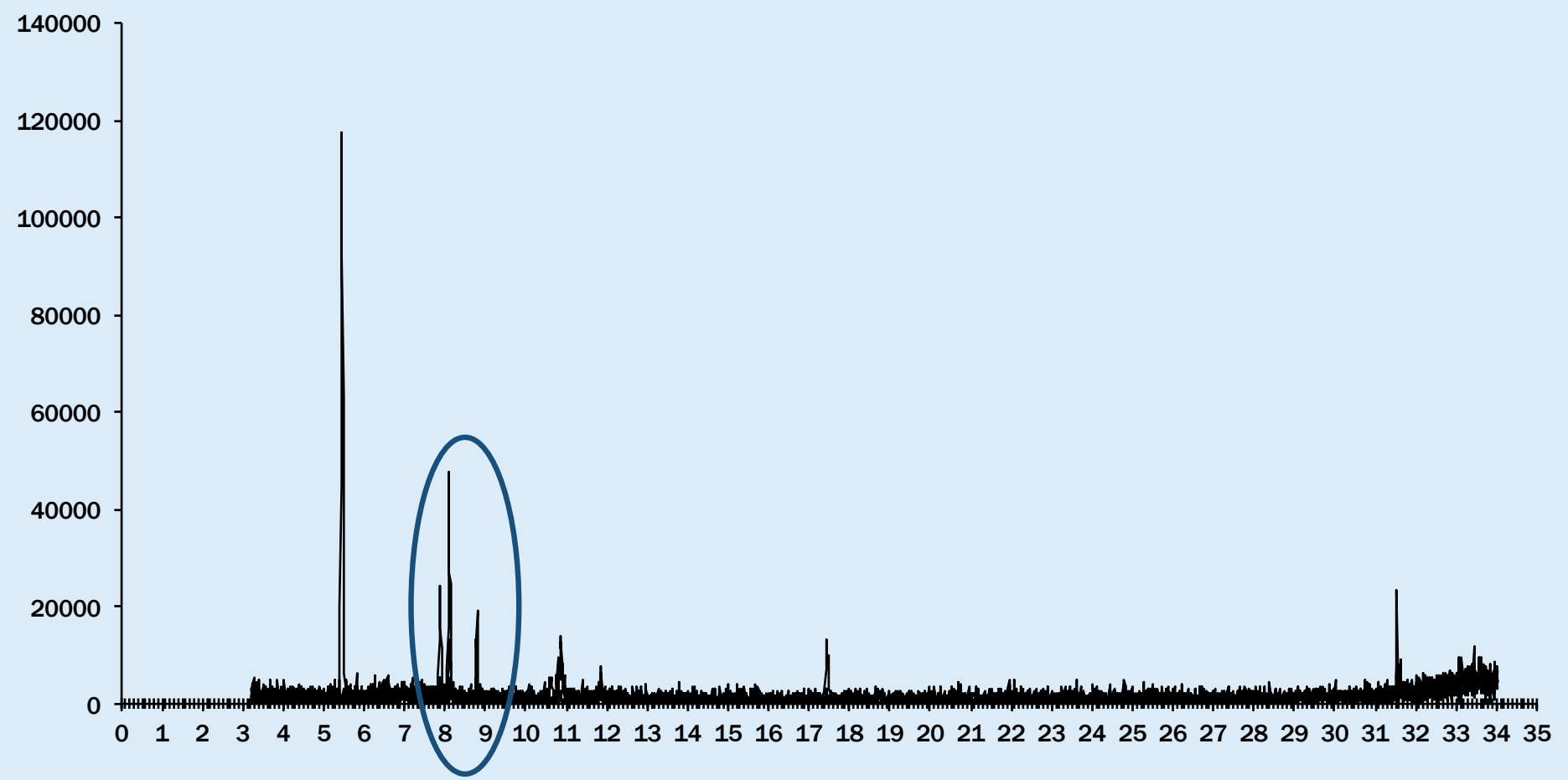
Control Test - Skin Burned with Gasoline





