

# Burning Down the House: A Case Study in Forensic Instrumental Analysis

by

**Adam M. Boyd** and **Randolph K. Larsen III**

Chemistry and Biochemistry  
St. Mary's College of Maryland



As Dr. Marie Stanforth steered her cumbersome SUV into an unoccupied space at the scene of the latest fire in upstate Michigan, she instantly recognized the address. It was the current residence of her ex-husband. Yet, with the same calm and collected demeanor with which she approached every crime scene she ever visited, Dr. Stanforth confidently opened the door of her car and walked purposefully towards the extinguished blaze.

Her boots crunched through a thin layer of snow as she trudged toward the scene. The record cold—the coldest morning to date that winter—gave rise to a light snow slowly blanketing the entire state for the first time that year. Marie marveled at how snow seemed to cover everything in a forgiving white veil. “Poor jerk,” she thought to herself as she approached the smoldering blaze with her hands tucked in the pockets of her heaviest parka. “I wonder where he’s going to live now.” Before she reached the scene, however, she was met by her partner, Adley.

“So what happened?” she dryly asked Adley as she tried to maneuver closer to the extinguished blaze.

“There was a fire,” Adley recounted. “There was a real bad fire.”

“Thanks for the update, partner,” Marie laughed as she put her hand on Adley’s shoulder. “Let’s have a look,” she added as she tried to push her way past Adley’s outstretched arms. “Last time I checked we still got paid poorly to dig through ashes and play around with chemicals in a lab.... Why are you blocking me?”

“I think there is something you need to hear,” said Adley as he grabbed hold of Marie’s arm.

“Look,” Marie retorted, as she looked down at her arm and then pried it loose from Adley’s grasp, “I know what you’re going to say. One of the higher-ups is going to take me off this case because Thomas and I officially broke it off a little over 13 months ago. Given my emotional state, yada yada yada, I shouldn’t have anything to do with the investigation—got it. I just feel bad that he’s going to have to find someplace else to live. Can we go do our jobs now?”

“It’s different than that, Marie.”

“How is it different? Look, Ad, newsflash: that was a year ago. It was over with Thomas about four days after it got started, so if you don’t mind I’d like to have a look at the crime scene before we both freeze to death.” With that Marie pushed past her partner and walked intently toward the roped off scene.

“Tom is dead,” Adley half muttered, forcing out the words as he choked on them. “I didn’t know how to tell you. He died in the fire.”

Marie turned slowly around to look her partner in the eye. Her head cocked to the side as her grey eyes appeared focused on something off in the distance. “He’s dead? Tom is dead?”

“He couldn’t make it out in time. Fire squad found him face down on his mattress. It looks like he tried to make his way out of his room, but the smoke was too dense. We won’t know exactly what happened until

we get the autopsy back from the coroner. Look, Marie, you're already off the case. Chief already came down here first thing this morning to make sure everybody knew. At the moment, the only thing you can do is go down to the station and talk to the police. They want to question you."

"What are you saying?" Marie asked despondently, hoping for Adley to change his story.

"You know what I'm saying," said Adley, his breath clouding up in front of his face as he stared through her. "They want to question you about the fire. They think it was arson. You're a suspect."

The final jab caught Marie off guard. Everything inside of her wanted to scream—her impeccable service record would be stained by unfounded charges. Instead she looked weakly at Adley and then trudged slowly back to her car.

When Marie arrived for questioning at the police station, she reiterated her pleas of innocence. "We're on the same team, remember? I've been putting away bad guys for ten years, and now I'm a suspect? We all know it's some sick kid out for kicks on a Friday night, or our serial guy who's already lit up half of Michigan. I didn't like Tom, but I wasn't going to burn down his house. Check with the lab," Marie said as she stood up from the table. "I can promise you that the results are going to show that it was either an accident or a hasty gasoline fire started by some amateur with emotional problems."

The detective looked over some files and then looked up at Marie. "Look, the fact of the matter is you've got a clearly defined motive and the intelligence necessary to pull off something like this. The victim's mother is downright convinced it was you. She says you've just been biding your time before you took a chance at doing some damage. Either way, the fire burned almost the entire house to the ground. So we either got one heck of an accidental fire on our hands or somebody made sure that fire finished what it started. We're not ruling anyone out until we hear back from the lab."



### ***At this point in the narrative, students should consider the following:***

You are a principal forensic chemist for the FBI. It is your job to analyze charred samples recovered from the crime scene and a clothing swatch obtained from Dr. Stanforth. You will analyze the samples for accelerants and compare your findings to standards of common propellants that are often used to start fires. You should devise a justified methodology for performing a qualitative analysis of the samples. Based on your findings, Adley and the fire investigators will be able to determine whether the fire was the result of arson and if charges leveled against Marie are credible.

Based on a report provided to you by Adley, you must analyze one cloth sample recovered from a glove found in Dr. Stanforth's trunk and three charred samples collected from the scene of the crime (see next page).

