

## AAAS & OSAC Identify Foundational Research Needs for Fire Investigation

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### 1. Introduction

And so, it begins – again: the start of a new era for the field of fire investigations. The last one began in the 1980s, when the NFPA issued the first of its science-based documentary standards for fire investigations, NFPA 1033 Standard for Professional Qualifications for Fire Investigator,<sup>1</sup> and began work on the second: NFPA 921 Guide for Fire and Explosion Investigations.<sup>2</sup> In 1992 the publication of the first edition of NFPA 921 signaled the beginning of the process of recording the collective wisdom of experts from diverse fields, all contributing to the knowledge base for fire investigations.

However, it was not until lawyers began to use the scientific aspects of NFPA 921 to challenge the reliability of expert opinions in court that investigators began to appreciate the full impact that these industry standards would have on the field. The fire investigation community has spent the decades since then experimenting, documenting, and refining what we think we know about the science in this field, and then revising NFPA 921 to reflect these advances. NFPA 1033 has developed in tandem, revising the minimum requirements for fire investigator qualifications to keep step with the evolution of fire science as reflected in NFPA 921.

Now, motivated by a big push from the National Academy of Science report, *Strengthening Forensic Science in the United States: A Path Forward*<sup>3</sup> (the NRC/NAS Report) and the accountability that it has inspired, leaders in our industry are evaluating the reliability and validity of methodologies used in fire investigations and developing a research agenda to fill perceived gaps. It has now come time to reinforce the foundations of our field: taking stock of the limitations of what we do know, and identifying what we do not yet know (but often surmise). In this context, significant headway has been made through the efforts of:

1. The American Association for the Advancement of Science (AAAS) Fire Investigation Working Group, in its July 2017 report: *Forensic Science Assessments A Quality and Gap Analysis Report 1—Fire Investigation & Annotated Bibliography*.<sup>4</sup> (hereafter referred to as the AAAS Gap Analysis Report on Fire Investigation); and,

2. The Organization of Scientific Area Committees (OSAC) Subcommittee on Fire and Explosion Investigation, 2016 Needs Assessments, summarized on OSAC's Research and Development Needs webpage:<sup>5</sup> *Potential for Reducing Bias in Fire and Explosion Investigations*<sup>6</sup> and *Validation of Origin*

and *Cause Determination Protocols*<sup>7</sup> (hereafter collectively referred to as the OSAC Needs Assessments).

The OSAC Subcommittee's findings are published in two condensed "Needs Assessments" forms, while the AAAS Gap Analysis Report on Fire Investigation is a thoroughly documented report approaching 90 pages in length. The findings of both organizations are consistent, pointing to two critical areas in which further research is required:

- First, they identified a need to research and implement methods that are effective to reduce bias by investigators.
- Second, they recognized a need for further research into the reliability and validity of methodologies used in origin and cause investigations, and the limitations of the application of current methodologies by investigators.

We begin by touching on the NRC/NAS Report recommendations driving the AAAS and OSAC assessments. Next, we introduce the AAAS and look at the impetus behind its decision to choose fire investigations to rank among the first of its series of forensic assessments into 10 different disciplines. This article then provides highlights of the AAAS report and the OSAC findings. We conclude with a call to action: urging our readers to download the AAAS report and closely study it alongside NFPA 921 to better understand the limits of the scientific underpinnings of fire investigations.

### 2. Background and NRC/NAS Report Recommendations

The research of the AAAS and OSAC stem from two of the NRC/NAS Report's 13 recommendations. Recommendation

No. 3 was to conduct research that:<sup>8</sup>

- verifies the reliability and validity of the basic scientific premises underlying each discipline,
- determines the accuracy of the techniques when applied by practitioners, and;
- develops measures of uncertainty in the conclusions reached by those conducting analyses.

Recommendation No. 5 advocated that:<sup>9</sup>

- research be conducted about human observer bias and error in forensic examinations; and,
- protocols be developed to minimize potential bias and error applicable to all forensic analysis that may be used in litigation.



