



NATIONAL FIRE PROTECTION ASSOCIATION

The leading information and knowledge resource on fire, electrical and related hazards

Technical Committee on Fire Investigator Professional Qualifications

NFPA 1033 (Custom A2021 Cycle)

Second Draft Meeting (REMOTE)

AGENDA

October 28th and 29th, 2020

10:00 AM Start Time (Eastern Time)

- I. Chair Dan Heenan calls meeting to order on October 28th, 2020.
- II. Welcome and Opening Remarks.
- III. NFPA Staff Update
- IV. Introduction of attendees.
- V. Approval of previous minutes:
 - [January 27, 2020, Orlando, FL](#)
- VI. Address submitted public comments and develop any second revisions.
- VII. Old business
- VIII. New business
- IX. Adjournment.



Public Comment No. 5-NFPA 1033-2020 [Section No. 1.2.4]

1.2.4

JPRs for each level and position shall be the tasks personnel shall be able to perform to carry out the job duties.

In order to carry out the job duties of a fire investigator, personnel must be able to perform all of the JPRs established in this standard.

Statement of Problem and Substantiation for Public Comment

The current sentence does not make any sense in it current construction. I have provided one possible rewrite of the sentence in order to convey the meaning of the standard.

Related Item

- User

Submitter Information Verification

Submitter Full Name: George Malone

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Submittal Date: Wed Jul 22 16:45:15 EDT 2020

Committee: PQU-FIV



Public Comment No. 11-NFPA 1033-2020 [Section No. 1.2.5]

1.2.5

Fire investigators who perform or support fire investigations shall remain current with the general knowledge, skills, and JPRs addressed for each level or position of qualification.

Revise Section 1.2.5 to read:

1.2.5*

Fire investigators who perform or support fire investigations shall remain current with the general knowledge, skills, and JPR's addressed for each level or position of qualification in order to maintain proficiency and competency with the JPR's covered in this standard.

A.1.2.5 Remaining professionally competent is important for any practitioner in a field. In the rapidly changing and developing field of the fire service this is particularly important. The Authority having Jurisdiction may consider establishing a path by which members can demonstrate continued JPR compliance and competency through continuing education or practice within the field consistent with current duties. It is recommended that any such program give consideration to the following factors:

- (1) Demonstrated and documented knowledge and competence of additions and/or revisions to the latest edition of the standards.
- (2) Documented training and education (including online) related to the standards since the last certification.
- (3) Documented experience in the field (ie. emergency operational experience for Fire Fighters, Fire Officers, Instructors, etc.).
- (4) Demonstrated and documented successful performance of duties, which may include skills assessment.
- (5) Annual performance appraisals.
- (6) Documented teaching and instruction related to the field.
- (7) Commendations, award and/or recognition for the performance of related duties.

Other items for consideration may include:

- (1) Memberships in professional organizations, including any positions held or special activities involved in the organization membership.
- (2) Published articles in trade journals, web-based publications, and other information distribution avenues.
- (3) Research and development activities related to the field.
- (4) Documented attendance at relevant conferences and training events.

The above list is not all inclusive and other factors specific to the field be considered for inclusion.

Statement of Problem and Substantiation for Public Comment

This is a proposed wording change to be consistent with proposed language in all Professional

Qualifications standards and to add an Annex with supplemental information developed by the Correlating Committee on Professional Qualifications.

The subject of a certified individual maintaining continuing professional development and competency with the requirements of an NFPA Professional Qualifications standard has been discussed for a number of years. A request was submitted to the NFPA Foundation by the Correlating Committee on Professional Qualifications to look at this specific issue and to develop recommendations for implantation in the NFPA Professional Qualifications project.

As a result of that request, recommendations for maintaining proficiency and competency with all JPR's contained in an NFPA Professional qualifications standard were made by the NFPA Research Foundation as part of a recently published report entitled, Fire and Emergency Service Personnel Knowledge and Skills Proficiency (hereinafter referred to as "the Report"). Various representatives of the fire service were invited to attend a meeting that the NFPA held in October of 2019 to discuss the Report. The Report notes that in parallel professions like EMS, licensure renewal is common practice. The participants at the meeting recognized the importance of continuing education in ensuring that persons who are certified to an NFPA Professional qualifications standard are prepared to carry out their duties as safely and effectively as possible.

