EXHIBIT B

WestVirginiaUniversity.
EBERLY COLLEGE OF ARTS AND SCIENCES

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May 29, 2019

RE: Report on the case of Jason Lively

Dear Mr. George,

In July 2018, Gordon Mowen (WV Assistant Attorney General) asked me to review the details of the State Fire Marshal's analysis in Jason Lively's case. Specifically, he asked if the analyses were performed and interpreted correctly, and whether I found any merit in Craig Beyler's counterargument to the State's original report. After I agreed to work *pro bono* on this case, Mr. Mowen then shared several documents for me to review. I contacted Mr. Mowen via email on August 21, and after a brief response from him on August 23, I did not hear back from him. I later learned that he had vacated his position around that time. After hearing from you last week, I am writing now to provide my opinions regarding the fire debris analysis in this case.

In forming my opinions, I have reviewed the following documents:

- Casto Investigations' report for Encompass Insurance by Mr. Raymond Griffith (dated 03/24/2005)
- Ralph Newell's report to Cailyn Knapp (no date) (36 pages).
- State Fire Marshall's Report by Mr. Robert Bailey (dated 09/09/05) (22 pages with some blank)
- WV State Fire Marshall's Laboratory Report by Ms. Koren Powers (dated 04/19/05) (50 pages)
- Dr. Craig Beyler's Report to Mr. Sidney Bell, Prosecuting Attorney (dated 05/31/2012) (20 pages)
- Dr. Craig Beyler's CV (8 pages)
- Dr. Craig Beyler's PPT in PDF format (24 pages)
- Photographs of the fire scene provided in PDF format by Andrew George (104 pages)

Summary Findings:

1) I agree with the State's finding of toluene in sample #12. However, given that toluene is frequently encountered in adhesives and flooring materials, and given that toluene is a common pyrolysis product of wood and flooring materials, one cannot be confident that the toluene in sample #12 is present because an ignitable liquid was applied to the matrix. The use of comparison samples—such as similar piece of flooring from an undamaged part of the bedroom—would have enabled more confident interpretation of the results,

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but comparison samples were not taken. Comparison samples are recommended in ASTM-E1618: Standard Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography-Mass Spectrometry and National Fire Protection Association (NFPA) 921: Guide for Fire and Explosion Investigations, 2004.

2) I agree with the reports of Dr. Beyler, Raymond Griffith and Ralph Newell, that the available evidence and prevailing wisdom indicate that the origin of the fire was most likely to be below the subfloor of the upstairs bedroom. Such an origin is inconsistent with the use of toluene as an ignitable liquid in the upstairs bedroom.

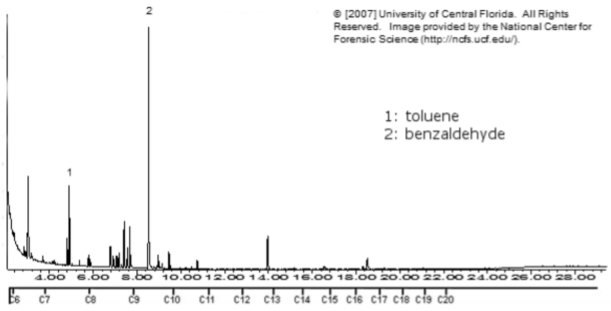
Disclaimer: The opinions expressed herein are based on my education, training and experience in the chemical analysis of ignitable liquids and familiarity with the fire scene analysis literature. A summary of my education and experience is obtained in my CV (attached). I reserve the right to modify my opinions in light of any new evidence.

Bases for opinions:
Ms. Powers' supporting data files include true negatives (blanks) and true positives (an aromatic standard mix and a commercial aromatic standard mixture), which all support the chemical identification of toluene in sample #12. The time stamps of the data files support the hypothesis that the instrument did not possess carryover or contamination prior to the analysis of any of the samples. The data file for sample #12 contains a dominant toluene peak (at $1.2x10^7$ counts) and relatively smaller (though still abundant at ~$1x10^6$ counts) contributions from common pyrolysis products, furfurol, p-xylene and styrene. These abundances are actually within the normal range of pyrolysis products, as will be described below.