It has come to be generally accepted that fire investigation is one of the forensic disciplines to which these recommendations apply.<sup>10</sup>

The AAAS and OSAC evaluations of the foundational research needs of fire investigations did not arise in a vacuum. These are achievements in a series of projects stemming from NRC/NAS Report's call for the overhaul of the forensic sciences used in the justice system. The relationships among these projects are important, but complex. Two publications help to explain, from the fire investigator's viewpoint, some of the most relevant projects and the purpose of each organization that has been tasked with implementing the NRC/NAS Report recommendations. This information underscores the importance of the AAAS and OSAC conclusions and places them into perspective:

1. [A Perfect Storm Brewing for Fire Investigators in Court.](#)<sup>11</sup> This article deals with the problems of wrongful convictions that served as an incentive for the NRC/NAS Report. It also provides specifics about the growing pressures on fire investigation community as a result of this NRC/NAS Report, including the roles of NFPA 921, NFPA 1033, and in the US, the Supreme Court decision in *Daubert v. Merrell Dow Pharmaceuticals Inc.*<sup>12</sup>
2. [Experts Beware: Are Your Foundations Open to Attack?](#)<sup>13</sup> This FISC Bulletin Board article picks up where the "Perfect Storm" leaves off, tracking benchmarks in carrying out the NRC/NAS Report Recommendation No. 3 (on foundational research). It includes a discussion of the Annotated Bibliography on "Burn Pattern" Questions<sup>14</sup> prepared by the Technical and Scientific Working Group for Fires and Explosions (T/SWGFEX)<sup>15</sup> in 2011, and the Views documents on foundational literature issued by the National Commission on Forensic Science (NCFS) in 2015<sup>16</sup> and 2016.<sup>17</sup>

By way of a brief review, in 2009, the same year that the NRC/NAS Report was published, the White House established a Subcommittee on Forensic Science (SoFS) to assist the President's National Science and Technology Council's Committee on Science with policies and procedures relating to forensic science in the criminal justice system.<sup>18</sup> The SoFS appointed five White House Interagency Working Groups (IWGs), one of which was the IWG for Research, Development, Testing, and Evaluation (IWG RDT&E). This IWG was empowered to identify and prioritize research for forensic science and conduct a gap analysis.<sup>19</sup> It identified fire investigations as one of the disciplines that merited study. Accordingly, it contacted T/SWGFEX, which developed the Annotated Bibliography on "Burn Pattern" Questions in response to the IWG RDT&E's inquiries.

Unfortunately, the IWG did nothing further with the T/SWGFEX Annotated Bibliography and no research agenda or gap analysis was developed as a result. Years later, the AAAS project has picked up where the IWG RDT&E's work ended. Therefore, this "Experts Beware" FISC Bulletin Board article sets forth helpful background information that is necessary to understanding the significance of the AAAS report, including relevant work of the SoFS, its RDT&E IWG, T/SWGFEX, the NCFS, and OSAC.

The AAAS Gap Analysis Report on Fire Investigation acknowledges using the T/SWGFEX Annotated Bibliography as

a starting point, updating and including it as an appendix in its report. It also recognizes the important roles of the NRC/NAS Report, the NCFS, and OSAC,<sup>20</sup> noting that its report will be submitted for review by the relevant OSAC Subcommittees.<sup>21</sup>

Having now summarized the framework for the AAAS and OSAC projects, we move on to introduce the AAAS and its Gap Analysis Report on Fire Investigation.

### 3. AAAS Forensic Science Assessments: A Quality and Gap Analysis Report—Fire Investigation

#### 3.1 Introducing the AAAS and Reasons for Its Forensic Assessment

According to its website, "The American Association for the Advancement of Science is an international nonprofit organization dedicated to advancing science for the benefit of all people."<sup>22</sup> It is a multidisciplinary scientific organization with members in 91 countries. The AAAS prides itself in its family of scientific journals.<sup>23</sup>

AAAS took note of the NRC/NAS Report's recommendations and the comments made by NCFS members on the need for further analysis into foundational research,<sup>24</sup> and decided to take action to fill this void. Ten forensic science disciplines were selected,<sup>25</sup> including fire investigations. The goal was to conduct a "quality and gap analysis" by evaluating the "quality of the studies [each discipline] relies on to support its practices and, where the scientific underpinning of these practices falls short, to recommend a research agenda for the field."<sup>26</sup> The series is entitled, "Forensic Science Assessments: A Quality and Gap Analysis." The AAAS Gap Analysis Report on Fire Investigation was the first in this series and was published on July 11, 2017. IAAI member Mr. John Lentini, a forensic practitioner and fire investigator, was one of the five interdisciplinary Working Group members who authored the report. The other Working Group members were a forensic chemist, "an academic fire engineer, an analytical chemist, and a psychologist who studies decision-making."<sup>27</sup>

#### 3.2 Why Fire Investigations?

Before delving into the contents of the AAAS report, consider why AAAS selected fire investigations as one of the first disciplines to study in its "Forensic Science Assessments" series, and the implications of this choice. After all, there are dozens of forensic disciplines<sup>28</sup> and the NRC/NAS Report observed that many lacked sufficient research to ensure their methodologies were soundly based in science.<sup>29</sup>

