

# **CERTIFICATION CURRICULUM MANUAL**

## **CHAPTER FIVE**

### **FIRE INVESTIGATOR**

**NFPA 921, 2024 Edition  
NFPA 1033, 2022 Edition**

**Effective August 1, 2025**



**Texas Commission on Fire Protection**  
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## REFERENCE LIST FOR THE FIRE INVESTIGATOR CURRICULUM

This Reference List is provided as a general guide for both instructors and students to locate information pertaining to the specific objectives in the TCFP Curriculum. This list is **not** all-inclusive and does not in any way limit TCFP development and use of questions to test the objectives of the curriculum.

### Required References

- Certification Curriculum Manual*. Austin, TX: Texas Commission on Fire Protection.
- Emergency Response Guidebook*, (Current ed.) U.S. Department of Transportation Research and Special Programs Administration, Office of Hazardous Materials Initiatives and Training.
- Fire Inspection and Code Enforcement* (9<sup>th</sup> ed.) (2023). Stillwater, OK: Fire Protection Publications. International Fire Service Training Association.
- Fire Investigator: Principles and Practice* (6<sup>th</sup> ed.) (2023). Burlington, MA: Jones and Bartlett Learning. ISBN:1284247724
- Fire Investigator* (3<sup>rd</sup> ed) (2021) Stillwater, OK: Fire Protection Publications. International Fire Service Training Association
- Fire Investigator Health and Safety Best Practices* (3<sup>rd</sup> edition) (April 13, 2022). The International Association of Arson Investigators, Inc. (On 2/24/2024 this publication was available online at <https://www.firearson.com/Publications-Resources/Fire-Investigator-Health-And-Safety-Best-Practices-Third-Edition.aspx>)
- Icove, David J., *Kirk's Fire Investigation*, (8<sup>th</sup> ed.) (2018). New York, NY: Pearson Education, Inc.
- NFPA 921: Guide for Fire and Explosion Investigations* (2024 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.
- NFPA 1033: Standard for Professional Qualifications for Fire Investigator* (2022 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.
- NFPA 1321: Standard for Fire Investigation Units* (2025 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.
- Standards Manual for Fire Protection Personnel*. Austin, TX: Texas Commission on Fire Protection.
- ASTM E620 Standard Practice for Reporting Opinions of Scientific or Technical Experts* (current ed.)
- ASTM E678 Standard Practice for Evaluation of Scientific or Technical Data* (current ed.)

### Required References (continued)

- ASTM E860 Standard Practice for Examining and Preparing Items That Are or May Become Involved in Criminal or Civil Litigation* (current ed.)
- ASTM E1188 Standard Practice for Collection and Preservation of Information and Physical Items by a Technical Investigator* (current ed.)
- ASTM E1459 Standard Guide for Physical Evidence Labeling and Related Documentation* (current ed.)

### Recommended References

The most current edition of the following publications and media are recommended (not required) supplemental material for program use.

- ASTM E1020 Standard Practice for Reporting Incidents that May Involve Criminal or Civil Litigation* (current ed.)
- ASTM E1492 Standard Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory* (current ed.)
- ASTM E2917 Standard Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs* (current ed.)
- Building Construction Related to the Fire Service* (4<sup>th</sup> ed.) (2016). Stillwater, OK: Fire Protection Publications. International Fire Service Training Association
- Cole, Lee S., *Investigation of Motor Vehicles*, (current ed.). Lee Books
- Crime Scene Investigation: A Guide for Law Enforcement* (current ed.). Largo, FL: National Forensic Science Technology Center. (On 11/13/2024 this publication was available online at: <https://www.nist.gov/system/files/documents/forensics/Crime-Scene-Investigation.pdf>)
- Emergency Field Guide*, (current ed.). NFPA  
[https://www.nfpa.org/education-and-research/emergency-response/emergency-response-guides#aq=%40culture%3D%22en%22&cq=%40taglistingpage%3D%3D\(%22EV%20Guides%22\)%20%20&numberOfResults=12&sortCriteria=%40title%20ascending](https://www.nfpa.org/education-and-research/emergency-response/emergency-response-guides#aq=%40culture%3D%22en%22&cq=%40taglistingpage%3D%3D(%22EV%20Guides%22)%20%20&numberOfResults=12&sortCriteria=%40title%20ascending)
- Crime Laboratory Service Manual Part II: Handbook*. Texas Department of Public Safety. Current edition  
<https://txdpslabs.qualtraxcloud.com/showdocument.aspx?ID=67707>
- Fire and Arson Scene Evidence: A Guide for Public Safety Personnel*, (current ed.). Washington, DC: US Department of Justice, Office of Justice Programs.  
(On 5/06/21 this publication was available online at:  
<https://www.ncjrs.gov/pdffiles1/nij/181584.pdf>)

### Recommended References (continued)

*Guide to Wildland Fire Origin and Cause Determination* (PMS 412)(current ed.), National Wildfire Coordinating Group. (On 11/13/2024 this publication was available online at: <https://www.nwcg.gov/sites/default/files/publications/pms412.pdf>)

Konefal, Joseph and Edward Nordskog. *Fire Death Scene Investigation*. (2019). Self-published. [www.arsonprofiler.com](http://www.arsonprofiler.com)

*Lentini, John J., Scientific Protocols for Fire Investigation (3<sup>rd</sup>. ed.) (2019) Boca Raton, FL: CRC Press*

*NFPA 556: Guide on Methods for Evaluating Fire Hazard to Occupants of Passenger Road Vehicles* (current ed.) Quincy, MA: National Fire Protection Association. NFPA Publications

*NFPA 1030: Standard for Professional Qualifications for Fire Prevention Program Positions (current ed.)*. Quincy, MA: National Fire Protection Association. NFPA Publications

*NFPA 1072: Standard for Hazardous Materials / Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications (current ed.)*. Quincy, MA: National Fire Protection Association. NFPA Publications

*NFPA 1730: Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations (current ed.)*. Quincy, MA: National Fire Protection Association. NFPA Publications.

*NIJ Research Report: Death Investigation: A Guide for the Scene Investigator* (current ed.). US Department of Justice, Office of Justice Programs, National Institute of Justice. (On 11/13/2024 this publication was available online at <https://www.ncjrs.gov/pdffiles1/nij/234457.pdf>)

*Passenger Vehicle Identification Manual* (current ed.) National Insurance Crime Bureau, 1111 E. Touhy Avenue, Suite 400, Des Plaines, IL 60018-2805.

*Rules of Criminal Evidence*, latest edition. (On 11/13/2024, this information was available online at: <http://www.txcourts.gov/rules-forms/rules-standards.aspx>)

*Strengthening Fire and Explosion Investigation in the United States: A Strategic Vision for Moving Forward*. 1 Apr. 2021, <https://doi.org/10.29325/OSAC.TG.0005>. Accessed 11/13/2024

*Strengthening Forensic Science in the United States: A Path Forward*, (current ed.) (Committee on Identifying the Needs for the Forensic Sciences Community. National Research Council. (On 11/13/2024 this publication was available online at <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>)

### Recommended References (continued)

*Texas Code of Criminal Procedure*, latest edition. (On 11/13/2024, this information was available online at <http://www.statutes.legis.state.tx.us/>)

*Texas Department of Public Safety Crime Laboratory Publications*. On 4/2/2025 this information was available online at: <https://www.dps.texas.gov/section/crime-laboratory/publications>

*Texas Family Code*, current ed. (On 11/13/2024, this information was available online at <http://www.statutes.legis.state.tx.us/>)

*Texas Insurance Code*, current ed. (On 11/13/2024 this information was available online at <http://www.statutes.legis.state.tx.us/>)

*Texas Penal Code*, current ed. (On 11/13/2024, this information was available online at <http://www.statutes.legis.state.tx.us/>)

*Texas Public Information Act Handbook*, current ed. (On 11/13/2024, this information was available online at [Public Information Act Training | Office of the Attorney General](#). It is available through the Texas Attorney General's office)

*United States Constitution*. (On 11/13/2024, this information was available online at <http://www.archives.gov/exhibits/charters/charters.html>).

**CHAPTER FIVE  
FIRE INVESTIGATOR  
COURSE OUTLINE**

<b>SECTION</b>	<b>SUBJECT</b>	<b>RECOMMENDED HOURS</b>
501-1	Commission on Fire Protection Rules and Regulations	2
501-2	NFPA 1033 - Administration	
501-3	Definitions	
501-4	Basic Methodology	2
501-5	Basic Fire Science	16
501-6	Fire Effects and Fire Patterns	20
501-7	Building Systems	2
501-8	Active Fire Protection Systems	4
501-9	Electricity and Fire	8
501-10	Building Fuel Gas Systems	4
501-11	Fire-Related Human Behavior	4
501-12	Legal Considerations	12
501-13	Safety	4
501-14	Sources of Information	6
501-15	Planning the Investigation	2
501-16	Documentation of the Investigation	12
501-17	Physical Evidence	12
501-18	Origin Determination	8
501-19	Fire Cause Determination	4
501-20	Analyzing the Incident for Cause and Responsibility	4
501-21	Failure Analysis and Analytical Tools	8
501-22	Explosions	8
501-23	Incendiary Fires	8
501-24	Fire and Explosion Deaths and Injuries	4
501-25	Appliances	2
501-26	Motor Vehicle Fires	8
501-27	Wildfire Investigations	8
501-28	Management of Complex Investigations	2
501-29	Marine Fire Investigations	2
501-30	Practical Exercises	24
<b>TOTAL HOURS RECOMMENDED</b>		<b>200</b>

\* The recommended hours includes time for skills evaluation and is based on 12 students. Actual hours needed will depend on the number of students, the number of examiners, availability of equipment, and the student skill level.

**NFPA 1033 MATRIX**

<b>2022 Objective</b>	<b>LOCATION IN CURRICULUM</b>	<b>SKILL</b>
<b>4.1</b>	<b>GENERAL</b>	
4.1.1	1	None
4.1.2	4	None
4.1.3	13, 15, 26	None
4.1.4	14, 15	None
4.1.5	12	None
4.1.6	15, 28	None
4.1.7	4, 5, 7, 8, 9, 10, 13, 16, 17, 20, 21, 22	None
<b>4.2</b>	<b>SCENE EXAMINATION</b>	
4.2.1	15, 17	1
4.2.2	13, 18	2, 26
4.2.3	18,	3
4.2.4	5, 6, 26	4, 5
4.2.5	5, 6, 7, 18, 26	5
4.2.6	5, 17, 26	6
4.2.7	6	7
4.2.8	7, 8, 9, 10, 14, 25	8
4.2.9	22	6
<b>4.3</b>	<b>DOCUMENTING THE SCENE</b>	
4.3.1	16, 17	9
4.3.2	16	10
4.3.3	12, 16	11
<b>4.4</b>	<b>EVIDENCE COLLECTION/PRESERVATION</b>	
4.4.1	11, 17, 24	12
4.4.2	12, 17	12
4.4.3	14, 17	12
4.4.4	12, 17	13
4.4.5	17	14
<b>4.5</b>	<b>INTERVIEW</b>	
4.5.1	14	15
4.5.2	14	16
4.5.3	14	17
<b>4.6</b>	<b>POST-INCIDENT INVESTIGATION</b>	
4.6.1	14, 16, 20, 21	18
4.6.2	16, 20, 21	19
4.6.3	12, 14, 15, 20, 21	20
4.6.4	11, 20, 21, 23	21
4.6.5	11, 18, 19, 20, 21, 23	22
<b>4.7</b>	<b>PRESENTATIONS</b>	
4.7.1	16, 30	23
4.7.2	30	24
4.7.3	12, 30	25
<b>Annex A</b>	<b>EXPLANATORY MATERIAL</b>	
A.1.1	26, 27, 29	

## **Course Instructor Information** **Fire Investigator**

### **Overview**

The Fire Investigator curriculum is designed to provide clear guidance that ensures adequate presentation of the information required to meet the Job Performance Requirements (JPRs) of *National Fire Protection Association (NFPA) 1033, Standard for Professional Qualifications for Fire Investigator*, 2022 edition.

The Fire Investigator curriculum is Chapter 5 of the Texas Commission on Fire Protection (TCFP) Curriculum Manual.

<b>Certification Level</b>	<b>TCFP Chapter Number</b>	<b>NFPA 1033 Chapter</b>
Fire Investigator	5	4

### **Layout**

The NFPA numbering sequence is mirrored to allow easy correlation between this document and the NFPA Standard. For example, 501-5.5.1 identifies the section in Fire Investigator that corresponds to *NFPA 921, Guide for Fire and Explosion Investigation (2024 Edition)* section 5.5.1.

### **TCFP Standards Manual**

It is critical that the Course Instructor review the chapters in the TCFP Standards Manual that apply to this curriculum. Of primary importance are the following chapters: Chapter 421, Standards for Certification; Chapter 437, Fees; Chapter 431, Fire Investigator Certification; Chapter 439, Examinations for Certification; Chapter 449.5, Certification as Head of a Prevention Only Department. These chapters do not address every issue that could impact this curriculum; therefore, the Course Instructor is encouraged to become familiar with the TCFP Standards Manual.

### **Supplemental Information**

Instructors are expected to provide supplemental information if the main reference text does not provide adequate information to ensure successful completion of the Job Performance Requirements as listed in the curriculum.

### **Components of the Curriculum**

Each section of the curriculum identifies the NFPA JPR in *NFPA 1033, Standard for Professional Qualifications for Fire Investigator*, 2022 Edition and knowledge components in *NFPA 921, Guide for Fire and Explosion Investigations, 2024 Edition* and subdivides them into learning components.

**For example:**

**4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.5\*** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

**(A) Requisite Knowledge:** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, time lines, link analysis, fault tree analysis, and data reduction matrixing).