An Ad Hoc Committee of participants in the NFPA Workshop submitted a written recommendation to the Correlating Committee on Professional Qualifications to continue to pursue additional work in the NFPA Professional Qualifications standards relating to maintaining proficiency and competency for continuing professional development activities in each of the individual standards. The Correlating Committee on Professional Qualifications agreed that specifically Each Pro-Qual Committee should include a recommendation for continuing education and training requirements when their standard is revised in their next cycle. The material developed by each Technical Committee should be included in the Annex material. This action would provide a consistent path for certified individuals who wish to demonstrate that they have "remained current" as identified by the technical experts of each individual professional qualification standard.

The Correlating Committee thoroughly discussed the continuing proficiency and competency proposal in June of 2020 and identified a Task Group to develop a recommended template for each NFPA Professional qualifications Technical Committee to follow in the development of their next revision. The Task Group reported back to the Correlating Committee in September of 2020 with the results of their work on the assigned topic. The Correlating Committee, in September of 2020, received the recommendation from the Correlating Committee Task Group, thoroughly discussed their work, and accepted their recommendation to move forward to direct each Technical Committee to develop specific criteria, to be included in each NFPA Professional Qualifications standard, with clear guidance to states and AHJ's on how to implement continuing education, while maintaining as much flexibility as possible by those jurisdictions.

The submitted Public Comment embraces the concept for the need of continuing education by all individuals certified to the requirements of each NFPA Professional Qualifications Standard, and of the NFPA 1000 Technical Committee that has previously reviewed this subject matter and recommended that this topic is best driven by requirements from the individual technical committee and any coordination of requirements for re certification, maintaining competency (or similar language) would fall under the Correlating Committee's direction to each of the Technical Committees. The Correlating Committee on Professional qualifications has therefore directed each Professional Qualifications Technical committee to have continued professional development and competency addressed in each of their assigned professional qualification standards.

Related Item

- FR

Submitter Information Verification

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Submittal Date: Tue Oct 06 13:40:38 EDT 2020

Committee: PQU-FIV



Public Comment No. 6-NFPA 1033-2020 [Section No. 1.2.5]

1.2.5

Fire investigators who perform or support fire investigations shall remain current with the general knowledge, skills, and JPRs addressed for each level or position of qualification.

Strike "for each level or position of qualification"

Statement of Problem and Substantiation for Public Comment

There are no different levels or positions set forth in this standard. So to talk about different levels and positions, makes the standard confusing.

Related Item

- User

Submitter Information Verification

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Committee: PQU-FIV



Public Comment No. 7-NFPA 1033-2020 [Section No. 1.3.2.4]

1.3.2.4

The JPRs for each level or position shall be completed in accordance with recognized practices and procedures or as defined by law or by the AHJ.

Strike "for each level or position"

Statement of Problem and Substantiation for Public Comment

There are no different levels or positions outlined in this standard. There is only Fire Investigator. This committee rejected my proposal for different levels. So if there is only going to be 1 level, do not make things confusing by talking about different levels and positions.

Related Item

- PI

Submitter Information Verification

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Committee: PQU-FIV



Public Comment No. 3-NFPA 1033-2020 [New Section after 3.3]

Add new definitions:

3.2.X Accredited. To give official authorization to or to approve a process or procedure to recognize as conforming to specific criteria, and to recognize an entity as maintaining standards appropriate to the provisions of its services.

3.2.X Accrediting Body. A voluntary, nongovernmental association that administers accrediting procedures for entities that certify individuals to fire service professional qualifications standards, or programs granting degrees in noneengineering fire /emergency services-fields.

3.2.X Certification. An authoritative attestation; specifically, the issuance of a document that states that an individual has demonstrated the knowledge and skills necessary to function in a particular fire service professional field.

3.2.X Certifying Entity. An organization that is accredited to award certification to individuals.