AAAS's choice to prioritize the assessment and gap analysis of fire investigations is particularly intriguing when one considers that one of OSAC's prime missions is to encourage the development and implementation of scientifically-based and quality standards and guides in the forensic sciences. NFPA 921 and NFPA 1033 were among the first documents approved for inclusion in the OSAC Registries of approved standards and guidelines. With the announcement of its registry approval, OSAC noted that NFPA 921 "sets a high bar for science-based investigation and analysis of fire and explosion incidents," it is recognized as the standard of care among members of the field and in the courts, and as it "address[es] all aspects of fire and explosion investigation including methodology," it serves as a guide for making accurate origin and cause determinations.<sup>30</sup> Therefore, it is reasonable to infer that NFPA 921 and NFPA 1033 put fire investigations in pretty good shape and ahead of many other disciplines that are lagging behind in science-based standards or guides.

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So, why did the AAAS, the world's largest scientific society, bring its resources to bear on the field of fire investigations? This issue is addressed in its report. AAAS first refers back to the T/SWGFEX Annotated Bibliography, saying that its report, "addresses the reliability and validity of fire investigations, one of the forensic areas the SoFS IWG identified as needing an up-to-date evaluation."<sup>31</sup> Thus, we can infer that the AAAS is cognizant of the reasons the SoFS put fire investigations in its sites, and decided that the issues raised in the T/SWGFEX Annotated Bibliography were worth pursuing. Further, the report states:

Because AAAS intended to analyze more than one forensic discipline, the Advisory Committee was asked to help choose which field to tackle first. The Advisory Committee based their selection(s) on two factors: (1) how often it is used in criminal investigations, and (2) the degree of current controversy and the extent to which the field's legitimacy is being challenged.<sup>32</sup>

With respect to the second factor (current controversy), wrongful convictions seem to have been a major consideration. After noting that "63 people convicted of arson have been exonerated since 1991,"<sup>33</sup> the report's Introduction goes on to say:

[O]ne of the authors of this report estimates that "a couple hundred" people are wrongly imprisoned because of methods used in fire investigation that have not been empirically validated. . . . We will never know for sure how many people have been wrongfully convicted based on the aforementioned methods and practices. Likewise, we will never know how many criminal arsonists have not been indicted because of inadequate forensic tools. <sup>34</sup>

Now, to recapitulate the events that have raised the issue of the reliability and validity of fire investigations (as explained in the "Perfect Storm" article and subsequent "Experts Beware" FISC Bulletin Board, mentioned above):

- First, in the conclusion to its assessment of the "Analysis of Explosives Evidence and Fire Debris," the NRC/NAS Report stated that, "Experiments should be designed to put arson investigations on a more solid scientific footing."<sup>35</sup>
- Next, the White House IWG RDT&E decided that the topic of "burn" (i.e. fire) patterns in fire investigations merited deeper inquiry and called upon the experts in T/SWGFEX to answer questions going to the heart of fire investigations—fire pattern interpretation. T/SWGFEX did this by producing its Annotated Bibliography on "Burn Pattern" Questions.<sup>36</sup>
- Finally, the AAAS conducted an assessment and gap analysis respecting the reliability and validity of both fire investigations and fire debris analysis, which was initiated by the work of T/SWGFEX.

It is this AAAS report that we come to now.

### 3.3 HIGHLIGHTS OF THE AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION

The AAAS report purports to set forth, "what is known about fire science and what remains unknown."<sup>37</sup> The report has 25 recommendations divided into two sections: 1) Fire Scene Investigation and 2) Fire Debris Analysis. The first section is the subject of this article. It is organized into five topics that each have a set of conclusions and related recommendations. A technical

analysis is also included, followed by a series of questions that identify issues or gaps in the knowledge base and discussion of each question. Below are some (not all) of the conclusions respecting Fire Scene Investigation in each of the five topics studied:<sup>38</sup>

#### Topic 1: Origin and Cause Determination Conclusions

- Notwithstanding extensive studies of fire and its behavior in building enclosures, its complexities are not fully understood, therefore, "using that knowledge to determine where a particular fire started and what caused it remains very challenging. An incorrect determination of a fire's origin generally leads to an incorrect determination of its cause."<sup>39</sup>
- Unlike determining the origin of a pre-flashover fire, using fire pattern analysis to determine, "the origin of post-flashover fires is more difficult because post-flashover fires may create new ventilation-generated burn patterns while obscuring pre-existing burn patterns. Moreover, the longer a fire burns in a fully involved condition, the more difficult is the determination of the correct area of origin."<sup>40</sup>
- While computer fire modelling can be helpful in testing various hypotheses respecting the origin of fire and its development, "such models cannot generally be used alone to determine the cause of a fire. Uncertainties exist concerning these models when they are applied to fire cause determination."<sup>41</sup>