**(B) Requisite Skills:** Analytical and assimilation skills.

**501-19.1**      **The Investigator candidate shall define fire cause and identify fire cause factors.**

- 19.1.1      *Fire Cause Factors*
- 19.1.2      *First Fuel Ignited*
- 19.1.3      *Ignition Source*
- 19.1.4      *Oxidant*
- 19.1.5      *Ignition Sequence*

**501-19.2**      **The Investigator candidate shall utilize the scientific method as the overall methodology.**

- 19.1.1      *Consideration of Data*
- 19.1.2      *Sequence of Activities*
- 19.1.3      *Point and Area of Origin*

**501-19.3**      **The Investigator candidate shall identify the data that needs to be collected for fire cause determination.**

**Skills**

NFPA's "Requisite Skills" requirements are addressed in the corresponding Skill Sheets and are based on the JPRs in *National Fire Protection Association (NFPA) 1033, Standard for Professional Qualifications for Fire Investigator*, 2022 edition.

**Descriptions of Certification Levels**

A Fire Investigator is an individual who has demonstrated the skills and knowledge necessary to conduct, coordinate, and complete a fire investigation.

## Fire Investigator

A Fire Investigator is an individual who has demonstrated the knowledge, skills, and abilities necessary to conduct, coordinate, and complete a fire investigation employing all the elements of the scientific method as the operating analytical process throughout the investigation. A Fire Investigator can competently determine the origin and cause of a fire and has mastered all the job performance requirements of *NFPA 1033: Standard for Professional Qualifications for Fire Investigator*.

### SECTION 1

#### TEXAS COMMISSION ON FIRE PROTECTION

#### RULES AND REGULATIONS

##### 4.1 General

**NFPA 1033 4.1.1** The fire investigator shall meet the job performance requirements (JPRs) defined in Sections 4.2 through 4.7.

##### References:

Certification Curriculum Manual  
Standards Manual for Fire Protection Personnel

**501-1.1**     **The Investigator candidate shall describe the purpose of the NFPA standard and guide applicable to Fire Investigators.**

- 1.1.1     *NFPA 1033 Standard for Professional Qualifications for Fire Investigator*, 2022 edition.
- 1.1.2     *NFPA 921 Guide for Fire and Explosion Investigations*, 2024 edition.

**501-1.2**     **The Investigator candidate shall identify rules applicable to the Fire/Arson Investigator certification adopted by the Texas Commission on Fire Protection.**

- 1.2.1     The Investigator candidate shall identify the requirements for certification as a Fire Investigator as stated in the *Standards Manual for Fire Protection Personnel*, Chapter 431.
- 1.2.2     The Investigator candidate shall identify the requirements for certification as an Arson Investigator as stated in the *Standards Manual for Fire Protection Personnel*, Chapter 431.

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1.2.3 The Investigator candidate shall identify the various levels of certification for Fire and/or Arson Investigator, as stated in the *Standards Manual for Fire Protection Personnel*, Chapter 431.

1.2.3.1 Basic

1.2.3.2 Intermediate

1.2.3.3 Advanced

1.2.3.4 Master

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## SECTION 2

### NFPA 1033

- NFPA 1033 1.1\* Scope.** This standard shall identify the minimum job performance requirements (JPRs) for fire investigators.
- 1.2\* Purpose.** This standard shall specify the minimum JPRs for serving as a fire investigator in both the private and public sectors.
- 1.2.1** This standard shall define the fire investigator position.
  - 1.2.2** The intent of this standard shall be to ensure that individuals who serve as fire investigators are qualified to do so.
  - 1.2.3** It shall not be the intent of this standard to restrict any jurisdiction from exceeding or combining these minimum requirements.
  - 1.2.4** JPRs for each duty are the tasks personnel shall be able to perform to successfully carry out that duty.
  - 1.2.5** Fire investigators who perform or support fire investigations shall remain current with the general knowledge, skills, and JPRs.
  - 1.2.6** Fire investigators who perform or support fire investigations shall remain current with practices and applicable standards.
- 1.3 Application.** The application of this standard shall be to specify the JPRs that shall apply to specific personnel who perform and support fire investigations.
- 1.3.1** The JPRs shall be accomplished in accordance with the requirements of the AHJ and all applicable NFPA and other standards development organization (SDO) standards.
  - 1.3.2** Priority.
    - 1.3.2.1** \* It shall not be required that the JPRs be mastered in the order in which they appear.
    - 1.3.2.2** The AHJ shall establish instructional priority and the training program content to prepare personnel to meet the JPRs of this standard.
    - 1.3.2.3** \* The performance of each requirement of this chapter shall be evaluated by personnel approved by the AHJ.
    - 1.3.2.4** The JPRs for fire investigators shall be completed in accordance with recognized practices and procedures or as defined by law or by the AHJ.
    - 1.3.2.5** Fire investigators who perform or support fire investigations shall meet the requirements of this standard for each fire investigation performed.
    - 1.3.2.6** The AHJ shall provide the necessary personal protective equipment (PPE), force protection, and clothing to conduct assignments.
    - 1.3.2.7** JPRs involving exposure to products of combustion shall be performed in approved PPE.
    - 1.3.2.8** Prior to training to meet the requirements of this standard, personnel shall meet the following requirements:
      - (1)** Be at least age 18
      - (2)** Have a high school diploma or equivalent
      - (3)** Be subjected to a thorough background and character investigation by the AHJ prior to being accepted as an individual candidate for certification as a fire investigator

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- 4.1.1 \* The fire investigator shall meet the job performance requirements defined in Sections 4.2 through 4.7. (see below)
- 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.
- 4.1.3 \* Because fire investigators are required to perform activities in adverse conditions, site safety assessments shall be completed on all scenes and regional and national safety standards shall be followed and included in organizational policies and procedures.
- 4.1.4 \* The fire investigator shall maintain necessary liaison with other interested professionals and entities.
- 4.1.5 \* The fire investigator shall adhere to all applicable legal and regulatory requirements.
- 4.1.6 The fire investigator shall understand the organization and operation of the investigative team within an incident management system.
- 4.1.7 \* In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:
  - (1) Fire science:
    - (a) Fire chemistry
    - (b) Thermodynamics
    - (c) Fire dynamics
    - (d) Explosion dynamics
  - (2) Fire investigation:
    - (a) Fire analysis
    - (b) Fire investigation methodology
    - (c) Fire investigation technology
    - (d) Evidence documentation, collection, and preservation
    - (e) Failure analysis and analytical tools
  - (3) Fire scene safety:
    - (a) Hazard recognition, evaluation, and basic mitigation procedures
    - (b) Hazardous materials
    - (c) Safety regulations
  - (4) Building systems:

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- (a) Types of construction
- (b) Fire protection systems
- (c) Electricity and electrical systems
- (d) Fuel gas systems

- 4.1.7.1** The fire investigator shall remain current in the subjects listed as “requisite knowledge” for the JPRs and as summarized in 4.1.7.
- 4.1.7.2** The fire investigator shall remain current by attending formal education courses, workshops, in-person or online seminars, and/or through professional publications, journals, and treatises.
- 4.1.7.3** The fire investigator shall complete and document a minimum of 40 hours of continuing education training every five years by attending formal education courses, workshops, and seminars.

### **28 Job Performance Requirements (Annex C, Table C.1)**

1. Secure the fire ground (4.2.1)
2. Conduct an exterior survey (4.2.2)
3. Conduct an interior survey (4.2.3)
4. Interpret fire patterns (4.2.4)
5. Interpret and analyze fire patterns (4.2.5)
6. Examine and remove fire debris (4.2.6)
7. Reconstruct the area of origin (4.2.7)
8. Inspect the performance of building systems (4.2.8)
9. Discriminate the effects of explosions (4.2.9)
10. Diagram the Scene (4.3.1)
11. Photographically document the scene (4.3.2)
12. Construct investigative notes (4.3.3)
13. Utilize proper procedures for managing victims and fatalities (4.4.1)
14. Locate, document, collect, label, package, and store evidence (4.4.2)
15. Select evidence for analysis (4.4.3)
16. Maintain a chain of custody (4.4.4)
17. Dispose of evidence (4.4.5)
18. Develop an interview plan (4.5.1)
19. Conduct interviews (4.5.2)
20. Evaluate interview information (4.5.3)

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21. Gather reports and records (4.6.1)
22. Evaluate the investigative file (4.6.2)
23. Coordinate expert resources (4.6.3)
24. Establish evidence as to motive and/or opportunity (4.6.4)
25. Formulate an opinion concerning origin, cause, or responsibility for the fire (4.6.5)
26. Prepare a written report (4.7.1)
27. Express investigative findings verbally (4.7.2)
28. Testify during legal proceedings (4.7.3)

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**SECTION 3**  
**DEFINITIONS**

**References:**  
**NFPA 921 2024 edition**

**501-3.1**      ***The Investigator candidate shall define the terms used in Chapter 3 of NFPA 921, Guide for Fire and Explosion Investigations (2024 Edition).***

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## **SECTION 4**

### **BASIC METHODOLOGY**

#### **4.1 General**

**NFPA 1033 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.

**4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following: (2)(b) Fire Investigation Methodology.

#### **References:**

**J & B, chapter 2**

#### **501-4.1**      **The Investigator candidate shall describe the nature of fire investigations.**

- 4.1.1      A forensic science discipline
- 4.1.2      A systematic approach

#### **501-4.2**      **The Investigator candidate shall apply the principles of the systematic approach of the scientific method.**

- 4.2.1      The Scientific Method
- 4.2.2      An organizational and analytical process

#### **501-4.3**      **The Investigator candidate shall describe the steps of the scientific method relating to fire investigations.**

- 4.3.1      Recognize the Need(s)
- 4.3.2      Define the Problem
- 4.3.3      Collect Data
- 4.3.4      Analyze the Data
- 4.3.5      Develop a Hypotheses (Inductive Reasoning)
- 4.3.6      Test the Hypotheses (Deductive Reasoning)
- 4.3.7      Select Final Hypothesis
- 4.3.8      Avoid Presumption
- 4.3.9      Expectation Bias
- 4.3.10     Confirmation Bias

#### **501-4.4**      **The Investigator candidate shall describe the basic method of a fire investigation.**

- 4.4.1      Receiving the Assignment
- 4.4.2      Preparing for the Investigation

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- 4.4.3 Conducting the Investigation
- 4.4.4 Collecting and Preserving Data and Evidence
- 4.4.5 Analyzing the Incident
- 4.4.6 Conclusions

**501-4.5** ***The Investigator candidate shall understand that there are various legal requirements of the admissibility of expert opinions in different jurisdictions.***

- 4.5.1 Expressions of Certainty
- 4.5.2 Fire Investigation Certainty

**501-4.6** ***The Investigator candidate shall develop “review procedures.”***

- 4.6.1 Administrative Review
- 4.6.2 Technical Review
- 4.6.3 Peer Review

**501-4.7** ***The Investigator candidate shall describe different reporting procedures.***

- 4.7.1 Written
- 4.7.2 Oral

## **SECTION 5**

### **BASIC FIRE SCIENCE**

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

- (1) Fire Science:
  - (a) Fire Chemistry
  - (b) Thermodynamics
  - (c) Fire Dynamics
  - (d) Explosion Dynamics

#### **4.2 Scene Examination.**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.4** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that each pattern is identified and analyzed with respect to the burning characteristics of the material involved, the stage of fire development, the effects of ventilation within the context of the scene, the relationship with all patterns observed, and the understanding of the methods of heat transfer that led to the formation of the patterns identified and analyzed, and the sequence in which the patterns were produced is determined.

- (A) **Requisite Knowledge.** Fire dynamics, fire development, and the interrelationship of heat release rate, form, and ignitability of materials.
- (B) **Requisite Skills.** Ability to interpret the effects of burning characteristics on different types of materials.

**NFPA 1033 4.2.5** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that fire development is determined, methods and effects of suppression are evaluated, false origin area patterns are recognized, and all areas of origin are correctly identified.

- (A) **Requisite Knowledge.** Fire behavior and spread based on fire chemistry, fire dynamics, and physics, fire suppression effects, building construction.
- (B) **Requisite Skills.** Ability to interpret variations of fire patterns on different materials with consideration given to heat release rate, form, and ignitability; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

**NFPA 1033 4.2.6** Examine and remove fire debris, given standard equipment and tools, so that all debris is checked for fire cause evidence, potential ignition source(s) is identified, and evidence is preserved without investigator-inflicted damage or contamination.

- (A) **Requisite Knowledge.** Basic understanding of ignition processes, characteristics of ignition sources, and ease of ignition of fuels; debris-layering techniques; use of tools and equipment during the debris search; types of fire cause evidence commonly found in various degrees of damage; and evidence-gathering methods and documentation.
- (B) **Requisite Skills.** Ability to employ search techniques that further the discovery of fire cause evidence and ignition sources, use search techniques that incorporate documentation, and collect and preserve evidence.