Statement of Problem and Substantiation for Public Comment

These definitions are extracts from NFPA 1000 and are needed for PC 2.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
<u>Public Comment No. 2-NFPA 1033-2020 [New Section after 4.1.1]</u>	
<u>Public Comment No. 2-NFPA 1033-2020 [New Section after 4.1.1]</u>	

Related Item

- PI 6

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Submittal Date: Thu Jul 16 07:26:27 EDT 2020

Committee: PQU-FIV



Public Comment No. 2-NFPA 1033-2020 [New Section after 4.1.1]

Insert new language:

4.1.2 Documentation of competency to the job performance requirements of this standard shall be demonstrated by the fire investigator achieving certification through a certifying entity that has achieved accreditation with an accrediting body.

Statement of Problem and Substantiation for Public Comment

In PI #5, the TC indicated it did not want to mandate certification. This PC requests the TC reconsider this position. As indicated in the original justification for this proposal, the National Research Council of National Academies indicated that the use of accrediting bodies is of the utmost importance to ensure the integrity of forensic science investigations. Why we would not want to ensure this integrity, within a field that has had significant failures with integrity through the years, fails to pass the straight face test to the citizens we serve and the courts. As an option, the TC could establish a date within the standard that this requirement would be expected to allow those that do not have certification through an accrediting body, to achieve it. This would at least move us into a direction to implement the NRC recommendation. The justification for the original PI is listed below.

Credibility and accountability with respect with respect to demonstrating competence is key to ensuring fire investigators actually achieve the competency as provide in this standard. This credibility and accountability can best be assured by the fire investigator achieving certification through an accredited program to the JPRs of this standard. This ensures that individuals and programs are assessed and validated so there is confidence that the individuals receiving certification are actually competent in those areas as required by the standard. The fire service already has numerous accrediting bodies and certification programs that are accredited to the NFPA 1033 standard so program availability is not an issue. The 2009 National Research Council of the National Academies report "Strengthening Forensic Science in the United States" provides recommendations that the utilization of accrediting bodies is of the utmost importance in order to ensure the integrity of forensic science investigations. Ensuring that NFPA 1033 recognizes the need for ensuring integrity in certification processes for those that are certified to the NFPA 1033 standard would be a major step forward toward improving the credibility of the fire investigation field in the eyes of the public, the courts and the profession.

Related Public Comments for This Document

Related Comment

Public Comment No. 3-NFPA 1033-2020 [New Section after 3.3]

Public Comment No. 3-NFPA 1033-2020 [New Section after 3.3]

Relationship

PC 3 are definitions for this item.

Related Item

- PI 5

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Committee: PQU-FIV



Public Comment No. 12-NFPA 1033-2020 [Section No. 4.1.2]

4.1.2*

The fire investigator shall employ all elements of the scientific method as the operating analytical process throughout the investigation and for the drawing of conclusions. In so doing, the fire investigator shall conduct the investigation objectively, truthfully, and without bias, preconception, or prejudice.

Statement of Problem and Substantiation for Public Comment

In the Public Input stage, I proposed a new paragraph in section 1 stating that the investigator shall conduct the investigation "objectively and without bias." (PI No. 104). In rejecting this proposal, the TC said in part, "In section 4.1.2 the application of the scientific method involves conducting the investigation and developing hypothesis objectively and without bias."

In examining the NFPA 1033 First Draft, there is no requirement that an investigation be completed objectively and without bias. In explaining the key steps in the scientific method, neither NFPA 921, 2021 ed. (Figure 4.3), nor NFPA 1033 A.4.1.2 makes any mention of the need to avoid bias. If there was not a problem with investigator bias, it would not be necessary for NFPA 921 to address the need to avoid presumption, expectation bias, and confirmation bias as it does in paragraphs 4.3.8, 4.3.9, and 4.3.10. These sections address issues beyond the steps in the scientific method. The fact that they are addressed at length in the Basic Methodology chapter underscores the importance of these cautions. NFPA 921 is merely a "guide" and is not mandatory. NFPA 1033 should specifically instruct investigators to avoid bias and this is the reason for the revision I am proposing in 4.1.2. This revision mirrors the words in NFPA 921, section 4.1, and reflects the guidance contained in the sections of NFPA 921 referred to above.