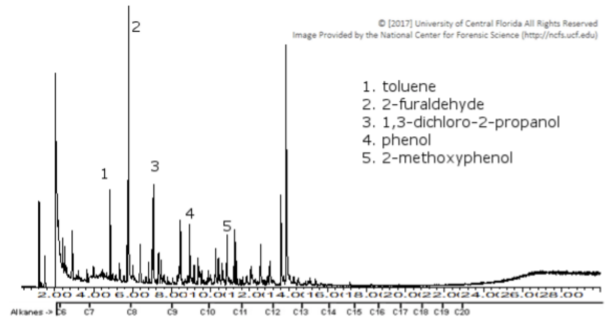
However, the interpretation of a dominant toluene peak in charred wooden flooring should take into account two important factors: 1) toluene is commonly found in wood and flooring materials, and 2) toluene is one of the most common pyrolysis products (e.g. J. R. Almirall, K. G. Furton. *J. Anal. Appl. Pyrolysis*, 2004, 71, 51-67; A. Akmeemana, M. R. Williams, M. E. Sigman, *Forens. Chem*., 2017, 5, 91-108). Once a compound or class of compounds is identified in fire debris, an analyst must take great care to determine whether the compounds arose from background contamination in the matrix, pyrolysis products during the fire, or from a foreign ignitable liquid.

To help analysts make such determinations, the National Center for Forensic Science (NCFS) hosts an ignitable liquid reference collection (ILRC) and a substrate database (e.g. http://ilrc.ucf.edu/substrate/search). These databases inform practitioners about the diversity and frequency of different compounds in different ignitable liquids and substrates. The substrate database includes unaltered and heat-treated substrates to provide examples of the changes in composition one might observe when a substrate undergoes direct and indirect heating during a fire.

In the substrate database, headspace GC-MS analysis (the same method used by the State Fire Marshal's Lab) of unaltered hardwood in samples M0024 and M1220 shows toluene as a major component in the wood. These two samples provide an indication of the variance in chemical composition that one can find between different hardwoods.



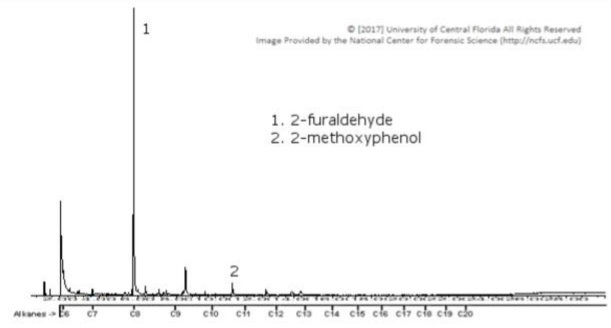
MRN	0024
HC Range	C 6-C 10
Material use class	Flooring -
Material use sub-class	Hardwood
Product Name/Description	Cherry Hardwood
Ignitable Liquid Residue Present	None
Method	Unburned -
Major Peaks	toluene benzaldehyde
Predominat Profile	Aromatics
Material Composition	Wood
Committee Reviewed	Yes
Sample detail & download section	
Related Records	



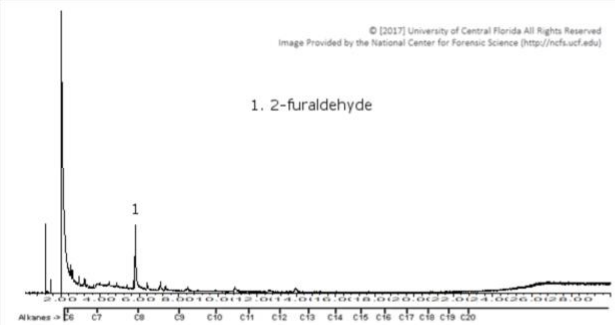
MRN	1220
HC Range	C 5-C 14
Material use class	Flooring -
Material use sub-class	Hardwood
Product Name/Description	Solid Hardwood Maple Modena
Ignitable Liquid Residue Present	None
Method	MDDM - 1 min.
Major Peaks	toluene 2-furaldehyde 1,3-dichloro-2-propanol phenol 2-methoxyphenol
Predominat Profile	Aromatics
Material Composition	Wood
Committee Reviewed	Yes
Sample detail & download section	
Related Records	

The analysis of other hardwood flooring materials can reveal relatively simple chromatograms of the type shown for sample #12, but that show furfurol (2-furaldehyde) as the major component in the chromatograms, even after some heating. Furfurol was among the four most abundant compounds in sample #12.

Examples of hardwoods containing simple headspace compounds and furfurol include M1260 and M1228, below.



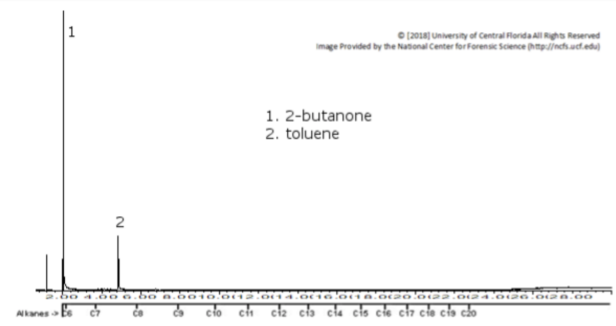
MRN	1260
HC Range	C 6-C 13
Material use class	Flooring -
Material use sub-class	Hardwood
Product Name/Description	Barrel Oak Hardwood Flooring
Ignitable Liquid Residue Present	None
Method	MDDM - 1 min.
Major Peaks	2-furaldehyde 2-methoxyphenol
Predominat Profile	Undetermined
Material Composition	Wood
Committee Reviewed	Yes
Sample detail & download section	
Related Records	