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References:  
J&B, chapter 2  
Kirk's, chapter 2  
IFSTA, chapter 3

**501-5.1**      **The Investigator candidate shall define and describe fire science.**

- 5.1.1      Fire and Energy
- 5.1.2      Energy
- 5.1.3      Power
- 5.1.4      Heat Flux
- 5.1.5      Fire Tetrahedron
  - 5.1.5.1      Fuel
  - 5.1.5.2      Oxidizing Agents
  - 5.1.5.3      Heat
  - 5.1.5.4      Uninhibited Chemical Chain Reaction

**501-5.2**      **The Investigator candidate shall be able to discuss fire chemistry as the study of chemical processes that occur in fires, including changes of state, decomposition, and combustion.**

- 5.2.1      Phase Changes and Thermal Decomposition
- 5.2.2      Combustion

**501-5.3**      **The Investigator candidate shall identify and describe products of combustion.**

- 5.3.1      Complete Combustion
- 5.3.2      Ventilation Controlled Fires
- 5.3.3      Solids, Liquids, and Gases
- 5.3.4      Soot
- 5.3.5      Fuel Controlled Fire
- 5.3.6      Incomplete Combustion
- 5.3.7      Smoke Color
- 5.3.8      Fire Suppression
- 5.3.9      Flashover

**501-5.4**      **The Investigator candidate shall identify and describe fluid flows generated by mechanical forces or by buoyant forces generated by temperature differences.**

- 5.4.1      General

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- 5.4.2 Buoyant Flows
- 5.4.3 Fire Plumes
- 5.4.4 Ceiling Jets
- 5.4.5 Vent Flows

**501-5.5**     ***The Investigator candidate shall define and describe methods of heat transfer.***

- 5.5.1 General
- 5.5.2 Conduction
- 5.5.3 Convection
- 5.5.4 Radiation
- 5.5.5 Thermometry
  - 5.5.5.1 Different systems
  - 5.5.5.2 Empirical Temperature Scales
  - 5.5.5.3 Thermodynamic (Absolute) Temperature Scales

**501-5.6**     ***The Investigator candidate shall define and describe the fuel load, fuel packages, and properties of flame.***

- 5.6.1 Fuel Load
- 5.6.2 Fuel Items and Fuel Package
- 5.6.3 Heat Release Rate
- 5.6.4 Properties of Flames
- 5.6.5 Thermal Structure of a Flame
  - 5.6.5.1 Continuous Flaming Region
  - 5.6.5.2 Intermittent Flame Region
  - 5.6.5.3 Plume Region
- 5.6.6 Heat Fluxes from Flames
  - 5.6.6.1 Heat Fluxes from Flames to Contacted Surfaces
  - 5.6.6.2 Heat Fluxes from Flames to Remote Surfaces

**501-5.7**     ***The Investigator candidate shall describe the different forms and mechanisms of ignition.***

- 5.7.1 Ignition in General
- 5.7.2 Ignition of Flammable Gases
- 5.7.3 Ignition of Liquids
- 5.7.4 Ignition of Solids

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**501-5.8**      ***The Investigator candidate shall describe the different flame spreads and their characteristics.***

- 5.8.1      General
  - 5.8.1.1    Counterflow Flame Spread
  - 5.8.1.2    Concurrent Flame Spread
  - 5.8.1.3    Fire Spread on Sloped Surfaces
- 5.8.2      Flame spread on Liquids
- 5.8.3      Flame spread on Solids

**501-5.9**      ***The Investigator candidate shall describe the different methods of fire spread in a compartment.***

- 5.9.1      General
- 5.9.2      Fire Spread
  - 5.9.2.1    Fire Spread by Flame Impingement
  - 5.9.2.2    Fire Spread by Remote Ignition

**501-5.10**     ***The Investigator candidate shall describe compartment fire development.***

- 5.10.1     General
- 5.10.2     Compartment Fire Phenomena
- 5.10.3     Compartment Vent Flows
- 5.10.4     Flashover
- 5.10.5     Fully Developed Compartment Fires
- 5.10.6     Effects of Enclosures on Fire Growth
  - 5.10.6.1   Room Volume and Ceiling Height
  - 5.10.6.2   Location of the Fire in the Compartment

**501-5.11**     ***The Investigator candidate shall identify fire spread between compartments.***

- 5.11.1     Fire Spread via Openings
- 5.11.2     Fire Spread via Barriers

**501-5.12**     ***The Investigator candidate shall describe the paths of fire and smoke spread through buildings.***

- 5.12.1     Transfer of Thermal Energy
- 5.12.2     Pressure Differences
- 5.12.3     Flow Path
- 5.12.4     Hot Gas Flows
- 5.12.5     Exhaust Flows
- 5.12.6     Air Entrainment

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- 5.12.7 Bidirectional Flow
- 5.12.8 Unidirectional Flow
- 5.12.9 Wind Speed

**501-5.13**     ***The Investigator candidate shall describe the paths of smoke spread in buildings***

- 5.13.1 The “Building Stack Effect”
- 5.13.2 HVAC Systems

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## SECTION 6

### FIRE EFFECTS AND FIRE PATTERNS

#### 4.2 Scene Examination.

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that each pattern is identified and analyzed with respect to the burning characteristics of the material involved, the stage of fire development, the effects of ventilation within the context of the scene, the relationship with all patterns observed, and the understanding of the methods of heat transfer that led to the formation of the patterns identified and analyzed, and the sequence in which the patterns were produced is determined.

- (A) **Requisite Knowledge.** Fire dynamics, fire development, and the interrelationship of heat release rate, form, and ignitibility of materials.
- (B) **Requisite Skills.** Ability to interpret the effects of burning characteristics on different types of materials.

**NFPA 1033 4.2.5** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that fire development is determined, methods and effects of suppression are evaluated, false origin area patterns are recognized, and all areas of origin are correctly identified.

- (A) **Requisite Knowledge.** Fire behavior and spread based on fire chemistry, fire dynamics, and physics, fire suppression effects, building construction.
- (B) **Requisite Skills.** Interpret variations of fire patterns on different materials with consideration given to heat release rate, form, and ignitibility; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

**NFPA 1033 4.2.7** Reconstruct potential area(s) of origin, given standard and, if needed, special equipment and tools as well as sufficient personnel, so that all protected areas and fire patterns are identified and correlated to contents or structural remains; and items potentially critical to cause determination are returned to their prefire location as a means of hypothesis testing, such that the area(s) or point(s) of origin is discovered.

- (A) **Requisite Knowledge.** The effects of fire on different types of material and the importance and uses of reconstruction.
- (B) **Requisite Skills.** Ability to examine all materials to determine the effects of fire, identify and distinguish among different types of fire-damaged contents, and return materials to their original position using protected areas and fire patterns.

#### References:

J&B, chapter 4  
Kirk's, chapter 5  
IFSTA, chapter 10, 12

**501-6.1**      **The Investigator candidate shall define fire effects and fire patterns.**

- 6.1.1      Collect and Analyze Data
- 6.1.2      Applying the Scientific Method to Fire Pattern Analysis

**501-6.2**      **The Investigator candidate shall be able to analyze the following fire effects.**

- 6.2.1      Introduction
- 6.2.2      Char
  - 6.2.2.1      Char Observations
  - 6.2.2.2      Material Sciences – Surface Effect of Char
  - 6.2.2.3      Pyrolysis
  - 6.2.2.4      Analysis of Char
  - 6.2.2.5      Depth of Char Diagram
  - 6.2.2.6      Measuring Depth of Char
  - 6.2.2.7      Measuring Depth of Char
  - 6.2.2.8      Missing Wood
  - 6.2.2.9      Depth of Char Surveys with Fuel Gases
  - 6.2.2.10      Appearance of Char
  - 6.2.2.11      Limitations with Char
  - 6.2.2.12      Rate of Wood Charring
- 6.2.3      Clean Burn
  - 6.2.3.1      Clean Burn Observations
  - 6.2.3.2      Material Sciences Related to Clean Burn
  - 6.2.3.3      Analysis of Clean Burn
  - 6.2.3.4      Limitations
- 6.2.4      Color Change
  - 6.2.4.1      Color Changes Observations
  - 6.2.4.2      Material Sciences Related to Color Changes
  - 6.2.4.3      Fabric Dyes
  - 6.2.4.4      Light
  - 6.2.4.5      Analysis of Color Changes
  - 6.2.4.6      Limitations
- 6.2.5      Deposition of Smoke on Surfaces
  - 6.2.5.1      Deposition of Smoke on Surfaces Observations
  - 6.2.5.2      Smoke Characteristics
  - 6.2.5.3      Material Sciences for Deposition of Smoke
  - 6.2.5.4      Analysis Related to Deposition of Smoke on Surfaces

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- 6.2.5.5 Smoke Settlement
- 6.2.5.6 Smoke Deposits
- 6.2.5.7 Limitations
- 6.2.6 Distorted Light Bulbs
  - 6.2.6.1 Observations for Distorted Light Bulbs
  - 6.2.6.2 Material Science for Distorted Light Bulbs
  - 6.2.6.3 Distorted Light Bulb Analysis
  - 6.2.6.4 Limitations
- 6.2.7 Furniture Springs
  - 6.2.7.1 Furniture Springs Observations
  - 6.2.7.2 Material Science Related to Furniture Springs
  - 6.2.7.3 Analysis of Furniture Springs
  - 6.2.7.4 Limitations
- 6.2.8 Gypsum Board
  - 6.2.8.1 Gypsum Board Observations
  - 6.2.8.2 Material Science related to Gypsum Board
  - 6.2.8.3 Analysis of Gypsum Board
  - 6.2.8.4 Mass Loss and Density
  - 6.2.8.5 General Indications of Calcination
  - 6.2.8.6 Depth of Calcination Survey
  - 6.2.8.7 Depth of Calcination Diagram
  - 6.2.8.8 Measuring Depth of Calcination
  - 6.2.8.9 Limitations
- 6.2.9 Mass Loss of Material
  - 6.2.9.1 Mass Loss Observations
  - 6.2.9.2 Fire-Damaged Materials and Exemplar Materials
  - 6.2.9.3 Material Science Related to Mass Loss
  - 6.2.9.4 Analysis of Mass Loss Observations
  - 6.2.9.5 Limitations
  - 6.2.9.6 Other Conditions of Nonuniformity
- 6.2.10 Melting of Materials
  - 6.2.10.1 Melting Observations
  - 6.2.10.2 Material Science Related to Melting
  - 6.2.10.3 Common Metals
  - 6.2.10.4 Thermoplastics
  - 6.2.10.5 Glass Softening
  - 6.2.10.6 Alloying of Metals
  - 6.2.10.7 Analysis of Melting Effects in Fires

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- 6.2.10.8 Limitations
- 6.2.11 Oxidation
  - 6.2.11.1 Observations
  - 6.2.11.2 Galvanized Steel
  - 6.2.11.3 Unprotected Iron or Steel
  - 6.2.11.4 Oxidized Steel
  - 6.2.11.5 Stainless Steel
  - 6.2.11.6 Copper
  - 6.2.11.7 Rocks and Soil
  - 6.2.11.8 Materials Science Related to Oxidation
  - 6.2.11.9 Analysis of Oxidation Observations
  - 6.2.11.10 Limitations
- 6.2.12 Rainbow Effect
  - 6.2.12.1 Rainbow Effect Observations
  - 6.2.12.2 Material Science for Rainbow Effects
  - 6.2.12.3 Analysis of Rainbow Effect
  - 6.2.12.4 Limitations
- 6.2.13 Smoke Alarms - Enhanced Soot Deposition, or Acoustic Soot Agglomeration
  - 6.2.13.1 Smoke Alarm Observations
  - 6.2.13.2 Enhanced Soot Deposition, or Acoustic Agglomeration
  - 6.2.13.3 Analysis of Smoke Alarms
  - 6.2.13.4 Examination of Soot
- 6.2.14 Spalling
  - 6.2.14.1 Observations
  - 6.2.14.2 Spalled Areas
  - 6.2.14.3 Analysis for Spalling
  - 6.2.14.4 Limitations
- 6.2.15 Thermal Expansion and Deformation of Materials
  - 6.2.15.1 Observations of Thermal Expansion and Deformation of Materials
  - 6.2.15.2 Material Science of Thermal Expansion and Deformation of Materials
  - 6.2.15.3 Deformation
  - 6.2.15.4 Metal Construction Elements
  - 6.2.15.5 Analysis of Thermal Expansion and Deformation
  - 6.2.15.6 Piping Systems

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- 6.2.15.7 Plastered Surfaces
- 6.2.15.8 Limitations
- 6.2.15.9 Collapse
- 6.2.16 Victim Injuries
  - 6.2.16.1 Victim Injuries Observations
  - 6.2.16.2 Material Science of Victim Injuries
  - 6.2.16.3 Skin Characteristics
  - 6.2.16.4 Body as a Source of Fuel
  - 6.2.16.5 Analysis of Victim Injuries
  - 6.2.16.6 Limitations
- 6.2.17 Window Glass
  - 6.2.17.1 Window Glass Observations
  - 6.2.17.2 Material Science of Glass
  - 6.2.17.3 Tempered Glass
  - 6.2.17.4 Analysis of Glass
  - 6.2.17.5 Limitations

**501-6.3**     ***The Investigator candidate shall identify how fire patterns are a combination of fire effect(s) and associated characteristics that produce a measurable and repeatable form.***

- 6.3.1 Introduction
- 6.3.2 Location of Patterns
- 6.3.3 Location of Objects
- 6.3.4 Penetrations of Horizontal Surfaces
- 6.3.5 Depth of Char Patterns with Fuel Gases

**501-6.4**     ***The Investigator candidate shall identify and interpret different types of generated patterns.***

- 6.4.1 Plume-Generated Patterns
- 6.4.2 Ventilation-Generated Patterns
- 6.4.3 Hot Gas Layer-Generated Patterns
- 6.4.4 Full Room Involvement-Generated Patterns
- 6.4.5 Suppression-Generated Patterns
- 6.4.6 Undetermined-Generated Patterns

**501-6.5**     ***The Investigator candidate shall identify various patterns having distinctive geometry or shape.***

- 6.5.1 V Patterns on Vertical Surfaces

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- 6.5.2 Inverted Cone (Triangular) Patterns
- 6.5.3 Hourglass Patterns
- 6.5.4 U-Shaped Patterns
- 6.5.5 Circular-Shaped Patterns
- 6.5.6 Truncated Cone Patterns
- 6.5.7 Irregular Patterns
- 6.5.8 Doughnut-Shaped Patterns
- 6.5.9 Linear Patterns
- 6.5.10 Area Patterns

**501-6.6**     ***The Investigator candidate shall identify fire effects on electrical systems and components***

- 6.6.1 Electrical Faults
- 6.6.2 Melting by Fire
- 6.6.3 Alloying
- 6.6.4 Extraneous Melting
- 6.6.5 Conductor Surface Colors
- 6.6.6 Arcing of Electrical Conductors
- 6.6.7 Interpretation of Arc Damage
- 6.6.8 Arc Survey and Arc Map Analysis and Interpretation
- 6.6.9 Cautions and Limitations

**501-6.7**     ***The Investigator candidate shall identify Pointer and Arrow patterns.***

- 6.7.1. Arrows
- 6.7.2. Severe Charring

**501-6.8**     ***The Investigator candidate shall describe the impact of firefighting actions***

- 6.8.1 Firefighting Tactics
- 6.8.2 Types and Placement of Hose Streams

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## SECTION 7 BUILDING SYSTEMS

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(4) Building Systems:

- (a) Types of Construction
- (b) Fire Protection Systems
- (c) Electricity and Electrical Systems
- (d) Fuel Gas Systems

### 4.2\* Scene Examination.

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.5** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that fire development is determined, methods and effects of suppression are evaluated, false origin area patterns are recognized, and all areas of origin are correctly identified.