As mentioned in the substantiation for my original proposal, we should be swayed by the fact that the 2009 report, "Strengthening Forensic Science in the United States: A Path Forward" (the NRC/NAS Report) (available at <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>) expressed grave concerns about bias among forensic sciences practitioners, (which we know includes fire investigators). There is also a growing body of cognitive neuroscientific literature addressing the important need to avoid bias among forensic science practitioners. See for example the work of Dr. Itel Dror, listed on his website: <https://www.ucl.ac.uk/~ucjtidr/> Another example of a publication stating the need for forensic science practitioners to avoid bias is the work product of the National Commission on Forensic Science adopted by a 93% majority vote entitled "Ensuring that Forensic Analysis is Based on Task Relevant Information" (available for download at <https://www.justice.gov/archives/ncfs/work-products-adopted-commission>) That problems of bias exist among fire investigators was also addressed by OSAC's Fire & Explosion Investigation Subcommittee in one of only two research needs assessments it published: "Potential for reducing bias in fire and explosion investigations."

In conclusion, bias is such a prevalent issue it should be addressed explicitly in the mandatory provisions of NFPA 1033.

Related Public Comments for This Document

Related Comment
Public Comment No. 13-NFPA 1033-2020 [Section No. A.4.1.2]

Relationship

Related Item

- PI 104 Proposed adding a new section after 1.3.8 to caution investigators that they shall conduct the investigation objectively and avoid bias.

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Submittal Date: Fri Oct 09 14:55:44 EDT 2020

Committee: PQU-FIV



Public Comment No. 1-NFPA 1033-2020 [Section No. 4.1.7.3]

4.1.7.3

The fire investigator shall complete and document a minimum of ~~40 hours~~ 80 hours of continuing education training every five years by attending formal education courses, workshops, and seminars.

Statement of Problem and Substantiation for Public Comment

The original submittal of this PI requested a 3 year period to complete the 40 hours of ceus. The TC changed this to a 5 year time period. The assumption is that 5 years was chosen to model after the IAAI recertification which is based on a 5 year time frame. If the TC is going to use a 5 year time frame and attempt to be consistent with the IAAI recertification program, the 40 hours should be increased. Based on the IAAI program, the least number of CEU's one would be required to obtain would be 80 hours under a Category 1 Tested Training Program. If the training was untested, that number could be 160 hours. Therefore, it seems reasonable to establish the NFPA 1033 ceu requirement based on 80 hours every 5 years as a bare minimum.

Setting aside the IAAI renewal certification as a base for this ceu requirement, requiring only 40 hours of ceus every 5 years seems to be wholly inadequate if the goal of the ceus is to maintain competency in the field to new science, technology and best practices. (I know I would not want a fire investigator conducting a fire investigation on my property that only had completed 40 ceu hours in the last five years.)

Related Item

- FR1

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Committee: PQU-FIV



Public Comment No. 9-NFPA 1033-2020 [Section No. 4.2.6 [Excluding any Sub-Sections]]

Examine and remove fire debris, given standard or, if necessary, special equipment and tools, so that fire patterns and fire effects concealed by debris are discovered and analyzed; all debris within the potential area(s) of origin is checked for fire cause evidence; potential ignition source(s) is identified; and evidence is preserved without investigator-inflicted damage or contamination.

Eliminate the clause "within the potential area(s) of origin" from the text.

Statement of Problem and Substantiation for Public Comment

Evidence of fire cause is not always located in the area of origin. Ignitable liquid containers are often in other areas or other rooms. Several electrical causes, such as ground faults or open neutrals, are often located remote from the area of fire origin. The scope of debris examination should not be limited to the immediate of fire origin.

Related Item

- PI 4.2.6

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Submittal Date: Tue Sep 29 00:27:18 EDT 2020

Committee: PQU-FIV



Public Comment No. 18-NFPA 1033-2020 [Section No. 4.6.1 [Excluding any Sub-Sections]]

Gather reports- and -, records, and scientific literature, given no special tools, equipment, or materials, so that all gathered documents are applicable to the investigation, complete, and authentic; the chain of custody is maintained; and the material is admissible in a legal proceeding.