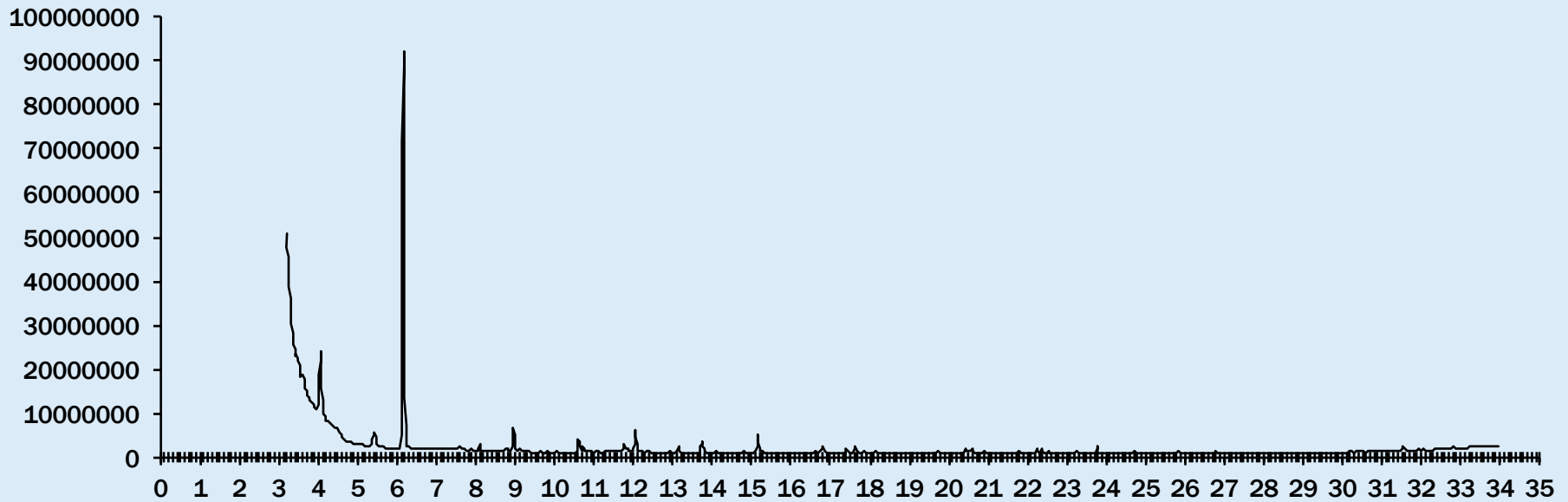
# SH RESULTS

Skin Burned without Gasoline - Aromatic Extracted Ion Profile



# SH RESULTS

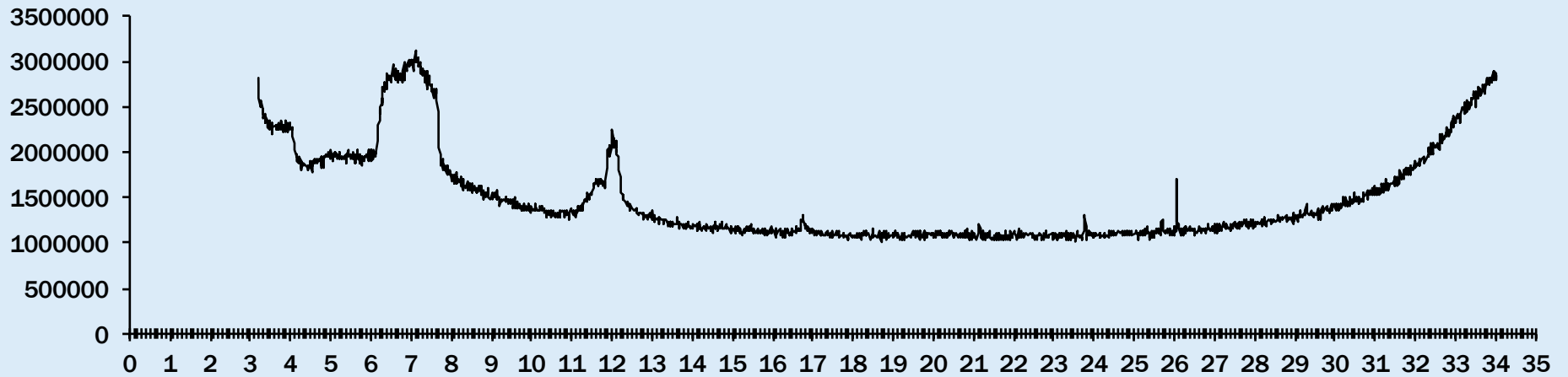
Cadaver 2 Groin Skin (SHSU)