- (A) **Requisite Knowledge.** Fire behavior and spread based on fire chemistry, fire dynamics, and physics, fire suppression effects, building construction.
- (B) **Requisite Skills.** Interpret variations of fire patterns on different materials with consideration given to heat release rate, form, and ignitability; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

**NFPA 1033 4.2.8** Inspect and analyze the performance of building systems, including fire protection, detection and suppression systems, HVAC, electricity and electrical systems, fuel gas systems, and building compartmentation, given standard and special equipment and tools, so that a determination can be made as to the need for expert resources; an operating system’s impact on fire growth and spread is considered in identifying origin areas; defeated and failed systems are identified; and the system’s potential as a fire cause is recognized.

- (A) **Requisite Knowledge.** Different types of detection, suppression, HVAC, utility, and building compartmentation such as fire walls and fire doors; types of expert resources for building systems; the impact of fire on various systems; common methods used to defeat a system’s functional capability; and types of failures.
- (B) **Requisite Skills.** Ability to determine the system's operation and its effect on the fire; identify alterations to, and failure indicators of, building systems; and evaluate the impact of suppression efforts on building systems.

### References:

J&B, chapter 3  
IFSTA, chapter 5

**501-7.1**     **The Investigator candidate shall recognize the reaction of buildings and building assemblies to fire.**

- a. Interior Layout
- b. Occupant Circulation Patterns
- c. Interior Finish Materials
- d. Building Services

**501-7.2**     **The Investigator candidate shall evaluate the features of design, construction and structural elements in evaluating fire development.**

- 7.2.1 General
- 7.2.2 Building design
  - 7.2.2.1 General
  - 7.2.2.2 Building Loads
  - 7.2.2.3 Room Size
  - 7.2.2.4 Compartmentation
  - 7.2.2.5 Concealed and Interstitial Spaces
  - 7.2.2.6 Planned Designs as Compared to “As-Built” Condition
- 7.2.3 Materials
  - 7.2.3.1 Ignitability
  - 7.2.3.2 Flammability
  - 7.2.3.3 Thermal Inertia
  - 7.2.3.4 Thermal Conductivity
  - 7.2.3.5 Toxicity
  - 7.2.3.6 Physical State and Heat Resistance
  - 7.2.3.7 Orientation, Position, and Placement
- 7.2.4 Occupancy
- 7.2.5 Computer Fire Model Survey of Building Component Variations
- 7.2.6 Explosion Damage

**501-7.3**     **The Investigator candidate shall identify the different types of building construction.**

**\*\*Note\*\* (Only 501-7.3.1)**

**The following section is not contained in NFPA 921, *Guide for Fire and Explosion Investigations*. The reference for this material is found in IFSTA, *Fire Inspection and Code Enforcement and Fire Investigator*.**

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- 7.3.1 General
  - 7.3.1.1 Type I – fire resistive
  - 7.3.1.2 Type II – non-combustible
  - 7.3.1.3 Type III – ordinary
  - 7.3.1.4 Type IV – heavy timber
  - 7.3.1.5 Type V – wood frame
- 7.3.2 Wood Frame (Type V)
  - 7.3.2.1 Platform Frame Construction
  - 7.3.2.2 Balloon Frame
  - 7.3.2.3 Plank and Beam
  - 7.3.2.4 Post and Frame
  - 7.3.2.5 Heavy Timber
  - 7.3.2.6 Alternative Residential Construction
    - 7.3.2.6.1 Manufactured Homes (Mobile Homes)
    - 7.3.2.6.2 Modular Homes
    - 7.3.2.6.3 Steel Frame Residential Construction
  - 7.3.2.7 Manufactured Wood Structural Elements
- 7.3.3 Ordinary Construction (Type III)
- 7.3.4 Mill Construction (Type IV)
- 7.3.5 Noncombustible Construction (Type II)
  - 7.3.5.1 General
  - 7.3.5.2 Metal Construction
  - 7.3.5.3 Concrete or Masonry Construction

**501-7.4** ***The Investigator candidate shall identify the different construction assemblies.***

- 7.4.1 General
- 7.4.2 Floor/Ceiling/Roof Assemblies
- 7.4.3 Walls
- 7.4.4 Doors
- 7.4.5 Concealed Spaces

**501-7.5** ***The Investigator candidate shall describe the different construction materials.***

- 7.5.1 Structural Steel
- 7.5.2 Reinforced Concrete
- 7.5.3 Wood

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**501-7.6**      **The Investigator candidate shall analyze the impact of passive fire protection systems on the investigation.**

- 7.6.1      Failures
- 7.6.2      Analysis of Structural Damage

**501-7.7**      **The Investigator candidate should analyze the design and installation parameters when the passive fire protection system is determined to be a factor.**

- 7.7.1      Identification of Passive Fire Protection
- 7.7.2      The Role of Passive Fire Protection
- 7.7.3      The Evaluation of Passive Fire Protection
- 7.7.4      Openings
- 7.7.5      Penetrations

**501-7.8**      **The Investigator candidate should produce the additional documentation and data collection when the passive fire protection system is determined to be a factor.**

- 7.8.1      Documentation and data collection
- 7.8.2      Gathering of information
- 7.8.3      History of permits
- 7.8.4      Invoices
- 7.8.5      As-built Drawings
- 7.8.6      Maintenance and Inspection Documentation
- 7.8.7      Product Literature
- 7.8.8      Evidence

**501-7.9**      **The Investigator candidate shall perform the required additional analysis.**

- 7.9.1      Code Analysis
- 7.9.2      Design Analysis
- 7.9.3      Installation Analysis
- 7.9.4      System Performance
- 7.9.5      Testing and Maintenance Analysis
- 7.9.6      Origin and Cause Determination

**501-7.10**      **The Investigator candidate shall maintain a basic understanding of heating systems commonly encountered in residential and light commercial fire incidents.**

- 7.10.1      Systems components

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- 7.10.1.1 Fuel Storage and Supply
- 7.10.1.2 Heat Producing Devices
- 7.10.1.3 Chimney/Vent
- 7.10.1.4 Control and Safety Devices
- 7.10.2 Installation
- 7.10.3 Operation and Maintenance
- 7.10.4 Potential Fire Causes
  - 7.10.4.1 Improper Installation of Fuel Delivery Systems
  - 7.10.4.2 Improper Installation of Heat Producing Devices
  - 7.10.4.3 Improper Installation of Control and Safety Devices
  - 7.10.4.4 Improper Installation of Chimneys and Vents
  - 7.10.4.5 Airspace Requirement Violations
  - 7.10.4.6 Utilizing Non-Listed Devices and Accessories
  - 7.10.4.7 Circumvented or Failed Control and Safety Components
  - 7.10.4.8 Inadequate Maintenance or Cleaning
  - 7.10.4.9 Improper Usage
  - 7.10.4.10 Electrical Events
- 7.10.5 Documentation and Data Collection
- 7.10.6 Analysis of Origin and Causes

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## SECTION 8 ACTIVE FIRE PROTECTION SYSTEMS

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(4) Building Systems:

(b) Fire Protection Systems

### **4.2. Scene Examination**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.8** Inspect and analyze the performance of building systems, including fire protection, detection and suppression systems, HVAC, electricity and electrical systems, fuel gas systems, and building compartmentation, given standard and special equipment and tools, so that a determination can be made as to the need for expert resources; an operating system’s impact on fire growth and spread is considered in identifying origin areas; defeated and failed systems are identified; and the system’s potential as a fire cause is recognized.

**(A) Requisite Knowledge.** Different types of detection, suppression, HVAC, utility, and building compartmentation such as fire walls and fire doors; types of expert resources for building systems; the impact of fire on various systems; common methods used to defeat a system’s functional capability; and types of failures.

**(B) Requisite Skills.** Ability to determine the system’s operation and its effect on the fire; identify alterations to, and failure indicators of, building systems; and evaluate the impact of suppression efforts on building systems.

### **References:**

**J&B, chapter 3**

**IFSTA-3, chapter 5**

**IFSTA, Fire Inspection, chapter 12-14**

### **501-8.1 The Investigator candidate shall develop basic understanding of active fire protection systems.**

- 8.1.1 Commonly Found Systems
- 8.1.2 Types of Systems
- 8.1.3 Performance of Systems
- 8.1.4 Documentation and Analysis of Systems

### **501-8.2 The Investigator candidate shall develop basic understanding of documentation of fire protection systems.**

- 8.2.1 Design Documentation
- 8.2.2 Permit History
- 8.2.3 Invoices and Contracts

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- 8.2.4 Installation Documentation
- 8.2.5 Inspection and Maintenance Records
- 8.2.6 Product Literature
- 8.2.7 Alarm / Activation History

**501-8.3**     ***The Investigator candidate shall identify the basic components and operation of a fire alarm system.***

- 8.3.1 General information
  - 8.3.1.1 Purpose of Systems
  - 8.3.1.2 System Components
  - 8.3.1.3 General System Operation
- 8.3.2 Key Components of Systems
  - 8.3.2.1 Fire Alarm Control Unit (FACU)
  - 8.3.2.2 Power Supply
  - 8.3.2.3 Initiating Devices
  - 8.3.2.4 Smoke Detection
  - 8.3.2.5 Heat Detection
  - 8.3.2.6 Other Types of Detectors
  - 8.3.2.7 Other Initiating Devices
  - 8.3.2.8 Notification Appliances
- 8.3.3 Operations and Installation Parameters of the System
  - 8.3.3.1 FACU Features
  - 8.3.3.2 Location and Spacing of Devices
  - 8.3.3.3 Internal System Communication
  - 8.3.3.4 Means of Alarm Transmission
  - 8.3.3.5 Systems Monitored and Controlled
- 8.3.4 Analysis
  - 8.3.4.1 System Documentation and Data Collection
  - 8.3.4.2 Code Analysis
  - 8.3.4.3 Design Analysis
  - 8.3.4.4 Installation Analysis
  - 8.3.4.5 Testing and Maintenance Analysis
  - 8.3.4.6 System Performance
  - 8.3.4.7 Development of Time Line
  - 8.3.4.8 Thermal Damage
  - 8.3.4.9 Fire Alarm Effectiveness
  - 8.3.4.10 Impact on Human Behavior

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**501-8.4**     ***The Investigator candidate shall identify the basic components and operation of a water-based fire suppression system.***

- 8.4.1     General Information
  - 8.4.1.1     Purpose of Systems
  - 8.4.1.2     General System Operation
- 8.4.2     Key Components of Water-Based Systems
  - 8.4.2.1     Sprinklers/Nozzles
  - 8.4.2.2     Piping
  - 8.4.2.3     Systems Valves
  - 8.4.2.4     Water Supply
- 8.4.3     Operation and Installation Parameters of the System
  - 8.4.3.1     Location and Spacing of Sprinklers
  - 8.4.3.2     Pipe Sizing and Arrangement
  - 8.4.3.3     Sprinkler Coverage and Distribution
  - 8.4.3.4     Water Flow Rate and Pressure
  - 8.4.3.5     Activation Mechanisms and Criteria
- 8.4.4     Analysis
  - 8.4.4.1     System Documentation and Data Collection
  - 8.4.4.2     Code Analysis
  - 8.4.4.3     Design Analysis
  - 8.4.4.4     Hazard Protected

**501-8.5**     ***The Investigator candidate shall identify the basic components and operation of a non-water-based fire suppression system.***

- 8.5.1     General Information
  - 8.5.1.1     Purpose of Systems
  - 8.5.1.2     Method of Application
  - 8.5.1.3     Suppression Agents
- 8.5.2     Key Components of Systems
  - 8.5.2.1     Suppression Agent Supply
  - 8.5.2.2     Pressure Sources
  - 8.5.2.3     Distribution Piping
  - 8.5.2.4     Valves, Hoses, and Fittings
  - 8.5.2.5     Proportioners
  - 8.5.2.6     Distribution Nozzles
  - 8.5.2.7     Actuation System
  - 8.5.2.8     System Monitoring and control
- 8.5.3     Operation and Installation Parameters of the System

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- 8.5.3.1 Location and Spacing of Nozzles
- 8.5.3.2 Pipe Sizing and Arrangement
- 8.5.3.3 Nozzle Coverage and Distribution
- 8.5.3.4 Activation Mechanisms and Criteria
- 8.5.3.5 Systems Monitored and Controlled
- 8.5.4 Analysis
  - 8.5.4.1 General Information and Codes
  - 8.5.4.2 Design Analysis

**501-8.6**     ***The Investigator candidate shall identify spoliation issues regarding the documentation of the fire protection system.***

- a. Special Expertise
- b. Loss or Alteration

**\*\*Note\*\***

The following sections (501-8.7 through 501-8.12) are not contained in NFPA 921, *Guide for Fire and Explosion Investigations*. The reference for this material is found in IFSTA, *Fire Inspection and Code Enforcement, chapter 12-14*.