Statement of Problem and Substantiation for Public Comment

It is necessary for investigators to consider if there is existing scientific, engineering, or technical research that is relevant to their investigation. We have labeled such documents "scientific literature," a phrase used by the National Commission on Forensic Science.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>	<u>Related Item</u>
Public Comment No. 15-NFPA 1033-2020 [Section No. 4.6.1(A)]		
Public Comment No. 16-NFPA 1033-2020 [Section No. 4.6.1(B)]		
Public Comment No. 17-NFPA 1033-2020 [New Section after A.4.4.2]		
Public Comment No. 15-NFPA 1033-2020 [Section No. 4.6.1(A)]		
Public Comment No. 16-NFPA 1033-2020 [Section No. 4.6.1(B)]		
• PI 107 proposing a new section after 1.3.8 dealing with conducting a scientific literature review.		

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Committee: PQU-FIV



Public Comment No. 15-NFPA 1033-2020 [Section No. 4.6.1(A)]

(A) Requisite Knowledge.

Types of reports needed that facilitate determining responsibility for the fire (e.g., police reports, fire reports, insurance policies, financial records, deeds, private investigator reports, outside photos, and videos) and location of these reports and types of scientific literature that are relevant to the investigation (e.g. scientific, engineering, or technical research and publications) and where to access such literature.

Statement of Problem and Substantiation for Public Comment

As demonstrated by each successive edition of NFPA 921, there is a growing body of research and publications relevant to fire investigations. While the first draft of chapter 4 lists requisite knowledge that an investigator must have concerning the topics listed in various sections of that chapter, this requisite knowledge may not be sufficient to solve the issues in an investigation. Therefore, investigators must know where to obtain relevant scientific literature. They also need to develop the necessary skills to conduct a literature review, which is addressed by another public comment to revise the "requisite skills" for this section.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 17-NFPA 1033-2020 [New Section after A.4.4.2]	
Public Comment No. 16-NFPA 1033-2020 [Section No. 4.6.1(B)]	
Public Comment No. 18-NFPA 1033-2020 [Section No. 4.6.1 [Excluding any Sub-Sections]]	
Public Comment No. 16-NFPA 1033-2020 [Section No. 4.6.1(B)]	
Public Comment No. 18-NFPA 1033-2020 [Section No. 4.6.1 [Excluding any Sub-Sections]]	
	<u>Related Item</u>
• PI 107 proposing a new section after 1.3.8 dealing with conducting a scientific literature review.	

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Committee: PQU-FIV



Public Comment No. 16-NFPA 1033-2020 [Section No. 4.6.1(B)]

(B) Requisite Skills.

Ability to identify the reports, documents, and ~~documents~~ scientific literature necessary for the investigation, implement the chain of custody, and organizational skills, and the ability to conduct a literature review of scientific, engineering, or technical materials using reliable research methodologies so that the investigator is able to identify, understand, and critically evaluate existing research and publications on a subject that is relevant to the investigation .

Statement of Problem and Substantiation for Public Comment

This section addresses the investigator's need to identify "reports and documents" necessary for the investigation. Nowhere in NFPA 1033 is the investigator instructed to identify relevant scientific literature. There is a growing body of scientific research and publications that may be critical to making accurate determinations in a fire investigation. The investigator should be specifically told to identify any scientific literature that may be relevant. As some investigators may not have developed the skill of conducting a literature review, which is necessary in order to identify relevant scientific publications, we are also submitting a public comment for an addition to the Annex with instructions on how to develop this skill.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
Public Comment No. 15-NFPA 1033-2020 [Section No. 4.6.1(A)]	
Public Comment No. 17-NFPA 1033-2020 [New Section after A.4.4.2]	
Public Comment No. 18-NFPA 1033-2020 [Section No. 4.6.1 [Excluding any Sub-Sections]]	
Public Comment No. 15-NFPA 1033-2020 [Section No. 4.6.1(A)]	
Public Comment No. 18-NFPA 1033-2020 [Section No. 4.6.1 [Excluding any Sub-Sections]]	
	<u>Related Item</u>
<ul style="list-style-type: none"> • PI 107 proposing a new section after 1.3.8 dealing with conducting a scientific literature review. 	