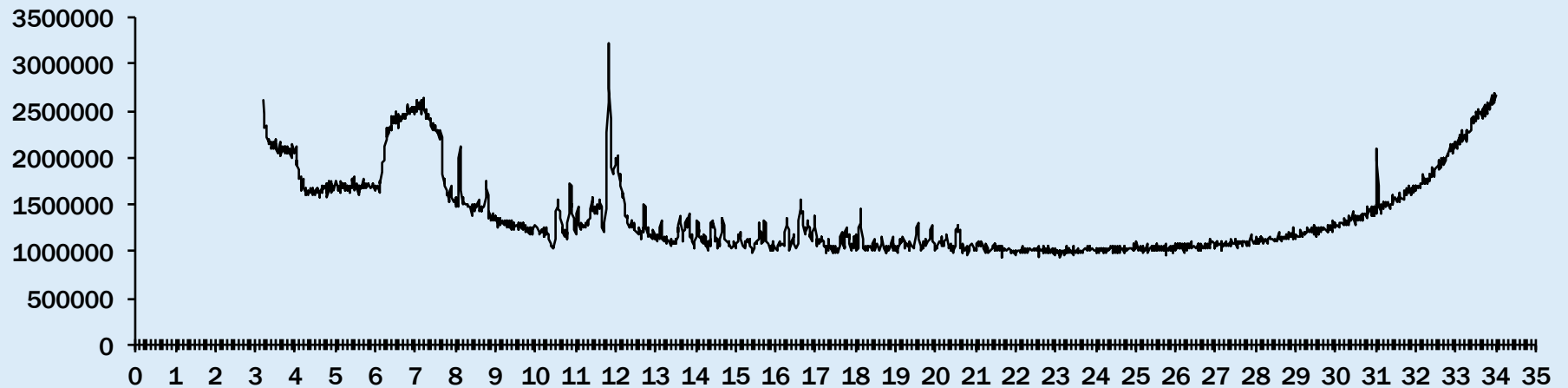
Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Arm skin	No	Arm skin	Yes	Arm skin	No
Armpit skin	No	Armpit skin	Yes	Armpit skin	Yes
Groin skin	Yes	Groin skin	Yes	Groin skin	Yes
Chest skin	Yes	Chest skin	Yes	Chest skin	Yes

# SH RESULTS

Control Test - Hair Burned without Gasoline



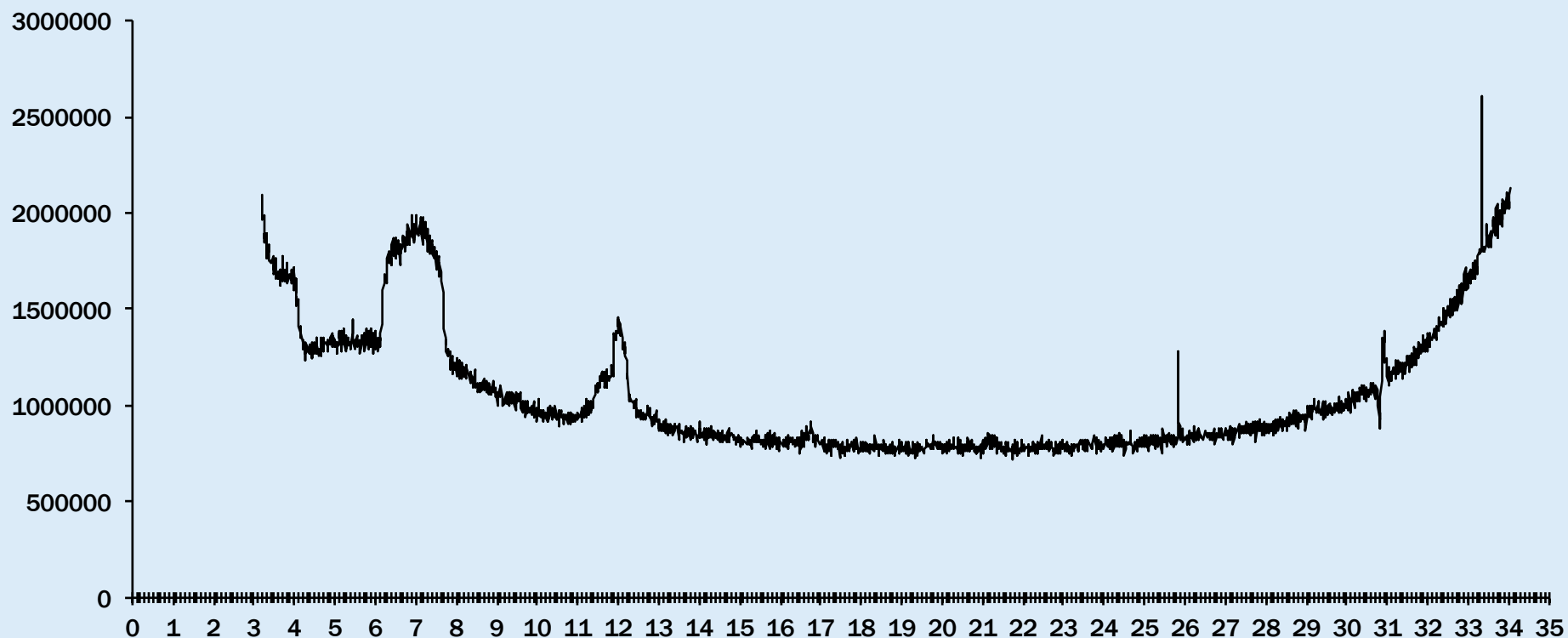
Control Test - Hair Burned with Gasoline