**501-8.7**     ***The Investigator candidate shall describe the types and characteristics of automatic sprinkler systems.***

- 8.7.1 Identify Various Types of Automatic Sprinkler Systems
  - 8.7.1.1 Wet Pipe
  - 8.7.1.2 Dry Pipe
  - 8.7.1.3 Pre-Action
  - 8.7.1.4 Deluge
  - 8.7.1.5 Residential
- 8.7.2 Identify Reasons for Unsatisfactory Performance of an Automatic Sprinkler System
- 8.7.3 Describe Fire Sprinkler Components and Operations

**501-8.8**     ***The Investigator candidate shall describe the types, operations, capabilities and the effects of proper application of "special agent" fire extinguishing systems.***

- 8.8.1 Dry Chemical
- 8.8.2 Wet Chemical
- 8.8.3 Halogenated Agent
- 8.8.4 Carbon Dioxide
- 8.8.5 Foam

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8.8.6 Gaseous Agent

**501-8.9** ***The Investigator candidate shall identify the classes and capabilities of standpipe and hose systems.***

- 8.9.1 Class I Systems
- 8.9.2 Class II Systems
- 8.9.3 Class III Systems

**501-8.10** ***The Investigator candidate shall identify alarm-initiating devices.***

- 8.10.1 Local System
- 8.10.2 Auxiliary System
- 8.10.3 Remote Station
- 8.10.4 Proprietary System
- 8.10.5 Central station System

**501-8.11** ***The Investigator candidate shall identify fire detection systems.***

- 8.11.1 Smoke
- 8.11.2 Flame
- 8.11.3 Heat
- 8.11.4 Gas

**501-8.12** ***The Investigator candidate shall describe Heating Ventilation and Air Conditioning (HVAC) system components and their relation to smoke and fire spread.***

- 8.12.1 Smoke Dampers
- 8.12.2 Automatic Shutoffs
- 8.12.3 Ductwork
- 8.12.4 Pipe and Duct Chases

## **SECTION 9**

### **ELECTRICITY AND FIRE**

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(4) Building Systems:

(c) Electricity and Electrical Systems

#### **4.2 Scene Examination.**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.8** Inspect and analyze the performance of building systems, including fire protection, detection and suppression systems, HVAC, electricity and electrical systems, fuel gas systems, and building compartmentation, given standard and special equipment and tools, so that a determination can be made as to the need for expert resources; an operating system’s impact on fire growth and spread is considered in identifying origin areas; defeated and failed systems are identified; and the system’s potential as a fire cause is recognized.

**(A) Requisite Knowledge.** Different types of detection, suppression, HVAC, utility, and building compartmentation such as fire walls and fire doors; types of expert resources for building systems; the impact of fire on various systems; common methods used to defeat a system’s functional capability; and types of failures.

**(B) Requisite Skills.** Ability to determine the system’s operation and its effect on the fire; identify alterations to, and failure indicators of, building systems; and evaluate the impact of suppression efforts on building systems.

#### **References:**

J&B-6, chapter 7

Kirk’s, chapter 3-4

IFSTA-3, chapter 6

**501-9.1**      **The Investigator candidate shall understand the basic principles of physics that relate to electricity and fire, including systems and equipment.**

- a.            120/240-volt, Single-Phase Systems
- b.            Higher Voltage Systems

**501-9.2**      **The Investigator candidate shall describe basic electrical theory.**

- 9.2.1        General
- 9.2.2        Comparing Electricity to Hydraulics
- 9.2.3        Ampacity
- 9.2.4        Conductivity of Conductors
- 9.2.5        Ohm’s Law

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- 9.2.6 Electrical Power
- 9.2.7 Ohm's Law Wheel
- 9.2.8 Applying Ohm's Law

**501-9.3**     ***The Investigator candidate shall describe the typical building electrical systems and its components.***

- 9.3.1 General
- 9.3.2 Electrical Service
  - 9.3.2.1 Single-Phase Service
  - 9.3.2.2 Three-Phase Service
- 9.3.3 Meter and Base
- 9.3.4 Significance

**501-9.4**     ***The Investigator candidate shall identify the functions of service equipment.***

- a. Meter Base
- b. Three Functions

**501-9.5**     ***The Investigator candidate shall identify the principle of grounding.***

- 9.5.1 General
- 9.5.2 Floating Neutral (Open Neutral)

**501-9.6**     ***The Investigator candidate shall describe the components of overcurrent protection.***

- 9.6.1 General
- 9.6.2 Fuses
  - 9.6.2.1 Operations
  - 9.6.2.2 Plug Fuses
  - 9.6.2.3 Type S Fuses
  - 9.6.2.4 Time-Delay Fuses
  - 9.6.2.5 Cartridge Fuses
- 9.6.3 Circuit Breakers
  - 9.6.3.1 Operations
  - 9.6.3.2 Main Breakers
  - 9.6.3.3 Branch Circuit Breakers
  - 9.6.3.4 Ground Fault Circuit Interrupters (GFCI)
  - 9.6.3.5 Arc Fault Circuit Interrupter (AFCI)
- 9.6.4 Circuit Breaker Panels

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**501-9.7**     **The Investigator candidate shall describe a branch circuit and its components.**

- 9.7.1     Conductors
- 9.7.2     Size of Conductors
- 9.7.3     Copper Conductors
- 9.7.4     Aluminum Conductors
- 9.7.5     Insulation

**501-9.8**     **The Investigator candidate shall identify and describe the different types of outlets and devices found in a branch circuit.**

- 9.8.1     Switches
- 9.8.2     Receptacles
- 9.8.3     Other Outlets, Devices, or Equipment

**501-9.9**     **The Investigator candidate shall describe how the use of improper electrical components can create sufficient heat for ignition.**

- 9.9.1     General
- 9.9.2     Resistance Heating
- 9.9.3     Overcurrent and Overload
- 9.9.4     Arcs
  - 9.9.4.1     General
  - 9.9.4.2     High-Voltage Arcs
  - 9.9.4.3     Static Electricity
  - 9.9.4.4     Parting Arcs
  - 9.9.4.5     Arcing Across a Carbonized Path
- 9.9.5     Sparks
- 9.9.6     High-Resistance Faults

**501-9.10**    **The Investigator candidate shall identify and describe types of damage encountered in electrical systems.**

- 9.10.1    Short-Circuit and Ground-Fault Parting Arcs
- 9.10.2    Arcing Through a Carbonized Path Due to Thermal Means (Arcing Through Char)
- 9.10.3    Connection Points
- 9.10.4    Overload
- 9.10.5    Mechanical Gouges
- 9.10.6    Insulation Damage

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**501-9.11**     **The Investigator candidate shall identify damaged conductors.**

- 9.11.1     Undersized Conductors
- 9.11.2     Nicked or Stretched Conductors
- 9.11.3     Deteriorated Insulation
- 9.11.4     Overdriven or Misdriven Staple
- 9.11.5     Short Circuit
- 9.11.6     Beaded Conductor

**501-9.12**     **The Investigator candidate shall describe the electrical system examination.**

- 9.12.1     Purpose
- 9.12.2     Preliminary Observations
- 9.12.3     Scene Safety
- 9.12.4     Systematic Approach
- 9.12.5     Examination of the Electric Service
- 9.12.6     Premises Wiring System
- 9.12.7     Other Than Premises Wiring System and Appliances

**501-9.13**     **The Investigator candidate shall describe arc surveys.**

- 9.13.1     Procedures and Limitations
- 9.13.2     Arc Map
- 9.13.3     Locating Arc Sites
- 9.13.4     Documenting the Damage

**501-9.14**     **The Investigator candidate shall describe the role of static electricity in an ignition sequence.**

- 9.14.1     Introduction to Static Electricity
- 9.14.2     Generation of Static Electricity
  - 9.14.2.1     General
  - 9.14.2.2     Ignitable Liquids
  - 9.14.2.3     Charges on the Surface of a Liquid
  - 9.14.2.4     Switch Loading
  - 9.14.2.5     Spraying Operations
  - 9.14.2.6     Gases
  - 9.14.2.7     Dusts and Fibers
  - 9.14.2.8     Static Electric Discharge from the Human Body
  - 9.14.2.9     Clothing
- 9.14.3     Incendive Arc

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- 9.14.4 Ignition Energy
- 9.14.5 Controlling Accumulations of Static Electricity
  - 9.14.5.1 Humidification
  - 9.14.5.2 Bonding and Grounding
- 9.14.6 Conditions Necessary for Static Arc Ignition
- 9.14.7 Investigating Static Electric Ignitions
- 9.14.8 Lightning
  - 9.14.8.1 General
  - 9.14.8.2 Lightning Characteristics
  - 9.14.8.3 Lightning Strikes
  - 9.14.8.4 Lightning Damage
  - 9.14.8.5 Lightning Detection Networks

**501-9.15**     ***The fire investigator candidate shall describe the characteristics of batteries.***

- 9.15.1 Lithium-ion Batteries

## **SECTION 10**

### **BUILDING FUEL GAS SYSTEMS**

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(4) Building Systems:

(d) Fuel Gas Systems

#### **4.2 Scene Examination.**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.8** Inspect and analyze the performance of building systems, including fire protection, detection and suppression systems, HVAC, electricity and electrical systems, fuel gas systems, and building compartmentation, given standard and special equipment and tools, so that a determination can be made as to the need for expert resources; an operating system’s impact on fire growth and spread is considered in identifying origin areas; defeated and failed systems are identified; and the system’s potential as a fire cause is recognized.

**(A) Requisite Knowledge.** Different types of detection, suppression, HVAC, utility, and building compartmentation such as fire walls and fire doors; types of expert resources for building systems; the impact of fire on various systems; common methods used to defeat a system’s functional capability; and types of failures.

**(B) Requisite Skills.** Ability to determine the system's operation and its effect on the fire; identify alterations to, and failure indicators of, building systems; and evaluate the impact of suppression efforts on building systems.

#### **References:**

**J&B-6, chapter 7**

**Kirk’s, chapter 4**

**IFSTA-3, chapter 12**

#### **501-10.1     The Investigator candidate shall describe building fuel gas systems.**

10.1.1     Impact of Fuel Gases on Fire and Explosions  
                  Investigations

10.1.2     Additional Fire Spread

#### **501-10.2     The Investigator candidate shall identify the different fuel gases.**

10.2.1     Natural Gas

10.2.2     Commercial Propane

10.2.3     Other Fuel Gases

                  10.2.3.1     Commercial Butane

                  10.2.3.2     Propane HD5

                  10.2.3.3     Manufactured Gases

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10.2.4 Odorization

**501-10.3** ***The Investigator candidate shall identify different natural gas systems.***

- 10.3.1 Transmission Pipelines
- 10.3.2 Main Pipelines (Mains)
- 10.3.3 Service Lines
- 10.3.4 Metering

**501-10.4** ***The Investigator candidate shall identify different LP-Gas Systems.***

- 10.4.1 LP-Gas Storage Containers
  - 10.4.1.1 Tanks
  - 10.4.1.2 Cylinders
- 10.4.2 Container Appurtenances
  - 10.4.2.1 Pressure Relief Devices
  - 10.4.2.2 Connections for Flow Control
  - 10.4.2.3 Liquid Level Gauging Devices
  - 10.4.2.4 Pressure Gauges
- 10.4.3 Pressure Regulation
- 10.4.4 Vaporizers

**501-10.5** ***The Investigator candidate shall identify common fuel gas system components.***

- 10.5.1 Pressure Regulations (Reduction)
- 10.5.2 Service Piping Systems
- 10.5.3 Valves
- 10.5.4 Gas Burners
  - 10.5.4.1 Manual Ignition
  - 10.5.4.2 Pilot Lights
  - 10.5.4.3 Pilotless Igniters

**501-10.6** ***The Investigator candidate shall identify the common piping in buildings.***

- 10.6.1 Size of Piping
- 10.6.2 Piping Materials
- 10.6.3 Joints and Fittings
- 10.6.4 Piping Installation
- 10.6.5 Main Shutoff Valves
- 10.6.6 Prohibited Locations
- 10.6.7 Electrical Bonding and Grounding

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**501-10.7**     ***The Investigator candidate shall identify common appliance and equipment requirements.***

- 10.7.1     Installation
- 10.7.2     Venting and Air Supply
- 10.7.3     Appliance Controls

**501-10.8**     ***The Investigator candidate shall identify common fuel gas utilization equipment.***

- 10.8.1     Air Heating
- 10.8.2     Water Heating
- 10.8.3     Cooking
- 10.8.4     Refrigeration and Cooling
- 10.8.5     Engines
- 10.8.6     Illumination
- 10.8.7     Incinerators, Toilets, and Exhaust Afterburners

**501-10.9**     ***The Investigator candidate shall explain investigating fuel gas systems.***

- 10.9.1     Recognize Limitations
- 10.9.2     Fuel Gas System Analysis
- 10.9.3     Compliance with Codes and Standards
- 10.9.4     Leakage
- 10.9.5     Pressure Testing
- 10.9.6     Locating Leaks
- 10.9.7     Testing Flow Rates and Pressures
- 10.9.8     Collection of Gas Piping
- 10.9.9     Underground Migration of Fuel Gases
- 10.9.10    Migration of Fuel Gases Through Snow

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## SECTION 11 FIRE-RELATED HUMAN BEHAVIOR

### **4.4 Evidence Collection/Preservation**

Duties shall include using proper physical and legal procedures to identify, document, collect, and preserve evidence required within the investigation.

**NFPA 1033 4.4.1** Utilize proper procedures for managing victims and fatalities, given a protocol and appropriate personnel, so that all evidence is discovered and preserved and the protocol procedures are followed.

**(A) Requisite Knowledge:** Types of evidence associated with fire victims and fatalities and evidence preservation methods.

**(B) Requisite Skills:** Observational skills and the ability to apply protocols to given situations.

### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.4:** Establish evidence as to motive and/or opportunity, given an incendiary fire, so that the evidence is supported by documentation and meets the evidentiary requirements of the jurisdiction.

**(A) Requisite Knowledge:** Types of motives common to incendiary fires, methods used to discover opportunity, and human behavioral patterns relative to fire-setting.

**(B) Requisite Skills:** Financial analysis, records gathering and analysis, interviewing, and interpreting fire scene information and evidence for relationship to motive and/or opportunity.

**NFPA 1033 4.6.5** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

**(A) Requisite Knowledge:** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, time lines, link analysis, fault tree analysis, and data reduction matrixing).