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Public Comment No. 13-NFPA 1033-2020 [Section No. A.4.1.2]

A.4.1.2

The basic methodology for fire investigation involves collecting data, then developing and testing hypotheses (*see the methodology chapter of NFPA 921*). The methodology recommended is the scientific method. Key steps in the scientific method are as follows:

- (1) Recognize the need (identify the problem)
- (2) Define the problem
- (3) Collect data
- (4) Analyze the data
- (5) Develop the hypotheses (inductive reasoning)
- (6) Test the hypotheses (deductive reasoning)
- (7) Select final hypothesis

Developing hypotheses is an ongoing process of data collection and evaluation that happens throughout the investigation. Hypotheses are generally developed and tested for evaluating fire spread and growth, evaluating the nature of fire patterns, and determining origin, cause, and responsibility.

NFPA 921, chapter 4 also provides guidance to investigators on accomplishing the steps in the scientific method objectively and truthfully, avoiding presumption and bias.

Testing of hypotheses can be either experimental or cognitive. Ultimately, the hypotheses and conclusions reached are only as dependable as the data used or available. Each investigator must apply a level of confidence in that opinion. For additional information regarding evaluation methods see ASTM E678, *Standard Practice for Evaluation of Scientific or Technical Data*.

Statement of Problem and Substantiation for Public Comment

See the substantiation in the related Public Comment that proposes a revision to 4.1.2. The revision to this Annex material will direct the reader to the sections in NFPA 921 specifically dealing with avoiding presumption, expectation bias, and confirmation bias.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
<u>Public Comment No. 12-NFPA 1033-2020 [Section No. 4.1.2]</u>	
<u>Related Item</u>	
• PI 104 Proposing a new section after 1.3.8.	

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Public Comment No. 8-NFPA 1033-2020 [Section No. A.4.2.2]

A.4.2.2

For additional information concerning safety requirements or training, see applicable local, state, or federal occupational safety and health regulations;- ~~Safety at Scenes of Fire and Related Incidents~~ ; IAAI ~~Fire Investigator Safety Checklist~~; NFPA 472; IFSTA ~~Hazardous Materials for Fire and Explosion Investigators: Guidelines and Procedures~~ ; IFSTA ~~Safety and Health Guidelines for Fire and Explosion Investigators~~ NFPA 472; the most current edition of IAAI Fire Investigator Health and Safety Best Practices ; and the safety chapter of NFPA 921.

Statement of Problem and Substantiation for Public Comment

The current reference document Safety at Scenes of Fire and Related Incidents is from 1994 and contains outdated information that does not reflect current fire investigator health and safety best practices.

The current reference document IFSTA Safety and Health Guidelines for Fire and Explosion Investigators is from 2002 and contains outdated information that does not reflect current fire investigator health and safety best practices.

The current reference document IAAI Fire Investigator Safety Checklist does not exist.

The current reference document IFSTA Hazardous Materials for Fire and Explosion Investigators is from 1998 and contains outdated information that does not reflect current fire investigator health and safety best practices.

The removal of these outdated materials and replacement with the reference to the most current edition of IAAI Fire Investigator Health and Safety Best Practices, and the continued reference to NFPA documents, will provide readers with the latest and best-available information on this important subject. With these changes, all referenced documents will be peer- and technical-reviewed documents that are regularly updated.

Related Item

- A.4.2.2

Submitter Information Verification

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Submittal Date: Tue Aug 11 10:45:01 EDT 2020

Committee: PQU-FIV



Public Comment No. 17-NFPA 1033-2020 [New Section after A.4.4.2]

A.4.6.1. Literature Review. A literature review involves identifying, summarizing, and critically evaluating existing research and publications on a particular subject. It is more than a summary of relevant publications. A literature review synthesizes the data available on a given research problem. It presents all sides of any dispute respecting the interpretation of data, highlighting areas where various authors agree or disagree. In critically evaluating the publications reviewed, the investigator will have to be particularly aware of bias by the authors or in the design of their research. The investigator will also have to be vigilant in avoiding his or her own biases to influence the results of the literature review, either in the materials included or in the conclusions reached.