# RESULTS & DISCUSSION

Cadaver 3 Hair

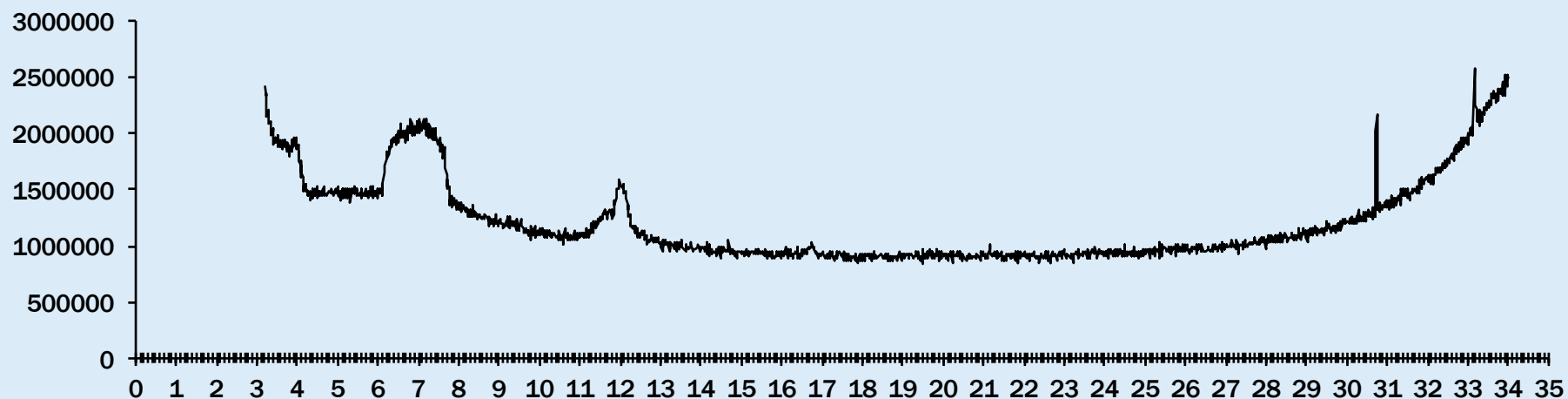


Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>SHSU</i>	<i>Sample</i>	<i>SHSU</i>	<i>Sample</i>	<i>SHSU</i>
Hair	No	Hair	No	Hair	No