#### Topic 2: Locating Ignitable Liquid Residues in Fire Debris

- "A well-trained canine detection team is the current 'gold standard' for locating samples at the fire scene that may test positive for ignitable liquid residues (ILRs) in the fire debris analysis laboratory. . . . However, canine alerts should not be relied upon unless confirmed by laboratory analysis."<sup>42</sup>

#### Topic 3: Reliability and Validity

- "Little is known about the consistency and accuracy of conclusions among experienced investigators when presented with the same data."<sup>43</sup>

#### Topic 4: Cognitive Bias

- "Interpretation of the evidence regarding origin and cause is often subjective and depends to a significant degree on human cognitive factors."<sup>44</sup>
- "Evidence . . . suggests that there are practical ways to mitigate and minimize bias. . . . The aim of such procedures is to maximize the independence of mind of forensic examiners to be as bias free as possible in both the identification of relevant evidence and the conclusion about what the evidence shows about a fire's origin and cause. In this context, the distinction between bias and relevance should be noted. For example, eyewitness testimony although potentially biasing, can also be relevant in some instances. . . ."<sup>45</sup>

#### Topic 5: Education, Certification, and Experience

- "There are insufficient educational and proficiency testing requirements for fire scene investigators."<sup>46</sup>
- "There is currently no scientific basis for concluding



that the accuracy of certified fire investigators, in particular, is better than the accuracy of non-certified fire investigators."<sup>47</sup>

These are but some of the report's conclusions. Each of the above sections also has a set of recommendations flowing from its conclusions.

The report has a second section on Fire Debris Analysis, which begins with the conclusion that, "Although the science of fire debris analysis (analytical chemistry) is more mature and reliable than the science of fire scene investigation, there is still room for improvement in the knowledge base and in the practice of fire debris analysis." The report goes on to suggest ways that fire debris analysis can be improved and its testing by laboratory analysts, strengthened.<sup>48</sup>

#### 4. OSAC Research Needs Assessments

Predating the AAAS Gap Analysis Report on Fire Investigation, the OSAC Subcommittee on Fire and Explosion Investigations prepared its Needs Assessments. In reviewing them, we recommend that you study the overlap with the AAAS report. Both Needs Assessments were approved by majority vote of the OSAC subcommittee on January 28, 2016. The assessments were then submitted to the subcommittee's umbrella Scientific Area Committee (SAC), the Crime Scene Death Investigation SAC, for review and approval, which was granted on May 6, 2016. The purpose of these assessments is to provide an informational resource to the forensic science community.<sup>49</sup> In the next two sections of this article are excerpts from each of the assessments.

A brief explanation is first in order respecting the phrase "domain irrelevant data" that is used in the first two excerpts below, from the Needs Assessment on reducing bias. The phrases "domain-relevant" and "domain-irrelevant" come from the field of cognitive decision-making. An area of forensic expertise is a "domain." Within a given forensic discipline, there may be various domains of forensic expertise. If a forensic expert is exposed to information not relevant AND necessary to the requirements of his or her examination or analysis, this information may be biasing. As one scholar notes:

Bluntly put, any information not necessary to the exercise of one's expertise will distort results. And the more such domain-irrelevant information engages emotions and desires, the stronger the distortion will be. These are among the best established and supported general propositions of modern cognitive psychology....<sup>50</sup>

A concept related to domain-relevant information is "task-relevant" information—data relevant to the precise task that a forensic science practitioner is asked to perform and which the practitioner should consider, as contrasted with "task-irrelevant" data which the practitioner should not consider. The NCFSS describes these concepts in stating its view that only task-relevant information should be considered in forensic analysis:<sup>51</sup>

When discussing what is task-relevant, it is useful to distinguish three phases at which forensic [Forensic Science Service Practitioners, known as] FSSPs may be involved in a criminal investigation.

There is often a preliminary phase, in which FSSPs survey a crime scene, decide what evidence to collect,

and determine what examinations are needed. This is followed by an analytic phase, during which specific items of evidence are examined, analyzed, and compared. This may be followed by an evaluative phase, in which FSSPs help police and lawyers understand the implications of the analytic findings and put them in context.

Evidence that is task-relevant during the evidence collection and evaluative phases may not be task-relevant during the analytic phase. For example, statements of witnesses about what happened during a crime may be task-relevant when deciding what evidence to collect at a crime scene or what examinations are needed. Such statements may also be task-relevant when making an overall assessment of the case in light of the forensic evidence. But witness statements generally are not relevant to the task of interpreting analytic tests. The results of analytic examinations and comparison should depend on the physical evidence examined, not on what witnesses say.