Organization of Literature Review. While it is important to note the date of publications selected for the literature review because information in older publications may have become outdated or disproven, it is preferable to organize the review around major points, rather than by date.

Research Methodology. Below is a general approach to research methodology in conducting a literature review:

- : **Make a Statement of Problem.** Start by making a written research plan which states the specific problem to be researched.
- : **Identify Sources of Publications and the Order of Access.** Outline the steps to be taken in the research, including the sources that will be accessed. One will generally begin with secondary sources such as handbooks or scientific journals, and from the cited references in such works, identify primary sources such as reports of relevant research or case studies. A good place to begin is by identifying the chapter(s) in NFPA 921 that deal with the research problem, and then listing potentially relevant publications from the Annex material in those chapters, and from Chapter 2 *Referenced Publications*.
- : **Identify Search Terms and a Glossary of Important Terms for Electronic Research.** Identify key terms or phrases from indexes of this Guide, the secondary and primary sources to be reviewed. Use these terms to narrow the results in researching electronic databases or Internet material.
- : **Conduct Internet Research Beginning with Scholarly Sites.** Include in the research plan Internet sources, including websites, videos, and online articles. Consider the value of paying for access to electronic databases that are available by subscription, or accessing electronic databases available in academic or public libraries.
- : **Select Relevant Publications.** Scan abstracts or introductions of publications to make preliminary determinations of which are relevant. Collect copies of electronic material in a

folder on a computer or print copies in a folder or binder.

: **Keep Track of Research Trail and Results of Research.** As the research proceeds, make notations of the sources reviewed.

: **Critically Evaluate Research Results.** Read and critically evaluate the publications resulting from the research. Discard publications that are only marginally relevant. Evaluate the reliability of each relevant source. Check citations of referenced material to determine if there are additional relevant publications should be added to the collection. In conducting this evaluation, avoid discarding publications with conclusions that are contrary to the hypotheses under study. It is better to include such publications in a literature review and discount them only if it can be shown that they are unreliable by using objective factors such as those outlined earlier.

: **Update Results Over Time.** There is an ever-growing body of research and publications pertaining to fire and explosion investigations. If time passes between an investigator's original research and the time a matter proceeds to trial, the investigator should determine if the literature review and conclusions need to be updated as a result of recent publications. Likewise, if an investigator plans to use the results of a previous literature review in later investigations, the research and conclusions should be updated.

Once the literature review is complete, the investigator should have a sufficient understanding of the data from existing research on the subject of the problem to begin developing or testing his or her hypotheses.

Statement of Problem and Substantiation for Public Comment

This annex material supplements the proposed revisions to s. 4.6.1, 4.6.1(A), and 4.6.1(B). While ASTM E678 addresses this topic, it does so in a vague way. This annex material provides simple directions to enable investigators to develop the skill of conducting a literature review. Further NFPA 921, 2021 edition has re-written chapter 14, "Sources of Information." It directs the investigator to consider research and publications (see s. 14.5.4). The revisions to NFPA 1033 s. 4.6.1 and this annex information flow logically from this new information in NFPA 921.

Related Public Comments for This Document

<u>Related Comment</u>	<u>Relationship</u>
<u>Public Comment No. 15-NFPA 1033-2020 [Section No. 4.6.1(A)]</u>	
<u>Public Comment No. 16-NFPA 1033-2020 [Section No. 4.6.1(B)]</u>	
<u>Public Comment No. 18-NFPA 1033-2020 [Section No. 4.6.1 [Excluding any Sub-Sections]]</u>	
	<u>Related Item</u>
• PI 107 proposing a new section after 1.3.8 dealing with conducting a scientific literature review.	