**(B) Requisite Skills:** Analytical and assimilation skills.

### **References:**

J&B, chapter 15

IFSTA-3, chapter 10

### **501-11.1     The Investigator candidate shall recognize that the analyses of fire related human behavior will often be an integral part of the investigation.**

11.1.1     Fire-related Human Behavior

11.1.2     Research

11.1.3     *SFPE Guide to Human Behavior in Fire*

### **501-11.2     The Investigator candidate shall recall the history of research as related to fire related human behavior.**

11.2.1     Peter G. Wood

11.2.2     John L. Bryan

### **501-11.3     The Investigator candidate shall identify and describe general**

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**considerations of human response to fires.**

- 11.3.1 Individual
  - 11.3.1.1 Physical Limitations
  - 11.3.1.2 Cognitive Comprehension Limitations
  - 11.3.1.3 Familiarity and Physical Setting
- 11.3.2 Groups
  - 11.3.2.1 Group Size
  - 11.3.2.2 Group Structure
  - 11.3.2.3 Group Permanence
  - 11.3.2.4 Roles and Norms
- 11.3.3 Characteristics of the Physical Setting
  - 11.3.3.1 Locations of Exits
  - 11.3.3.2 Number of Exits
  - 11.3.3.3 Height of Structure
  - 11.3.3.4 Fire Alarm Systems
  - 11.3.3.5 Fire Suppression Systems
- 11.3.4 Characteristics of the Fire
  - 11.3.4.1 Presence of Flames
  - 11.3.4.2 Presence of Smoke
  - 11.3.4.3 Effects of Toxic Gases and Oxygen Depletion

**501-11.4** **The Investigator candidate shall identify and describe the factors related to fire initiation.**

- 11.4.1 Factors Involved in Accidental Fires
  - 11.4.1.1 Improper Maintenance and Operations
  - 11.4.1.2 Housekeeping
  - 11.4.1.3 Product Labels, Instructions, and Warnings
  - 11.4.1.4 Purpose of Labels
  - 11.4.1.5 Purpose of Instructions
  - 11.4.1.6 Purpose of Warnings
  - 11.4.1.7 Key Elements of a Proper Warning
  - 11.4.1.8 Standards on Labels, Instructions, and Warnings
- 11.4.2 Recalls
- 11.4.3 Other Considerations
- 11.4.4 Violations of Fire Safety Codes and Standards

**501-11.5** **The Investigator candidate shall identify and describe the factors related to youth fire-setting behavior.**

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- 11.5.1 Developmental Stages
- 11.5.2 Mental Health

**501-11.6** ***Incendiary fires – see SECTION 501-23.4 for additional information.***

**501-11.7** ***The Investigator candidate shall identify and describe human factors related to fire spread.***

- 11.7.1 Actions or Omissions
- 11.7.2 Prefire Conditions

**501-11.8** ***The Investigator candidate shall identify the basic concepts in recognition and response to fires.***

- 11.8.1 Perception of the Danger (Sensory Cues)
- 11.8.2 Decision to Act (Response)
- 11.8.3 Action Taken
- 11.8.4 Escape Factors
- 11.8.5 Information Received from Survivors

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## SECTION 12 LEGAL CONSIDERATIONS

<p><b>4.1 General</b> <b>NFPA 1033 4.1.5*</b> The fire investigator shall adhere to all applicable legal and regulatory requirements.</p>
<p><b>4.3 Documenting the Scene</b> Duties shall include diagramming the scene, photographing, and taking field notes to be used to compile a final report.</p> <p><b>NFPA 1033 4.3.3</b> Construct investigative notes, given a fire scene, available documents (e.g., prefire plans and inspection reports), and interview information, so that the notes are accurate, provide further documentation of the scene, and represent complete documentation of the scene findings.</p> <p><b>(A) Requisite Knowledge.</b> Relationship between notes, diagrams, and photos, how to reduce scene information into concise notes, and the use of notes during report writing and legal proceedings.</p> <p><b>(B) Requisite Skills.</b> Data-reduction skills, note-taking skills, and observational and correlating skills.</p>
<p><b>4.4 Evidence Collection/Preservation.</b> Duties shall include using proper physical and legal procedures to identify, document, collect and preserve evidence required within the investigation.</p> <p><b>NFPA 1033 4.4.2</b> Locate, document, collect, label, package and store evidence, given standard or special tools and equipment and evidence collection materials, so that evidence is identified, preserved, collected, packaged and stored for use in testing, legal, or other proceedings and examinations, ensuring cross-contamination and investigator-inflicted damage and the chain of custody is established.</p> <p><b>(A) Requisite Knowledge.</b> Types of evidence, authority requirements, impact of removing evidentiary items on civil or criminal proceedings (exclusionary or fire-cause supportive evidence), types, capabilities, and limitations of standard and special tools used to locate evidence, types of laboratory tests available, packaging techniques and materials, and impact of evidence collection on the investigation.</p> <p><b>(B) Requisite Skills.</b> Ability to recognize different types of evidence and determine whether evidence is critical to the investigation.</p> <p><b>NFPA 1033 4.4.4</b> Maintain a chain of custody, given standard investigative tools, marking tools, and evidence tags or logs, so that written documentation exists for each piece of evidence and evidence is secured.</p> <p><b>(A) Requisite Knowledge. Rules of custody and transfer procedures, types of evidence (e.g., physical evidence obtained at the scene, photos, and documents), and methods of recording the chain of custody.</b></p> <p><b>(B) Requisite Skills.</b> Ability to execute the chain of custody procedures and accurately complete necessary documents.</p>

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**4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.3** Coordinate expert resources, given the investigative file, reports, and documents, so that the expert's competencies are matched to the specific investigation needs, financial expenditures are justified, and utilization clearly furthers the investigative goals of determining cause or affixing responsibility.

**(A) Requisite Knowledge.** How to assess one's own expertise, qualification to be called for expert testimony, types of expert resources (e.g., forensic, CPA, polygraph, financial, human behavior disorders, and engineering), and methods to identify expert resources.

**(B) Requisite Skills.** Ability to apply expert resources to further the investigation by networking with other investigators to identify experts, questioning experts relative to their qualifications, and developing a utilization plan for use of expert resources.

**4.7 Presentations.**

Duties shall include the presentation of findings to those individuals not involved in the actual investigations.

**NFPA 1033 4.7.3** Testify during legal proceedings, given investigative findings, contents of reports, and consultation with legal counsel, so that all pertinent investigative information and evidence are presented clearly and accurately and the investigator's demeanor and attire are appropriate to the proceedings.

**(A) Requisite Knowledge.** Types of investigative findings, types of legal proceedings, professional demeanor requirements, and an understanding of due process and legal proceedings.

**(B) Requisite Skills.** Communication and listening skills and ability to differentiate facts from opinion and determine accepted procedures, practices, and etiquette during legal proceedings.

**References:**

**J&B, chapter 5**  
**IFSTA-3, chapter 14**

**501-12.1**     **The Investigator candidate shall recognize the legal consideration impact on every phase of the fire investigation.**

12.2.1     12.1.1     Every Phase of the Investigation

12.2.2     12.1.2     Civil Liability or Criminal Prosecution

**501-12.2**     **The Investigator candidate shall ensure that constitutional considerations are observed.**

12.2.3     Amendment Four

12.2.4     Amendment Five

12.2.5     Amendment Six

**501-12.3**     **The Investigator candidate shall observe all legal considerations during the investigation.**

12.3.1     Authority to Conduct the Investigation

12.3.2     Right of Entry

12.3.3     Method of Entry

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- 12.3.3.1 Consent
- 12.3.3.2 Exigent Circumstance
- 12.3.3.3 Administrative Search Warrant
- 12.3.3.4 Criminal Search Warrant
- 12.3.4 The Questioning of Suspects
- 12.3.5 Spoliation of Evidence
  - 12.3.5.1 Responsibility
  - 12.3.5.2 Documentation
  - 12.3.5.3 Remedies for Spoliation
  - 12.3.5.4 Notification to Interested Parties
  - 12.3.5.5 Documentation Prior to Alteration
  - 12.3.5.6 Alteration and Movement of Evidence
  - 12.3.5.7 Notification Prior to Destructive Testing

**501-12.4**     ***The Investigator candidate shall recognize pretrial legal considerations.***

- 12.4.1 Introduction
- 12.4.2 Forms of Discovery
  - 12.4.2.1 Request to Produce
  - 12.4.2.2 Interrogatories
  - 12.4.2.3 Depositions
    - 12.4.2.3.1 Procedure
    - 12.4.2.3.2 Discovery Depositions
    - 12.4.2.3.3 Trial Depositions
  - 12.4.2.4 Reports
- 12.4.3 Motions

**501-12.5**     ***The Investigator candidate shall identify the trial procedures in criminal and civil cases.***

- 12.5.1 Rules of Evidence
- 12.5.2 Types of Evidence
  - 12.5.2.1 Demonstrative Evidence
    - 12.5.2.1.1 Photographs/Illustrative Forms of Evidence
    - 12.5.2.1.2 Samples
  - 12.5.2.2 Documentary Evidence
  - 12.5.2.3 Testimonial Evidence
    - 12.5.2.3.1 Fact Witnesses
    - 12.5.2.3.2 Expert Witnesses
    - 12.5.2.3.3 Admissibility of Expert Testimony

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- 12.5.2.3.4 Relevance
- 12.5.2.3.5 Qualifications of Expert
- 12.5.2.3.6 Reliability of Opinions
- 12.5.3 Forms of Examination
  - 12.5.3.1 Direct Examination
  - 12.5.3.2 Cross-Examination
- 12.5.4 Forms of Testimony
  - 12.5.4.1 Affidavits
  - 12.5.4.2 Answers to Interrogatories
  - 12.5.4.3 Depositions and Trial Testimony
- 12.5.5 Burden of Proof
- 12.5.6 Criminal Prosecution
  - 12.5.6.1 Arson
  - 12.5.6.2 Arson Statutes
  - 12.5.6.3 Factors to be Considered
  - 12.5.6.4 Other Fire-Related Criminal Acts
  - 12.5.6.5 Arson-Reporting/Immunity Statutes
- 12.5.7 Civil Litigation
  - 12.5.7.1 Negligence
  - 12.5.7.2 Codes, Regulations, and Standards
  - 12.5.7.3 Product Liability
  - 12.5.7.4 Strict Liability

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## SECTION 13

### FIRE INVESTIGATOR SAFETY, HEALTH, AND WELLNESS

#### 4.1 General

**NFPA 1033 4.1.3\*** Because fire investigators are required to perform activities in adverse conditions, site safety assessments shall be completed on all scenes and regional and national safety standards shall be followed and included in organizational policies and procedures.

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(3) Fire Scene Safety:

- (a) Hazard Recognition, Evaluation, and Basic Mitigation Procedures
- (b) Hazardous Materials
- (c) Safety Regulations

#### 4.2 Scene Examination.

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.2\*** Conduct an exterior survey, given standard equipment and tools, so that evidence is identified and preserved, fire damage is interpreted, hazards are identified to avoid injuries, accessibility to the property is determined, and all potential means of ingress and egress are discovered.

**(A) Requisite Knowledge.** The types of building construction and the effects of fire on construction materials, types of evidence commonly found in the perimeter, evidence preservation methods, the effects of fire suppression, fire behavior and spread, fire patterns, and a basic awareness of the dangers of hazardous materials.

**(B) Requisite Skills.** Ability to assess fire ground and structural condition, observe the damage from and effects of the fire, and interpret fire patterns.

#### References:

J&B, chapter 6

IFSTA-3, chapter 2

IAAI, Fire Investigator Health and Safety Best Practices

**501-13.1**     ***The Investigator candidate shall describe the safety, health, and wellness issues as they relate to the fire investigation.***

- 13.1.1     Safe Workplace Duty
- 13.1.2     Safety, Health, and Wellness Programs
  - 13.1.2.1     Common Components of a Safety, Health, and Wellness Program
  - 13.1.2.2     Education and Training
  - 13.1.2.3     Incident Reporting

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**501-13.2**     ***The Investigator candidate shall describe the fire investigation scene safety following the scientific method.***

- 13.2.1     Recognize the Need and Identify the Problem
- 13.2.2     Define the Problem at Notification of Investigation
- 13.2.3     Collect Data – Hazard Identification
- 13.2.4     Analyze the Data – Risk Assessment
- 13.2.5     Develop Hypothesis – Action Plan
- 13.2.6     Test Hypothesis – Scene Exam
- 13.2.7     Select Final Hypothesis – Successful Completion
- 13.2.8     Expectation Bias

**501-13.3**     ***The Investigator candidate shall describe hazard identification, risk assessment and mitigation.***

- 13.3.1     Hazard Identification
- 13.3.2     Physical Hazards
- 13.3.3     Environmental Hazards
- 13.3.4     Structural Hazards
- 13.3.5     Utility Hazards
- 13.3.6     Chemical Hazards
- 13.3.7     Biological Hazards
- 13.3.8     Mechanical Hazards
- 13.3.9     Toxic Hazards
- 13.3.10    Special Hazards

**501-13.4**     ***The Investigator candidate shall perform a Risk Assessment and Evaluation.***

- 13.4.1     Informal Assessment
- 13.4.2     Formal Assessment
- 13.4.3     Identify the Hazards
- 13.4.4     Consequence Determination
- 13.4.5     Perform Risk Assessment
- 13.4.6     Evaluate and Manage Risk
- 13.4.7     Hazard Mitigation Strategies

**501-13.5**     ***The Investigator candidate shall describe factors associated with hazard exposure.***

- 13.5.1     Inhalation

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- 13.5.2 Dermal (Cutaneous and Mucosal) Absorption
- 13.5.3 Ocular Exposure
- 13.5.4 Ingestion
- 13.5.5 Injection

**501-13.6** ***The Investigator candidate shall describe the exposure effects.***

- 13.6.1 Local Effect
- 13.6.2 Systematic Effect
- 13.6.3 Acute Exposure
- 13.6.4 Chronic Exposure
- 13.6.5 Cumulative Exposure
- 13.6.6 Latency Period
- 13.6.7 Susceptibility
- 13.6.8 Exposure Documentation

**501-13.7** ***The Investigator candidate shall describe the risk mitigation methods.***

- 13.7.1 Need for Personal Protective Equipment (PPE)
- 13.7.2 Types of PPE

**501-13.8** ***The Investigator candidate shall describe other safety equipment.***

- 13.8.1 Gas Monitors and Detectors
- 13.8.2 Other Specialized Equipment

**501-13.9** ***The Investigator candidate shall describe decontamination.***

- 13.9.1 Dangers of Cross-Contamination
- 13.9.2 Decontamination Procedures
- 13.9.3 Clean Cab Concept

**501-13.10** ***The Investigator candidate shall develop Site-Specific Safety and Emergency Action Plans.***

- 13.10.1 Confined Space Plan
- 13.10.2 Management of Plans and Site Safety
- 13.10.3 Safety Meetings and Briefings
- 13.10.4 Investigator Fatigue
- 13.10.5 Investigator Rehabilitation
- 13.10.6 Coordination of Activities

**501-13.11** ***The Investigator candidate shall establish First Aid Training, Supplies,***

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**and Emergency Notification Numbers**

- 13.11.1 First Aid Training
- 13.11.2 Notification Procedures
- 13.11.3 Emergency Notification Signals/Systems

**\*\*Note\*\***

The following part of Section 13 (501-13.12 through 501-13.16) is not contained in NFPA 921, *Guide for Fire and Explosion Investigations*. The reference for this material is found in IFSTA, *Fire Inspection and Code Enforcement*. See also the *Emergency Response Guidebook (ERG)*.