MRN	1228
HC Range	C 7-C 10
Material use class	Flooring -
Material use sub-class	Hardwood
Product Name/Description	Solid Hardwood Maple Modena
Ignitable Liquid Residue Present	None
Method	Indirect Heat - 3 min.
Major Peaks	2-furaldehyde
Predominat Profile	Aromatics
Material Composition	Wood
Committee Reviewed	Yes
Sample detail & download section	
Related Records	

The substrate database also shows that laminate and vinyl flooring materials often contain toluene as the dominant component of the headspace (e.g. M0179 & M0180 (laminate flooring)), M0186, M0187 & M0187 (vinyl plank flooring) and M0849 (vinyl plank flooring). However, the flooring in the bedroom fire in question supposedly contained hardwood flooring, not vinyl or laminate.

If the wooden flooring was installed with any adhesives, the adhesives are very likely to contain a dominant profile for toluene. This assertion is supported by numerous research articles and reference data from the NCFS database. For example, sample M1489 is an adhesive that contains two major components. However, the peak for 2-butanone would not be observable in the analysis conditions used by Ms. Powers. In short, a hardwood installed with an adhesive would be expected to contain toluene and furfurol as major components in the headspace, just like sample #12. The peaks for p-xylene and styrene in sample #12 are expected, normal contributions from pyrolysis.



MRN	1489
HC Range	C 5-C 8
Material use class	Building Materials -
Material use sub-class	Adhesives
Product Name/Description	Plastic and Emblem Adhesive
Ignitable Liquid Residue Present	Oxygenated
Method	Unburned -
Major Peaks	2-butanone toluene
Predominat Profile	Aromatics
Material Composition	See Supplemental Info
Committee Reviewed	Yes
Sample detail & download section	
Related Records	

NFPA 921 (2004) section 6.17.8.2.2 describes the importance of comparison samples to help distinguish the source of compounds that are common to both ignitable liquids and pyrolysis products. One part of this standard states:

> *It should be noted that pyrolysis products, including hydrocarbons, can be detected in gas chromatographic analysis of fire debris in the absence of the use of accelerants. It can be helpful for the laboratory, when analyzing carpet debris, to burn a portion of the comparison sample and run a gas chromatographic analysis on both. By comparing the results of the burned and unburned comparison samples with those from the fire debris sample, it may be*

possible to determine whether or not hydrocarbon residues in the debris sample were products of pyrolysis or residue of an accelerant.

The NFPA standard makes such comparisons optional (i.e. "It can be helpful"), but in cases like sample #12 in the Jason Lively case, a comparison sample is essential to differentiate between the different potential sources of toluene.

Similarly, ASTM 1618 also recommends the use of comparison (e.g. control) samples. For example, section 11.5.2 states:

If there is suspicion that an ignitable liquid found might be indigenous to the substrate, the testing of an appropriate comparison sample, if available, may aid in determining whether an ignitable liquid is foreign to the substrate.

ASTM 1618 also cautions about reporting compounds as ignitable liquids in matrices that are known to contain the same compounds. E.g., section 12.3.3.2 states:

The analyst shall use caution and not report positive results if the submitted items may contain a matrix which is known to contain an ignitable liquid of the type detected. If the laboratory elects to report matrix compounds, such as terpenes in wood and alcohols in clothing, the report shall reflect the nature of the ignitable liquid. Examples of report conclusions for items with matrices that contain known ignitable liquids include:

No ignitable liquids were detected on Items #7 and #8 (sneakers) other than compounds associated with the items.

Toluene was identified on Items #3 and #4 (sneakers). Toluene is found in glue commonly used in the manufacturing of shoes.

No ignitable liquids were detected on Item #11 (pine studs) except for terpenes which are common to softwoods.

Again, to assert that the toluene in sample #12 is due to the addition of toluene liquid to the matrix, one would first have to establish that the background levels of toluene in a portion of the same matrix (e.g. wood, adhesives and pyrolysis) were known to be devoid of liquid toluene. Unfortunately, no such comparison sample was analyzed in this case.

Abundance and variance of pyrolysis products

Sample #12 was asserted to contain an ignitable liquid, possibly because it met three criteria: 1) toluene can be found in liquid form in commercial products, 2) the toluene peak is considerably more abundant in sample #12 than the other pyrolysates in the sample, and 3) chromatogram #12 does not contain many other abundant pyrolysis products. However, as I will show below, the other samples in this case contain distributions of pyrolysates that demonstrate that the chromatogram in sample #12 fits within the range of observed pyrolysis products, so it is not reliable to assert that liquid toluene was involved.