In 2015, the NCFSS published its view that the OSAC standards and guidelines for forensic practice should "specify what types of information are task-relevant and task-irrelevant for common forensic tasks." It is with this background that the OSAC Subcommittee on Fire Investigation issued its Needs Assessment on the Potential for Reducing Bias in Fire and Explosion Investigations.

#### 4.1. Potential for Reducing Bias in Fire and Explosion Investigations

**"Description of research need:** Bias from domain irrelevant data has the potential to cause errors in the scientific determination of origin and cause. Separating the duties of examining the physical evidence and credible eyewitness statements from law enforcement functions of identifying suspects and motives and other data not relevant to determination of origin and cause has the potential to eliminate some of this bias. Effectiveness of methods and protocols to reduce bias should be evaluated."<sup>52</sup>

"In what ways would the research results improve services to the criminal justice system? Previous examples in fire investigations have led to erroneous conclusions and convictions owing to bias (Texas v. Willingham; Texas v. Willis). In at least one documented case, protecting the scene investigator from domain irrelevant data by using a second investigator to manage the investigation was shown to eliminate any challenge of the expert based on bias (NV v. Valerie Moore)."<sup>53</sup>

#### 4.2. Validation of Origin and Cause Determination Protocols

**"Description of research need:** Reliability and validity studies need to be conducted on current methodologies used to determine origin and cause. New methodologies could also be proposed and tested. Existing guidance in NFPA 921 does not fully address uncertainty, repeatability, and limitations associated with current methodologies used to determine origin and cause. There is a need for

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comprehensive statistically sound assessments of current methodologies.<sup>54</sup>

**"In what ways would the research results improve services to the criminal justice system?"** Previous examples in fire investigations have led to erroneous conclusions and convictions owing to poor methodologies (Texas v. Willingham; New York v. Villabos, et al.). There is a lack of research on the validity of current methodologies. Research results will improve the reliability and scientific credibility of incendiary fire determinations.<sup>55</sup>

## 5. Conclusion

The AAAS Gap Analysis Report on Fire Investigation is consistent with the OSAC Needs Assessments in the issues they raise. The OSAC Fire and Explosion Investigation Subcommittee has said it plans to channel the results of research arising from its Needs Assessments into proposals for revisions to NFPA 921 or NFPA 1033.<sup>56</sup> AAAS plans to submit its report for review by the OSAC subcommittees<sup>57</sup> on Fire and Explosion Investigation and on Fire Debris Analysis. It's reasonable to assume that to the extent either subcommittee agrees with the AAAS report's recommendations and that any research is generated as a result, the OSAC subcommittees will present proposals for revisions to the relevant NFPA or ASTM documentary standards.

It is the writers' opinion that even in the absence of further research, the existing research referenced in the AAAS report and the OSAC Needs Assessments are sufficient to develop proposals for NFPA 921, 2020 edition, to address: 1) methodologies to reduce cognitive and context bias, and 2) appropriate cautions with respect to expressing fire origin and cause opinions based on fire patterns in the circumstances delineated in the AAAS report that raise issues about the reliability or validity of such opinions. The Public Input closing date (i.e. deadline) for NFPA 921 is January 4, 2018.<sup>58</sup>

In the meantime, the AAAS report is aimed at a broad audience that includes agencies that can potentially fund the research recommended, as well as prosecution and defense attorneys, courts, law enforcement officers, and fire investigators.<sup>59</sup> Just as the NRC/NAS Report was concerned not only with criminal, but also with civil litigation,<sup>60</sup> so too, this report will be influential for lawyers, judges, and experts handling civil cases such as insurance and liability claims. As this report deals with science, not law, its impact is not limited to the US, but may

extend to any country where scientifically-based fire origin and cause investigations are conducted. A plain language version is available to facilitate the use of the report by those less familiar with the field of fire investigations.<sup>61</sup>

In terms of the immediate implications for fire investigators, neither OSAC nor AAAS connects the dots between the research needs they have identified and the related sections of NFPA 921 or NFPA 1033. We invite our readers to do so. Download and carefully study the three publications addressed in this article (they are all free). Take the time to correlate their findings to the sections of NFPA 921 and NFPA 1033 that are most significant to your work. The issues raised by both OSAC and the AAAS are fundamental to the training, qualifications, and practice of fire investigations.

While both OSAC and AAAS have undertaken these efforts for the betterment of the fire investigations field, the shortcomings they expose will not be lost on knowledgeable lawyers and judges.

Investigators and experts should take heed of the gaps exposed and prepare themselves to meet a new round of challenges in court fueled by these publications. We can only hope that our industry leaders have the courage to press on and continue to explore these shortcomings with a view to ultimately shoring up the foundations of fire investigations and improving the outcomes in individual cases, notwithstanding the growing pains that we expect the fire investigation community will experience in the meantime.