**501-13.12 The Investigator candidate shall demonstrate knowledge of safety principles applicable to hazardous materials response.**

- a. Approach Cautiously from Upwind, Uphill, and/or Upstream
- b. Secure the Scene
- c. Identify the Hazards Using Any Available Information
- d. Assess the Situation
- e. Obtain Help
- f. Respond

**501-13.13 The Investigator candidate shall identify the difference between hazardous materials incidents and other emergencies.**

- a. More Complex
- b. Requires Specialized Training
- c. Requires Specialized Equipment
- d. Requires Specialized Procedures

**501-13.14 The Investigator candidate, utilizing the Emergency Response Guidebook, shall:**

- 1) Identify the Three Methods for Determining the Appropriate Guide Page for a Specific Hazardous Material
  - a) Locate UN Number in the Yellow-Bordered Pages
  - b) Locate Name of Material in the Alphabetic Listing in the Blue-Bordered Pages
  - c) Locate a Matching Placard in the Table of Placards and Consult the Two-Digit Guide Number Located Next to the Similar Placard
- 2) Identify Two General Types of Hazards Found on each Guide Page
  - a) Fire/Explosive

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- b) Health

**501-13.15** **The Investigator candidate, given an example of an NFPA 704 marking, shall identify the significance of the following components.**

- 1) Three Categories of Hazard
  - a) Health - Blue Color
  - b) Flammability - Red Color
  - c) Instability - Yellow Color
- 2) Special Hazards that may be Indicated
  - a) OX (or OXY)
  - b) COR
  - c) ALK
  - d) ACID
- 3) Numerical Rating System of Hazards

**501-13.16** **The Investigator candidate shall identify the following information from safety data sheets (SDS).**

- 1) The Investigator Candidate Shall List Four Organizations from Which to Obtain a Safety Data Sheet (SDS)
  - a) Manufacturer of the Material
  - b) Supplier
  - c) Facility Hazard and Communication Plan
  - d) Local Emergency Planning Committee (LEPC)
- 2) The Investigator Candidate Shall be Familiar with the Different SDS Chapters

## SECTION 14 SOURCES OF INFORMATION

<p><b>4.1 General</b></p> <p><b>NFPA 1033 4.1.4</b> The fire investigator shall maintain necessary liaison with other interested professionals and entities.</p>
<p><b>4.2 Scene Examination.</b></p> <p>Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.</p> <p><b>NFPA 1033 4.2.</b> Inspect and analyze the performance of building systems, including fire protection, detection and suppression systems, HVAC, electricity and electrical systems, fuel gas systems, and building compartmentation, given standard and special equipment and tools, so that a determination can be made as to the need for expert resources; an operating system's impact on fire growth and spread is considered in identifying origin areas; defeated and failed systems are identified; and the system's potential as a fire cause is recognized.</p> <p><b>(A) Requisite Knowledge.</b> Different types of detection, suppression, HVAC, utility, and building compartmentation such as fire walls and fire doors; types of expert resources for building systems; the impact of fire on various systems; common methods used to defeat a system's functional capability; and types of failures.</p> <p><b>(B) Requisite Skills.</b> Determine the system's operation and its effect on the fire; identify alterations to, and failure indicators of, building systems; and evaluate the impact of suppression efforts on building systems.</p>
<p><b>4.4 Evidence Collection/Preservation.</b></p> <p>Duties shall include using proper physical and legal procedures to identify, document, collect, and preserve evidence required within the investigation.</p> <p><b>NFPA 1033 4.4.3</b> Select evidence for analysis given all information from the investigation, so that items for analysis support specific investigation needs.</p> <p><b>(A) Requisite Knowledge.</b> Purposes for submitting items for analysis, types of analytical services available, and capabilities and limitations of the services performing the analysis.</p> <p><b>(B) Requisite Skills.</b> Evaluate the fire incident to determine forensic, engineering, or laboratory needs.</p>
<p><b>4.5 Interview.</b></p> <p>Duties shall include obtaining information regarding the overall fire investigation from others through verbal communication.</p> <p><b>NFPA 1033 4.5.1</b> Develop an interview plan, given no special tools or equipment, so that the plan reflects a strategy to further determine the fire cause and affix responsibility and includes a relevant questioning strategy for each individual to be interviewed that promotes the efficient use of the investigator's time.</p> <p><b>(A) Requisite Knowledge.</b> Persons who can provide information that furthers the fire cause determination or the affixing of responsibility, types of questions that are pertinent and efficient to ask of different information sources (first responders, neighbors, witnesses, suspects, and so forth), and pros and cons of interviews versus document gathering.</p>

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**(B) Requisite Skills.** Planning skills, development of focused questions for specific individuals, and evaluation of existing file data to help develop questions and fill investigative gaps.

**NFPA 1033 4.5.2** Conduct interviews, given incident information, so that pertinent information is obtained, follow-up questions are asked, responses to all questions are elicited, and the response to each question is documented accurately.

**(A) Requisite Knowledge.** Types of interviews, personal information needed for proper documentation or follow-up, documenting methods and tools, and types of nonverbal communications and their meaning.

**(B) Requisite Skills. Ability to** adjust interviewing strategies based on deductive reasoning, interpret, and analyze verbal, and nonverbal communications, apply appropriate legal requirements, and exhibit strong listening skills.

**NFPA 1033 4.5.3** Evaluate interview information, given interview transcripts or notes and incident data, so that all interview data is individually analyzed and correlated with all other interviews, corroborative and conflictive information is documented, and new leads are developed.

**(A) Requisite Knowledge.** Types of interviews, report evaluation methods, and data correlation methods.

**(B) Requisite Skills.** Data correlation skills and the ability to evaluate source information (e.g., first responders and other witnesses).

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.1** Gather reports and records, 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.

**(A) Requisite Knowledge:** Types of reports needed that facilitate determining responsibility for the fire (e.g. police reports, insurance policies, financial records, deeds, private investigator reports, outside photos, and videos) and location of these reports.

**(B) Requisite Skills:** Identify the reports and documents necessary for the investigation, implement the chain of custody, and organizational skills.

**NFPA 1033 4.6.3** Coordinate expert resources, given the investigative file, reports, and documents, so that the expert's competencies are matched to the specific investigation needs, financial expenditures are justified, and utilization clearly furthers the investigative goals of determining cause or affixing responsibility.

**(A) Requisite Knowledge:** How to assess one's own expertise, qualification to be called for expert testimony, types of expert resources (e.g., forensic, CPA, polygraph, financial, human behavior disorders, and engineering), and methods to identify expert resources.

**(B) Requisite Skills:** Apply expert resources to further the investigation by networking with other investigators to identify experts, questioning experts relative to their qualifications, and developing a utilization plan for use of expert resources.

References:  
J&B, chapter 10  
ASTM E678  
ASTM E860  
ASTM 1188

**501-14.1**     ***The Investigator candidate shall identify sources of information and assistance available to the Investigator during a fire investigation.***

- 14.1.1     Purpose of Obtaining Information
- 14.1.2     Number and Diversity of Informational Sources
- 14.1.3     Data Relevance, Accuracy, and Reliability

**501-14.2**     ***The Investigator candidate shall describe the legal considerations on sources of information.***

- 14.2.1     Freedom of Information Act
- 14.2.2     Privileged Communications
- 14.2.3     Confidential Communications
- 14.2.4     Privacy Considerations
- 14.2.5     Authorizations for Release of Information

**501-14.3**     ***The Investigator candidate shall identify the ASTM standards for collecting, preserving and evaluating data.***

- a)     *ASTM E678, Standard Practice for Evaluation of Scientific or Technical Data*
- b)     *ASTM E860, Standard Practice for Examining and Preparing Items that Are or May Become Involved in Criminal or Civil Litigation*
- c)     *ASTM E1188, Standard Practice for Collection and Preservation of Information and Physical Items by a Technical Investigator*

**501-14.4**     ***The Investigator candidate shall distinguish differing forms of information.***

- 14.4.1     Verbal Information
- 14.4.2     Written and Printed Information
- 14.4.3     Visual Information
- 14.4.4     Digital Information

**501-14.5**     ***The Investigator candidate shall identify sources of non-scene data.***

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- 14.5.1 Witness Data
- 14.5.2 Property Data
- 14.5.3 Electronically Stored Information
- 14.5.4 Existing Research and Publications
- 14.5.5 Experimentation and Testing
- 14.5.6 Governmental Sources of Information
- 14.5.7 Federal Government
- 14.5.8 Other Federal Agencies

**501-14.6** ***The Investigator candidate shall identify private sources of information useful during a fire investigation.***

- 14.6.1 National Fire Protection Association (NFPA)
- 14.6.2 Society of Fire Protection Engineers (SFPE)
- 14.6.3 American Society for Testing and Materials (ASTM)
- 14.6.4 American National Standards Institute (ANSI)
- 14.6.5 National Association of Fire Investigators (NAFI)
- 14.6.6 International Association of Arson Investigators (IAAI)
- 14.6.7 Regional Fire Investigations Organizations
- 14.6.8 Real Estate Industry
- 14.6.9 Abstract and Title Companies
- 14.6.10 Financial Institutions
- 14.6.11 Insurance Industry
- 14.6.12 Educational Institutions
- 14.6.13 Utility Companies
- 14.6.14 Trade Organizations
- 14.6.15 News Organizations
- 14.6.16 Lightning Detection Networks

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## **SECTION 15**

### **PLANNING THE INVESTIGATION**

#### **4.1 General**

**NFPA 1033 4.1.3** Because fire investigators are required to perform activities in adverse conditions, site safety assessments shall be completed on all scenes and regional and national safety standards shall be followed and included in organizational policies and procedures.

**NFPA 1033 4.1.4** The fire investigator shall maintain necessary liaison with other interested professionals and entities.

**NFPA 1033 4.1.6** The fire investigator shall understand the organization and operation of the investigative team within an incident management system.

#### **4.2 Scene Examination.**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.1** Secure the fire ground, given marking devices, sufficient personnel, and special tools and equipment, so that unauthorized persons can recognize the perimeters of the investigative scene and are kept from restricted areas and all evidence or potential evidence is protected from damage or destruction.

**(A) Requisite Knowledge.** Fire ground hazards, types of evidence, and the importance of fire scene security, evidence preservation, and issues relating to spoliation.

**(B) Requisite Skills.** Use of marking devices.

#### **4.6 Post-Incident Investigation**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.3** Coordinate expert resources, given the investigative file, reports, and documents, so that the expert's competencies are matched to the specific investigation needs, financial expenditures are justified, and utilization clearly furthers the investigative goals of determining cause or affixing responsibility.

**(A) Requisite Knowledge.** How to assess one's own expertise, qualifications to be called for expert testimony, types of expert resources (e.g. forensic, CPA, polygraph, financial, human behavior disorders, an engineering), and methods to identify expert resources.

**(B) Requisite Skills.** Apply expert resources to further the investigation by networking with other investigators to identify experts, questioning experts relative to their qualifications, and developing a utilization plan for use of expert resources.

**References:**

J&B, chapter 8  
Kirk's, chapters 1 and 5  
IFSTA-3, chapter 10

**501-15.1**     ***The Investigator candidate shall identify basic considerations of concern prior to beginning the incident scene investigation.***

- 15.1.1     Number of Investigators
- 15.1.2     Resources
- 15.1.3     “Team Concept”

**501-15.2**     ***The Investigator candidate shall identify basic incident information necessary to plan and conduct an investigation.***

- 15.2.1     Location
- 15.2.2     Date and Time of Incident
- 15.2.3     Weather Conditions
- 15.2.4     Size and Complexity of the Incident
- 15.2.5     Type and Use of Structure
- 15.2.6     Nature and Extent of Damage
- 15.2.7     Security of the Scene
- 15.2.8     Purpose of the Investigation

**501-15.3**     ***The Investigator candidate shall be able to organize the basic investigation functions that are commonly performed in each investigation.***

- 15.3.1     Basic Functions
- 15.3.2     Specialized Expertise

**501-15.4**     ***The Investigator candidate shall identify the goals of a pre-investigation team meeting.***

- 15.4.1     Equipment and Facilities
- 15.4.2     Personal Safety Equipment
- 15.4.3     Tools and Equipment

**501-15.5**     ***The Investigator candidate shall identify the specialized personnel and technical consultants that may be needed to provide technical assistance.***

- 15.5.1     Specialized Personnel and Technical Consultants
- 15.5.2     Materials Engineer or Scientist

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- 15.5.3 Mechanical Engineer
- 15.5.4 Electrical Engineer
- 15.5.5 Chemical Engineer/Chemist
- 15.5.6 Fire Science and Engineering
- 15.5.7 Industry Expert
- 15.5.8 Attorney
- 15.5.9 Insurance Agent/Adjuster
- 15.5.10 Canine Teams

**501-15.6** ***The Investigator candidate shall identify a method to organize information generated throughout the investigation and coordinate the efforts of the various people involved.***

- 15.6.1 Organization
- 15.6.2 Coordination
- 15.6.3 Case Management

## **SECTION 16**

### **DOCUMENTATION OF THE INVESTIGATION**

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following: (2)(c) Fire Investigation Technology.