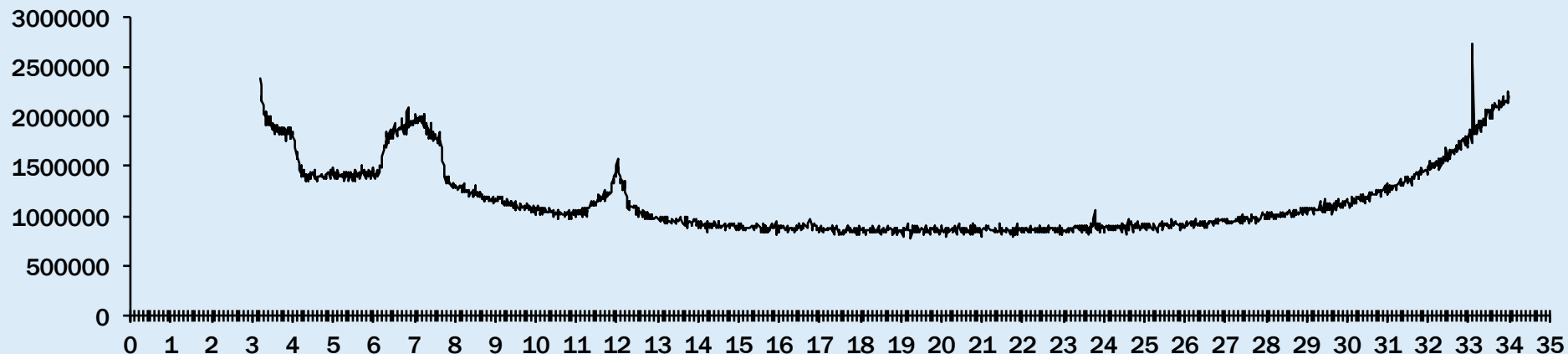


# RESULTS & DISCUSSION

Control Test - Cotton Top Burned with Gasoline



Control Test - Polyester Top Burned with Gasoline

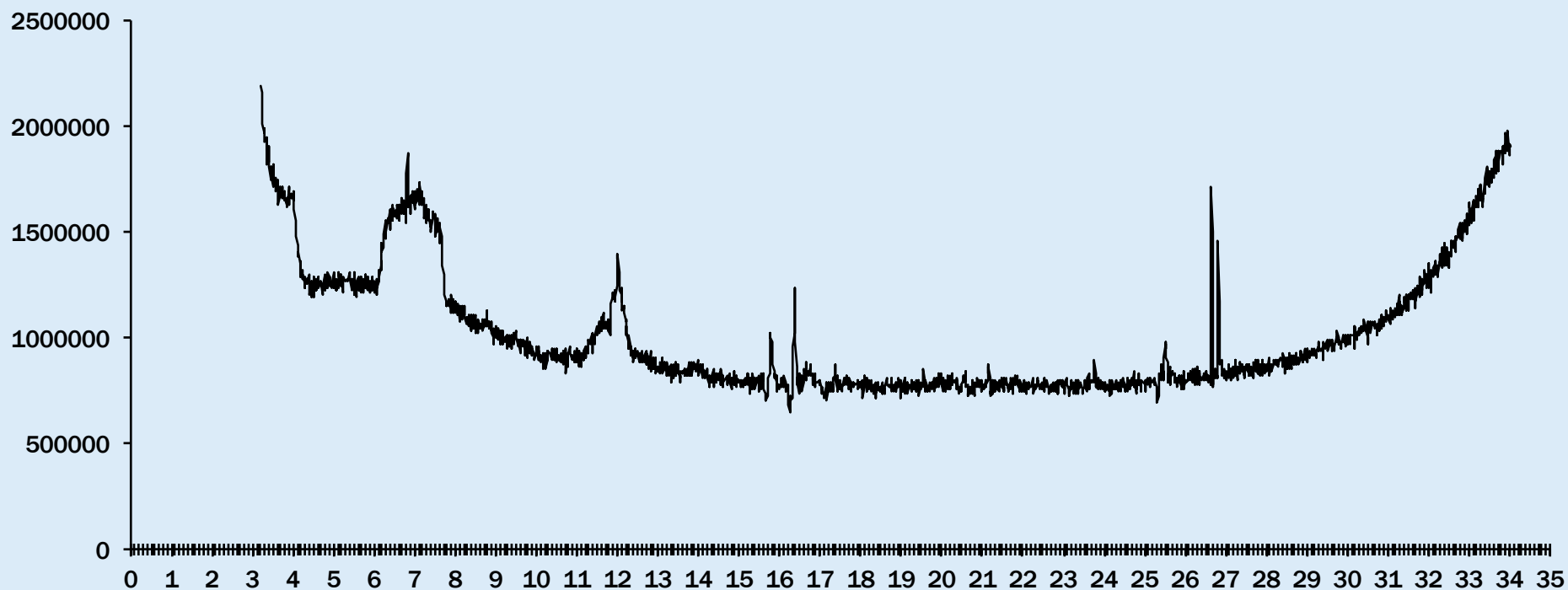






# RESULTS & DISCUSSION

Cadaver 1 Polyester Shirt



Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Shirt	No	Shirt	No	Shirt	No
Pants	No	Pants	No	Pants	No