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## Endnotes

1 NAT'L FIRE PROT. ASS'N TECHNICAL COMM. ON FIRE INVESTIGATOR PROFESSIONAL QUALIFICATIONS, NFPA 1033 STANDARD FOR PROFESSIONAL QUALIFICATIONS FOR FIRE INVESTIGATOR (1987 ed.)

2 NAT'L FIRE PROT. ASS'N TECHNICAL COMM. ON FIRE INVESTIGATIONS, NFPA 921 GUIDE FOR FIRE AND EXPLOSION INVESTIGATIONS (1992 ed.).

3 COMM. ON IDENTIFYING THE NEEDS OF THE FORENSIC SCI. CMTY. ET AL., NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD (2009) [hereinafter NRC/NAS REPORT], available at <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>.

4 JOSÉ ALMIRALL ET AL., FORENSIC SCIENCE ASSESSMENTS A QUALITY AND GAP ANALYSIS: FIRE INVESTIGATION & ANNOTATED BIBLIOGRAPHY (2017) [hereinafter AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION], available at <https://www.aaas.org/report/fire-investigation>.

5 OSAC Research and Development Needs, NIST-OSAC FOR FORENSIC SCIENCE <https://www.nist.gov/topics/forensic-science/osac-research-development-needs> (last visited September 3, 2017).

6 OSAC SUBCOMM. ON FIRE AND EXPLOSION INVESTIGATION, OSAC RESEARCH NEEDS ASSESSMENT FORM: POTENTIAL FOR REDUCING BIAS IN FIRE AND EXPLOSION INVESTIGATIONS (Jan. 28, 2016) [hereinafter OSAC FIRE & EXPL. SUB., POTENTIAL FOR REDUCING BIAS RESEARCH NEEDS], available at <https://www.nist.gov/document/osac-research-needs-assessment-form-bias-v-1-1pdf>.

7 OSAC SUBCOMM. ON FIRE AND EXPLOSION INVESTIGATION, OSAC RESEARCH NEEDS ASSESSMENT FORM: VALIDATION OF ORIGIN AND CAUSE DETERMINATION PROTOCOLS (Jan. 28, 2016) [hereinafter OSAC FIRE & EXPL. SUB., VALIDATION OF O&C PROTOCOLS RESEARCH NEEDS], available at <https://www.nist.gov/document/osac-research-needs-assessment-form-protocols-v-1-1pdf>.

8 NRC/NAS REPORT, supra note 3, at 8, 22-23.

9 NRC/NAS REPORT, supra note 3, at 24.

10 See, e.g., AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 1-8; FISC Bulletin Board, Experts Beware: Are Your Foundations Open to Attack?, Vol. 67 FIRE AND ARSON INVESTIGATOR J. No. 3, 30, (Jan. 2017) § 6, available at [https://www.firearson.com/uploads/FAI-2017/FISC\\_BulletinBoard\\_Jan2017.pdf](https://www.firearson.com/uploads/FAI-2017/FISC_BulletinBoard_Jan2017.pdf) (IAAI Member sign-in required).

11 Terry-Dawn Hewitt & Wayne J. McKenna, A Perfect Storm Brewing for Fire Investigators in Court, LEGAL SCHOLARSHIP NETWORK (2014), available at <http://ssrn.com/abstract=2381519>.

12 (1993), 509 U.S. 579.

13 FISC Bulletin Board, Experts Beware: Are Your Foundations Open to Attack?, Vol. 67 FIRE AND ARSON INVESTIGATOR J. No. 3, 30, (Jan. 2017) § 6, available at [https://www.firearson.com/uploads/FAI-2017/FISC\\_BulletinBoard\\_Jan2017.pdf](https://www.firearson.com/uploads/FAI-2017/FISC_BulletinBoard_Jan2017.pdf) (IAAI Member sign-in required). The first part of this FISC Bulletin Board was published in the January 2017 edition of the Fire & Arson Investigator Journal. The complete article is available to IAAI members to download free of charge from the IAAI website. Follow this breadcrumb trail:



- www.firearson.com > Publications and Resources > Fire & Arson Investigator Journal (member sign in required). Scroll down past the heading "2017 Fire & Arson Investigator Journal" and click on the link: Please click here to read the January 2017 FISC Bulletin Board in its entirety. After signing in to your IAAI account, this article will open in PDF.
- 14 TECH. & SCIENTIFIC WORKING GROUP FOR FIRE AND EXPLOSIONS, ANNOTATED BIBLIOGRAPHY ON "BURN PATTERN" QUESTIONS (Dec. 12, 2011), available at <http://www.nist.gov/forensics/upload/Annotated-Bibliography-Burn-Pattern.pdf>.
- 15 The Technical Working Group for Fire and Explosions and the Scientific Working Group for Fire and Explosions, (together known as T/SWGFEX), were founded in 1999 by the National Center for Forensic Science at the University of Central Florida and work together to improve fire and explosion laboratory analyses and scene investigations. The mission of TWGFEX is to establish and maintain nationally accepted programs for the forensic investigation of fire, arson and explosion scenes and devices. The mission of SWGFEX is to establish and maintain nationally accepted guidelines for fire, arson and explosive laboratory analysts. When it was active, there were approximately 100 members of SWGFEX and TWGFEX at any one time. The membership is broad-ranging, including fire investigators, fire debris analysts and explosive examiners. Members were from the public sector (federal, state, and local representatives) and from the private sector. As of June, 2016, the Executive Committee acted to suspend the activities of T/SWGFEX, with the exception of some ongoing work, until OSAC and the National Commission on Forensic Science have concluded their work. (See Email from T/SWGFEX Chair Dennis Hilliard to T/SWGFEX Members (Jun. 27, 2016). More information is about T/SWGFEX and its publications is available at the T/SWGFEX website <https://www.swgfex.com/>).
- 16 SCIENTIFIC INQUIRY AND RESEARCH SUB-COMM. OF THE NAT'L COMM. ON FORENSIC SCI., SCIENTIFIC LITERATURE IN SUPPORT OF FORENSIC SCIENCE AND PRACTICE (2015), available at: <https://www.justice.gov/ncfs/file/786591/download>.
- 17 SCIENTIFIC INQUIRY AND RESEARCH SUB-COMM. OF THE NAT'L COMM. ON FORENSIC SCI., VIEWS OF THE COMMISSION REGARDING IDENTIFYING AND EVALUATING LITERATURE THAT SUPPORTS THE BASIC PRINCIPLES OF A FORENSIC SCIENCE METHOD OR FORENSIC SCIENCE DISCIPLINE (2016), available at: <https://www.justice.gov/ncfs/file/839716/download>.
- 18 NAT'L SCI. AND TECH. COUNCIL. CHARTER OF THE SUBCOMM. ON FORENSIC SCI. COMM. ON SCI. § B, (on file with the authors) (emphasis added).
- 19 NAT'L SCI. AND TECH. COUNCIL. COMM. ON SCI., SUBCOMM. ON FORENSIC SCI., CHARTER INTER-AGENCY WORKING GROUP RESEARCH, DEVELOPMENT, TESTING AND EVALUATION (on file with the authors).
- 20 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 1-8.
- 21 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 3. The relevant OSAC subcommittees are the Fire and Explosion Investigation Subcommittee and the Fire Debris and Explosives Subcommittee.
- 22 About AAAS, AMERICAN ASS'N FOR THE ADVANCEMENT OF SCIENCE, <https://www.aaas.org/about/mission-and-history> (last visited Sept. 5, 2017).
- 23 Id.
- 24 MARK FRANKEL & DEBORAH RUNKLE, PRESENTATION ON AAAS FORENSIC SCIENCE ASSESSMENTS: A QUALITY AND GAP ANALYSIS, PRESENTATION TO THE NATIONAL COMMISSION ON FORENSIC SCIENCE, MEETING 8, WASHINGTON D.C., at 13 (Dec. 8, 2015) available at <https://www.justice.gov/ncfs/file/798986/download>.
- 25 Id. at 15. The 10 disciplines are: Fire Investigations, Latent Fingerprints, Firearms and Toolmarks/Ballistics, Bloodstain Pattern Analysis, Digital Evidence, Footwear and Tire Tracks, Forensic Odontology – Bitemark Analysis, Trace Evidence – Fibers, Trace Evidence – Hair, Trace Evidence – Paint and Other Coatings.
- 26 Supra note 24, at 13.
- 27 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 4, appx. D, E. The AAAS report explains one of the criteria for selecting its working group members based on a desire to embed a "culture of science" into the report:
- In its report, the NAS noted that because most forensic science was developed in crime labs, not academic laboratories, and its practitioners had little training in research and statistical methods, the forensic fields had "never been exposed to stringent scientific testing." Similarly, Senator Rockefeller, quoting a witness who testified at one of his hearings, lamented that most forensic fields lack a "culture of science." Based on these descriptions of the practice of forensics, staff decided to include scientists and engineers trained in research methods and embedded in a "culture of science" in the fire investigation Working Group. These individuals were identified by staff and vetted by the Advisory Committee. A forensic practitioner was also included in the Working Group to assure forensic practitioners that they had a voice at the table and to help staff, and other Working Group members, if necessary, to understand the forensic practice and to write a primer. The fire investigation Working Group included an academic fire engineer, an analytical chemist, and a psychologist who studies decision-making, in addition to a forensic practitioner (see Appendices D and E).