Sample #4 is typical of pyrolysis products in that the compounds in the chromatogram span a wide range of boiling points from toluene at ~4 minutes to compounds well beyond the methyl

naphthalenes at ~11 minutes. The chromatogram is dominated by common pyrolysates like toluene, furfurol, styrene, pinene, limonene and naphthalene, with a maximum abundance of $4x10^5$ counts for styrene. Of these compounds, furfurol, styrene, pynene and limonene are generally not present in petroleum distillates. Although naphthalene and alkylnaphthalenes are present in many petroleum distillates, the extracted ion profiles provided in the Fire Marshal's report show that the relative distribution of 2-methylnaphthalene and 3-methylnaphthalene are significantly different than is typically observed in petroleum distillates (e.g. E. Stauffer, J. A. Dolan, R. Newman, Fire Debris Analysis, Elsevier, New York, NY, 2008).

Samples #7, 9 and 10 (no ignitable liquids detected) contain similarly complex, abundant and characteristic examples of pyrolysates. Sample #10 contains abundant pyrolysates with a maximum of $1.6x10^7$ counts for styrene and methylstyrene, which both exceed the abundance of toluene in sample #12. Sample #10, in particular, supports the hypothesis that pyrolysates can easily exceed 10^7 counts using the extraction and analysis conditions of the State Fire Marshal's Laboratory. For this reason, the abundance of toluene in sample #12 is not a justifiable reason to suspect liquid toluene in sample #12.

Samples #1, 2, 3, 6 and 11 (no ignitable liquids detected) show relatively simple chromatograms, with ten or fewer major peaks. In sample #2 (no ignitable liquid detected), the chromatogram is dominated by alpha-pinene at an abundance of $4x10^6$ counts. The next largest peak is beta-pinene at ~$1.3x10^6$ counts followed by camphene at ~$2x10^6$counts. Note that the difference between the dominant peak and the next most abundant non-isomer peak is more than a factor of 10. These samples support the hypothesis that samples containing pyrolysates can provide quite simple chromatograms with 10 or fewer major, identifiable peaks. Sample #2 supports the hypothesis that one pyrolysis product can be more than 10 times the abundance of the next non-isomer pyrolysis product. For these reasons, the relative simplicity of the chromatogram in sample #12 is not a justifiable reason to suspect liquid toluene in sample #12.

In samples #4 and 7, the toluene peak is 4 to 5 times the abundance of furfurol, which supports the hypothesis that toluene can vastly exceed the abundance of compounds like furfurol in a chromatogram. For this reason, the dominance of toluene (a pyrolysis product) relative to other pyrolysates in sample #12 is not a justifiable reason to suspect liquid toluene in sample #12.

Alternative hypothesis

Regarding Dr. Beyler's opinion (supported by Raymond Griffith and Ralph Newell), that the fire most likely originated between the subfloor and the first-floor ceiling, I find this hypothesis much more likely than the State's unsupported hypothesis of two origins.

NFPA 921, section 6, describes common and reliable fire patterns that fire investigators should use to establish origins of structure fires. According to the NFPA, and as a matter of common sense, a hole that is larger in the subfloor than the hardwood floor above it indicates that the fire originated beneath the subfloor of the second floor, not above it. (Technically, this pattern could also support the hypothesis that the fire was burning for a longer time or with more overall heat release than the fire above it, but this alternative hypothesis is still inconsistent with the Fire Marshal's hypothesis.)

I agree with Dr. Beyler's analysis that a liquid accelerant, poured onto a floor—including a hardwood floor—would not be expected to burn a hole downwards through the floor for two reasons: 1) heat rises, so most heat damage occurs above the fuel source. Fires rarely travel down through floor levels; and 2) there is no oxygen supply from beneath/within the subfloor to support combustion from the direction of the floor.

It is also unlikely that seepage of toluene into the joist bay through small cracks or seams in the flooring would result in combustion between the subfloor of the second floor and the first-floor ceiling because of the lack of a sufficient heat or oxygen source to support continued combustion.

From the standpoint of material properties, large wooden joists in a restricted space would take many times longer to burn than a typical couch with good ventilation. So, the eyewitness testimony that the couch was still on fire when the firefighters entered, and the photographic evidence that the couch is only partially consumed, both support Dr. Beyler's hypothesis that the couch must have ignited from falling debris or burning embers from the fire at the ceiling level. The partially-combusted couch that was still on fire in the later stages of the fire is not consistent with the Fire Marshal's hypothesis of a second simultaneous point of origin in the downstairs living room.

Please feel free to contact me if you have any additional questions or concerns.

Sincerely,

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