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Public Comment No. 10-NFPA 1033-2020 [Section No. D.1.1 [Excluding any Sub-Sections]]

The term *fire science* as used in this standard refers to a group of interrelated subjects listed in D.1.1(1) through D.1.1(4).

(1) *Fire chemistry:*

- (a) States of matter (gases, liquids, and solids)
- (b) Chemical reactions (fire triangle and fire tetrahedron)
- (c) Stoichiometry
- (d) Chemical composition of common combustibles
- (e) Phase changes and reactions that might require or produce energy (exothermic and endothermic processes)
- (f) Material properties (density, conductivity, specific heat, deformation, melting, vaporization, vapor pressure)
- (g) Structural properties (effect of temperatures on properties)
- (h) Combustion properties (flammable limits, minimum ignition energy, critical flux for ignition, ignition temperatures, heat of combustion, flash point of liquid, and fire point)
- (i) Fuels
- (j) Complete and incomplete combustion reaction products (combustion efficiency and role of fuel/air ratio in product composition)
- (k) The response of materials to heat (melting, dehydration, pyrolysis, charring, loss of mass, deformation, evaporation, and calcination)
- (l) Different temperature scales

(2) *Thermodynamics:*

- (a) Definition of energy, work, and power
- (b) Ideal gas law ($PV = nRT$)
- (c) Conservation of energy
- (d) Phase changes and energy requirements
- (e) Vapor pressures
- (f) Heat capacity

(3) *Fire dynamics: Concepts and units of energy, heat release rate (HRR) (power), and heat flux:*

- (a) Means by which temperature can be measured
- (b) Incorporation of temperature measurement controls in devices and appliances
- (c) Piloted and spontaneous ignition of solids
- (d) Smoldering and pyrolysis
- (e) Self-heating
- (f) Heat transfer (definition, units, conduction, convection, and radiation)
- (g) Thermal inertia, thermal conductivity, density, and specific heat (thermally thin and thermally thick)
- (h) Natural versus forced convection
- (i) Point source radiant heat transfer
- (j) Flame spread (counter- and concurrent-flow)
- (k) Orientation of fuels and the effect on flame spread
- (l) Flames (height, tilt, temperatures, velocity, widths, and relationship between HRR and

height)

- (m) Buoyancy
 - (n) Diffusion and premixed flames
 - (o) Laminar and turbulent flames
 - (p) Fuel packages and associated HRRs
 - (q) Fluid flows [plume development, ceiling jets (depth, temperature, and velocity), vent flows, and stack/chimney effect]
 - (r) Development of a compartment fire(s)
 - (s) Plumes and hot gas layer development
 - (t) Vent flows (flow paths, ~~one-direction and~~ unidirectional and bidirectional flows, exhaust and inlet flows, and neutral planes)
 - (u) Flashover (definition, recognition, and impact on damage)
 - (v) Full-room involvement (definition, impact on damage, and how to interpret as a fire investigator)
 - (w) Relationship of compartment fire dynamics phenomena to fire pattern development (plume-generated patterns, hot gas layer-generated patterns, ventilation-generated patterns, and effects of full-room involvement)
 - (x) Suppression effects (influence on damage and on spread)
 - (y) Ventilation-limited burning
 - (z) Effects of fuel location in a compartment
- (4) *Explosion dynamics:*
- (a) How chemistry, physics, fire science, engineering disciplines of fluid and solid mechanics, and heat transfer interact to influence explosion behavior
 - (b) Deflagration versus detonation
 - (c) Chemical, mechanical, BLEVE, electrical, and dust explosions
 - (d) Recognition of damage caused by fuel/air explosions
 - (e) Recognition of damage caused by low explosives
 - (f) Recognition of damage caused by high explosives
 - (g) Positive and negative pressure waves
 - (h) Cascading explosions
 - (i) Flame front and pressure propagation in a flammable gas cloud

Statement of Problem and Substantiation for Public Comment

The antonym of bidirectional is unidirectional and is the term that is taught in most training courses and textbooks. This change merely reflects the appropriate terminology instead of the current text of one direction.

Related Item

- Addition of Appendix D

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