### ***Questions***

1. What is the legal definition of arson?
2. What types of evidence have been used to convict individuals of arson? How will you be able to tell if arson has been committed?
3. What is the significance of the term "point of origin"?
4. Given that the analytes of interest are volatile, what techniques could you use to conduct your investigation?
5. Which of the techniques you identified do you think will work best in your investigation, and why?

## Lab Report

Students should draft a lab report in which you:

- determine if the fire was the result of arson,
- determine whether Dr. Stanforth can be ruled out as a potential suspect,
- justify and explain your conclusions, and
- describe your methodology.

## Crime Scene Schematic

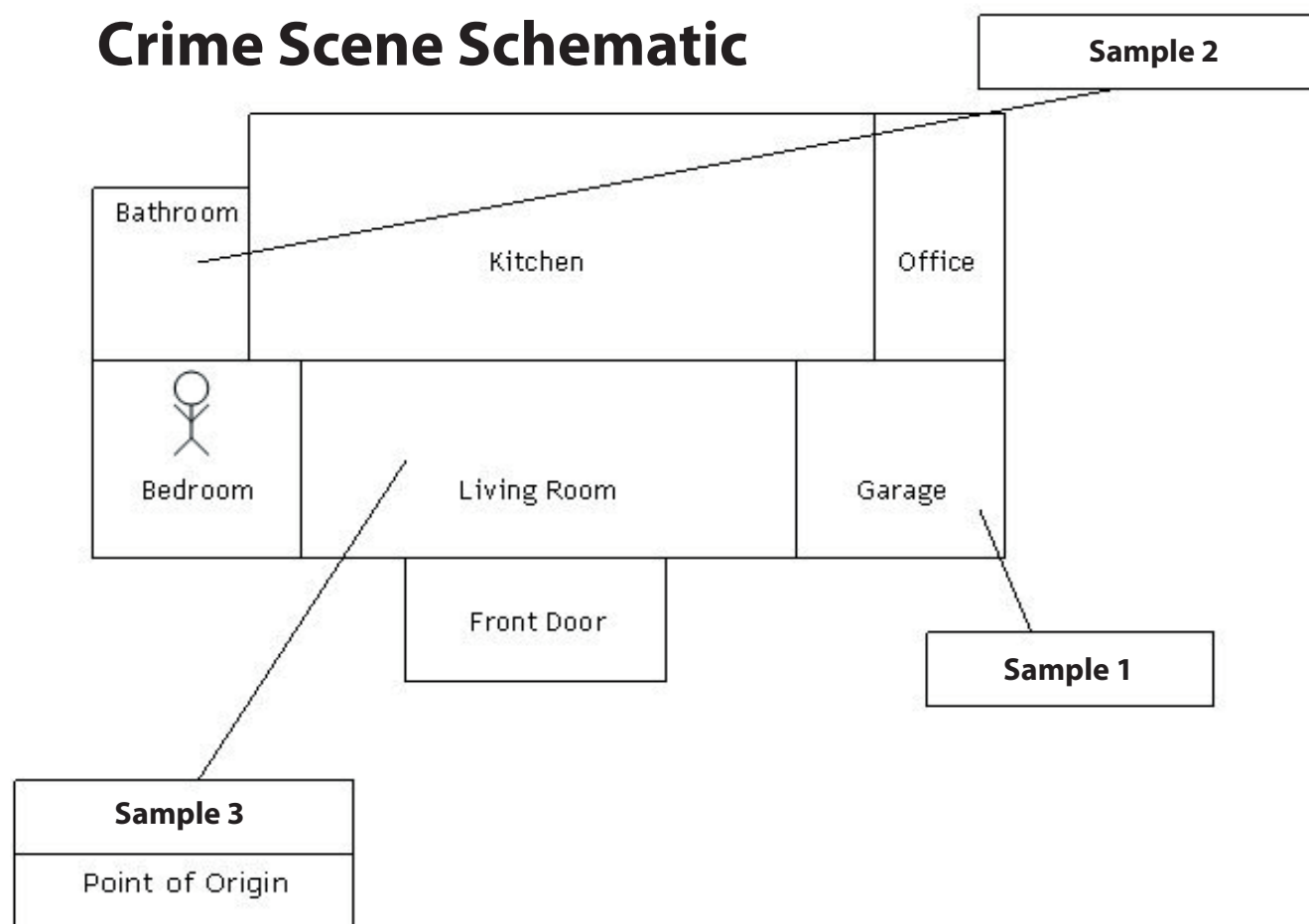


Image Credit: Title image based on photo by TJ Kloster ©.

Copyright © 2005 by the National Center for Case Study Teaching in Science.

Originally published 10/19/05 at [http://www.sciencecases.org/burning\\_house/burning\\_house.asp](http://www.sciencecases.org/burning_house/burning_house.asp)

Please see our [usage guidelines](#), which outline our policy concerning permissible reproduction of this work.