# SH DISCUSSION

Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Arm Swab	No	Arm Swab	No	Arm Swab	No
Armpit Swab	No	Armpit Swab	No	Armpit Swab	No
Groin Swab	No	Groin Swab	No	Groin Swab	No
Chest Swab	No	Chest Swab	No	Chest Swab	No
Arm Skin	No	Arm Skin	Yes	Arm Skin	No
Armpit Skin	No	Armpit Skin	Yes	Armpit Skin	Yes
Groin Skin	Yes	Groin Skin	Yes	Groin Skin	Yes
Chest Skin	Yes	Chest Skin	Yes	Chest Skin	Yes
Shirt	No	Shirt	No	Shirt	No
Pants	No	Pants	No	Pants	No
Hair	No	Hair	No	Hair	No

# SH DISCUSSION

Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Arm Swab	No	Arm Swab	No	Arm Swab	No
Armpit Swab	No	Armpit Swab	No	Armpit Swab	No
Groin Swab	No	Groin Swab	No	Groin Swab	No
Chest Swab	No	Chest Swab	No	Chest Swab	No
Arm Skin	No	Arm Skin	Yes	Arm Skin	No
Armpit Skin	No	Armpit Skin	Yes	Armpit Skin	Yes
<b>Groin Skin</b>	<b>Yes</b>	Groin Skin	Yes	Groin Skin	Yes
<b>Chest Skin</b>	<b>Yes</b>	Chest Skin	Yes	Chest Skin	Yes
Shirt	No	Shirt	No	Shirt	No
Pants	No	Pants	No	Pants	No
Hair	No	Hair	No	Hair	No

# SH DISCUSSION

Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Arm Swab	No	Arm Swab	No	Arm Swab	No
Armpit Swab	No	Armpit Swab	No	Armpit Swab	No
Groin Swab	No	Groin Swab	No	Groin Swab	No
Chest Swab	No	Chest Swab	No	Chest Swab	No
Arm Skin	No	<b>Arm Skin</b>	<b>Yes</b>	Arm Skin	No
Armpit Skin	No	<b>Armpit Skin</b>	<b>Yes</b>	Armpit Skin	Yes
<b>Groin Skin</b>	<b>Yes</b>	<b>Groin Skin</b>	<b>Yes</b>	Groin Skin	Yes
<b>Chest Skin</b>	<b>Yes</b>	<b>Chest Skin</b>	<b>Yes</b>	Chest Skin	Yes
Shirt	No	Shirt	No	Shirt	No
Pants	No	Pants	No	Pants	No
Hair	No	Hair	No	Hair	No

# SH DISCUSSION

Cadaver 1		Cadaver 2		Cadaver 3	
<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>	<i>Sample</i>	<i>ILR</i>
Arm Swab	No	Arm Swab	No	Arm Swab	No
Armpit Swab	No	Armpit Swab	No	Armpit Swab	No
Groin Swab	No	Groin Swab	No	Groin Swab	No
Chest Swab	No	Chest Swab	No	Chest Swab	No
Arm Skin	No	<b>Arm Skin</b>	<b>Yes</b>	Arm Skin	No
Armpit Skin	No	<b>Armpit Skin</b>	<b>Yes</b>	<b>Armpit Skin</b>	<b>Yes</b>
<b>Groin Skin</b>	<b>Yes</b>	<b>Groin Skin</b>	<b>Yes</b>	<b>Groin Skin</b>	<b>Yes</b>
<b>Chest Skin</b>	<b>Yes</b>	<b>Chest Skin</b>	<b>Yes</b>	<b>Chest Skin</b>	<b>Yes</b>
Shirt	No	Shirt	No	Shirt	No
Pants	No	Pants	No	Pants	No
Hair	No	Hair	No	Hair	No





# CONCLUSIONS

- Skin swabs are unable to remove absorbed ignitable liquids and are not recommended for use.
- Skin and hair are the best sampling substrates to collect from a burned cadaver for the determination of ignitable liquid residues.
  - Take skin from natural folds in the body near the torso. Pieces as small as 3cm x 3cm of skin may be collected, but it is advisable to collect a larger area such as 9cm x 9cm.
  - All available hair should be collected. It is not necessary to remove the hair all the way down to the root.
- Clothing did not test positive using this methodology. It is advisable to collect it for backup testing.

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# Questions?

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