- Thus, the only fire investigation practitioner in the working group was John Lentini, a forensic scientist qualified as a fire investigator and a fire debris analyst.
- 28 This statement is supported by OSAC's organization. OSAC has 25 subcommittees, each one of which is committed to improve a designated forensic science discipline, which means there are at least 25 forensic science disciplines.
- 29 NRC/NAS REPORT, supra note 3, at 187.
- 30 NAT'L INSTITUTE OF STANDARDS AND TECHNOLOGY, NEWS, Fire and Explosion Guideline Approved for OSAC Registry, <https://www.nist.gov/news-events/news/2016/09/fire-and-explosion-investigation-guideline-approved-osac-registry> (Sept. 20, 2016).
- 31 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 4.
- 32 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 3.
- 33 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 5.
- 34 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 5 (quoting John Lentini, one of the report's authors, as saying that a "couple hundred" people are wrongfully imprisoned).
- 35 NRC/NAS Report, supra note 3, at 172-173 (emphasis added).
- 36 TECH. & SCIENTIFIC WORKING GROUP FOR FIRE AND EXPLOSIONS, ANNOTATED BIBLIOGRAPHY ON "BURN PATTERN" QUESTIONS (Dec. 12, 2011), available at <http://www.nist.gov/forensics/upload/Annotated-Bibliography-Burn-Pattern.pdf>.
- 37 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 1.
- 38 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 6-9. The cross-references to the technical analysis portions of the report have been removed from these quotes, but are available in the report, for readers interesting in reviewing the analysis and references supporting each conclusion.
- 39 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 6.
- 40 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 6.
- 41 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 6.
- 42 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 7.
- 43 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 7.
- 44 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 8.
- 45 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 8.
- 46 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 9.
- 47 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 9.
- 48 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 10-12.
- 49 OSAC FIRE & EXPL. SUB., POTENTIAL FOR REDUCING BIAS RESEARCH NEEDS, supra note 6; OSAC FIRE & EXPL. SUB., VALIDATION OF O&C PROTOCOLS RESEARCH NEEDS, supra note 7.
- 50 Michael D. Risinger, The NAS Report on Forensic Science: A Glass Nine-Tenths Full (This is About the Other Tenth), SSRN, 2-3 (July 21, 2009), available at <https://ssrn.com/abstract=1437276> or <http://dx.doi.org/10.2139/ssrn.1437276>.
- 51 HUMAN FACTORS SUBCOMM. OF THE NAT'L COMM. ON FORENSIC SCI., ENSURING THAT FORENSIC ANALYSIS IS BASED ON TASK-RELEVANT INFORMATION (2015), available at <https://www.justice.gov/archives/ncfs/page/file/641676/download>.
- 52 OSAC FIRE & EXPL. SUB., POTENTIAL FOR REDUCING BIAS RESEARCH NEEDS, supra note 6, at 1.
- 53 OSAC FIRE & EXPL. SUB., POTENTIAL FOR REDUCING BIAS RESEARCH NEEDS, supra note 6, at 2.
- 54 OSAC FIRE & EXPL. SUB., VALIDATION OF O&C PROTOCOLS RESEARCH NEEDS, supra note 7, at 1.
- 55 OSAC FIRE & EXPL. SUB., VALIDATION OF O&C PROTOCOLS RESEARCH NEEDS, supra note 7, at 2.
- 56 OSAC FIRE & EXPL. SUB., POTENTIAL FOR REDUCING BIAS RESEARCH NEEDS, supra note 6; OSAC FIRE & EXPL. SUB., VALIDATION OF O&C PROTOCOLS RESEARCH NEEDS, supra note 7.
- 57 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 3.
- 58 The deadlines for Public Inputs and Public Comments, as well as other stages in this process are posted under the "Next Edition" tab on the NFPA 921 Document Information Page available at [www.nfpa.org/921](http://www.nfpa.org/921).
- 59 AAAS GAP ANALYSIS REPORT ON FIRE INVESTIGATION, supra note 4, at 5.
- 60 See, e.g., NRC/NAS REPORT, supra note 3, at xix, 7, 17, 79, 190.
- 61 Charlie Hanger, Forensic Science Assessments A Quality and Gap Analysis: Fire Investigation—Plain Language Summary (2017), available at <https://www.aaas.org/report/fire-investigation-plain-language-summary>.