#### **4.3 Documenting the Scene.**

Duties shall include diagramming the scene, photographing, and taking field notes to be used to compile a final report.

**NFPA 1033 4.3.1** Diagram the scene, given standard tools and equipment, so that the scene is accurately represented and evidence, pertinent contents, significant patterns, and area(s) or point(s) of origin are identified.

**(A) Requisite Knowledge.** Commonly used symbols and legends that clarify the diagram, types of evidence and patterns that need to be documented, and formats for diagramming the scene.

**(B) Requisite Skills.** Ability to sketch the scene, basic drafting skills, and evidence recognition and observational skills.

**NFPA 1033 4.3.2** Photographically document the scene, given standard tools and equipment, so that the scene is accurately depicted and the photographs support scene findings.

**(A) Requisite Knowledge.** Working knowledge of high-resolution camera and flash, the types of film, media, and flash available, and the strengths and limitations of each.

**(B) Requisite Skills.** Ability to use a high-resolution camera, flash, and accessories.

**NFPA 1033 4.3.3** Construct investigative notes, given a fire scene, available documents (e.g., prefire plans and inspection reports), and interview information, so that the notes are accurate, provide further documentation of the scene, and represent complete documentation of the scene findings.

**(A) Requisite Knowledge.** Relationship between notes, diagrams, and photos, how to reduce scene information into concise notes, and the use of notes during report writing and legal proceedings.

**(B) Requisite Skills.** Data-reduction skills, note-taking skills, and observational and correlating skills.

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.1** Gather reports and records, 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.

**(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.

**(B) Requisite Skills.** Ability to identify the reports and documents necessary for the investigation, implement the chain of custody, and organizational skills.

**NFPA 1033 4.6.2** Evaluate the investigative file, given all available file information, so that areas for further investigation are identified, the relationship between gathered documents and information is interpreted, and corroborative evidence and information discrepancies are discovered.

**(A) Requisite Knowledge.** File assessment and/or evaluation methods, including accurate documentation practices, and requisite investigative elements.

**(B) Requisite Skills.** Information assessment, correlation, and organizational skills.

#### **4.7 Presentations**

Duties shall include the presentation of findings to those individuals not involved in the actual investigations.

**NFPA 1033 4.7.1** Prepare a written report, given investigative findings, so that the report accurately reflects the facts, data, and scientific principles on which the investigator relied; clearly identifies and expresses the investigator's opinions and conclusions; and contains the reasoning by which each opinion or conclusion was reached in order to meet the requirements of the intended audience(s).

**(A) Requisite Knowledge.** Elements of writing, typical components of a written report, and types of audiences and their respective needs or requirements.

**(B) Requisite Skills.** Writing skills, ability to analyze information and determine the reader's needs or requirements.

#### **References:**

**J&B, chapter 11**

**Kirk's, chapter 6**

**IFSTA-3, chapter 8**

**ASTM E860, ASTM E620**

#### **501-16.1      The Investigator candidate shall describe the purpose of recording the fire scene.**

16.1.1      Accurate Recording

16.1.2      Accurate Documentation

#### **501-16.2      The Investigator candidate shall describe the purpose of fire scene photography and the importance of timing.**

16.2.1      General

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- 16.2.2 Timing
- 16.2.3 Basics
- 16.2.4 Understanding the Parts of a Camera
  - 16.2.4.1 Lenses
  - 16.2.4.2 Focal Length
  - 16.2.4.3 Depth of Field
  - 16.2.4.4 Filters
  - 16.2.4.5 Shutter Speed
- 16.2.5 Lighting
- 16.2.6 Special Types of Photography
  - 16.2.6.1 Composition and Techniques
  - 16.2.6.2 Sequential Photographs
  - 16.2.6.3 Mosaic Photographs
  - 16.2.6.4 Photo Diagram
  - 16.2.6.5 Assisting Photographer
  - 16.2.6.6 Photography and the Courts
- 16.2.7 Video
- 16.2.8 Suggested Activities to Be Documented
  - 16.2.8.1 During the Fire
  - 16.2.8.2 Overhaul Photographs
  - 16.2.8.3 Bystander Photographs
  - 16.2.8.4 Exterior Photographs
  - 16.2.8.5 Structural Photographs
  - 16.2.8.6 Interior Photographs
  - 16.2.8.7 Utility Photographs
  - 16.2.8.8 Evidence Photographs
  - 16.2.8.9 Victim Photographs
  - 16.2.8.10 Witness Viewpoint Photographs
  - 16.2.8.11 Aerial Photographs
  - 16.2.8.12 Satellite Imagery
- 16.2.9 Photography Tips
- 16.2.10 Presentation of Photographs

**501-16.3**     ***The Investigator candidate shall describe the importance of note taking.***

- 16.3.1 Forms of Incident Field Notes
- 16.3.2 Forms for Collecting Data
- 16.3.3 Dictation of Field Notes

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**501-16.4**     ***The Investigator candidate shall explain the importance of diagrams and drawings.***

- 16.4.1     Types of Drawings
  - 16.4.1.1     Sketches
  - 16.4.1.2     Diagrams
- 16.4.2     Selection of Drawings
- 16.4.3     Drawing Tools and Equipment
- 16.4.4     Diagram Elements
  - 16.4.4.1     General Information
  - 16.4.4.2     Identification of Compass Orientation
  - 16.4.4.3     Scale
  - 16.4.4.4     Symbols
  - 16.4.4.5     Legend
- 16.4.5     Drawings
  - 16.4.5.1     Site or Area plans
  - 16.4.5.2     Floor Plans
  - 16.4.5.3     Elevations
  - 16.4.5.4     Details and Sections
  - 16.4.5.5     Exploded View Diagrams
  - 16.4.5.6     Three-Dimensional (3D) Representations
  - 16.4.5.7     Specialized Fire Investigation Diagrams
- 16.4.6     Prepared Design and Construction Drawings
  - 16.4.6.1     General
  - 16.4.6.2     Architectural and Engineering Drawings
  - 16.4.6.3     Architectural and Engineering Schedules
  - 16.4.6.4     Specifications
  - 16.4.6.5     Appliances and Building Equipment

**501-16.5**     ***The Investigator candidate shall describe the purpose and the legal requirements for reports and testimony.***

- 16.5.1     Purpose of Reports
- 16.5.2     Report Organization and Content
- 16.5.3     Descriptive Information
- 16.5.4     Opinions and Conclusions
- 16.5.5     Physical Scene Documentation
- 16.5.6     Pertinent Facts
- 16.5.7     Reference to Methodology
- 16.5.8     Expert Opinions

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- 16.5.9 Level of Certainty or Confidence
- 16.5.10 Uncertainty or Limitations
- 16.5.11 Error Rate

**\*\*Note: The following part of Section 16 does not come from NFPA 921\*\*  
The reference for this material is found in *ASTM E620 Standard Practice for Reporting Opinions of Scientific or Technical Experts* (current ed.)**

**501-16.6     *The Investigator candidate shall identify and describe the process of*  
preparing and completing a final, accurate and concise report.**

- a) Scope
- b) Referenced Documents
- c) Significance and Use
- d) Report
- e) Keywords

## SECTION 17

### PHYSICAL EVIDENCE

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(2) Fire Investigation:

(d) Evidence Documentation, Collection, and Preservation

#### 4.2 Scene Examination.

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.1** Secure the fire ground, given marking devices, sufficient personnel, and special tools and equipment, so that unauthorized persons can recognize the perimeters of the investigative scene and are kept from restricted areas and all evidence or potential evidence is protected from damage or destruction.

(A) **Requisite Knowledge.** Fire ground hazards, types of evidence, and the importance of fire scene security, evidence preservation, and issues relating to spoliation.

(B) **Requisite Skills.** Use of marking devices.

**NFPA 1033 4.2.6** Examine and remove fire debris, given standard equipment and tools, so that all debris is checked for fire cause evidence, potential ignition source(s) is identified, and evidence is preserved without investigator-inflicted damage or contamination.

(A) **Requisite Knowledge.** Basic understanding of ignition processes, characteristics of ignition sources, and ease of ignition of fuels; debris-layering techniques; use of tools and equipment during the debris search; types of fire cause evidence commonly found in various degrees of damage; and evidence-gathering methods and documentation.

(B) **Requisite Skills.** Ability to employ search techniques that further the discovery of fire cause evidence and ignition sources, use search techniques that incorporate documentation, and collect and preserve evidence.

#### 4.3 Documenting the Scene.

Duties shall include diagramming the scene, photographing, and taking field notes to be used to compile a final report.

**NFPA 1033 4.3.1** Diagram the scene, given standard tools and equipment, so that the scene is accurately represented and evidence, pertinent contents, significant patterns, and area(s) or point(s) of origin are identified.

(A) **Requisite Knowledge.** Commonly used symbols and legends that clarify the diagram, types of evidence and patterns that need to be documented, and formats for diagramming the scene.

(B) **Requisite Skills.** Ability to sketch the scene, basic drafting skills, and evidence recognition and observational skills.

#### 4.4 Evidence Collection/Preservation

Duties shall include using proper physical and legal procedures to retain evidence required within the investigation.

**NFPA 1033 4.4.1** Utilize proper procedures for managing victims and fatalities, given a protocol and appropriate personnel, so that all evidence is discovered and preserved, and the protocol procedures are followed.

(A) **Requisite Knowledge.** Types of evidence associated with fire victims and fatalities and evidence preservation methods.

(B) **Requisite Skills.** Observational skills and the ability to apply protocols to given situations.

**NFPA 1033 4.4.2\*** Locate, collect, and package evidence, given standard or special tools and equipment and evidence collection materials, so that evidence is identified, preserved, collected, and packaged to avoid contamination and investigator-inflicted damage and the chain of custody is established.

(A) **Requisite Knowledge.** Types of evidence, authority requirements, impact of removing evidentiary items on civil or criminal proceedings (exclusionary or fire-cause supportive evidence), types, capabilities, and limitations of standard and special tools used to locate evidence, types of laboratory tests available, packaging techniques and materials, and impact of evidence collection on the investigation.

(B) **Requisite Skills.** Ability to recognize different types of evidence and determine whether evidence is critical to the investigation.

**NFPA 1033 4.4.3** Select evidence for analysis given all information from the investigation, so that items for analysis support specific investigation needs.

(A) **Requisite Knowledge.** Purposes for submitting items for analysis, types of analytical services available, and capabilities and limitations of the services performing the analysis.

(B) **Requisite Skills.** Evaluate the fire incident to determine forensic, engineering, or laboratory needs.

**NFPA 1033 4.4.4** Maintain a chain of custody, given standard investigative tools, marking tools, and evidence tags or logs, so that written documentation exists for each piece of evidence and evidence is secured.

(A) **Requisite Knowledge.** Rules of custody and transfer procedures, types of evidence (e.g., physical evidence obtained at the scene, photos, and documents), and methods of recording the chain of custody.

(B) **Requisite Skills.** Ability to execute the chain of custody procedures and accurately complete necessary documents.

**NFPA 1033 4.4.5** Dispose of evidence, given jurisdictional or agency regulations and file information, so that the disposal is timely, safely conducted, and in compliance with jurisdictional or agency requirements.

(A) **Requisite Knowledge.** Disposal services available and common disposal procedures and problems.

(B) **Requisite Skills.** Documentation skills.

**References:**

**J&B, chapter 9**

**Kirk's, chapter 7**

**IFSTA-3, chapter 9**

**4 ASTM E1188**

**ASTM E1459**

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**501-17.1**     ***The Investigator candidate shall describe the recommended and accepted methods of processing physical evidence.***

- a)            Recommended Methods
- b)            Accepted Methods

**501-17.2**     ***The Investigator candidate shall define physical evidence.***

- 17.2.1      Physical Evidence
- 17.2.2      The Decision on What Physical Evidence to Collect

**501-17.3**     ***The Investigator candidate shall describe the importance of preservation of the fire scene and physical evidence.***

- 17.3.1      General
- 17.3.2      Fire Patterns as Physical Evidence
- 17.3.3      Artifact Evidence
- 17.3.4      Protecting Evidence
- 17.3.5      Role and Responsibilities of Fire Suppression Personnel in Preserving the Fire Scene
  - 17.3.5.1    General
  - 17.3.5.2    Preservation
  - 17.3.5.3    Caution in Fire Suppression Operations
- 17.3.6      Roles and Responsibilities of the Fire Investigator
- 17.3.7      Practical Considerations

**501-17.4**     ***The Investigator candidate shall describe contamination of physical evidence.***

- 17.4.1      Contamination of Evidence Containers
- 17.4.2      Contamination During Collection
- 17.4.3      Contamination by Fire Fighters

**501-17.5**     ***The Investigator candidate shall describe methods of collection.***

- 17.5.1      General
- 17.5.2      Documenting the Collection of Physical Evidence
- 17.5.3      Collection of Traditional Forensic Physical Evidence
- 17.5.4      Collection of Evidence for Accelerant Testing
  - 17.5.4.1    Liquid Accelerant Characteristics
  - 17.5.4.2    Canine-Handler Teams
  - 17.5.4.3    Collection of Liquid Samples for Ignitable Liquid Testing
  - 17.5.4.4    Collection of Liquid Evidence Absorbed by Solid Materials
  - 17.5.4.5    Collection of Solid Samples for Accelerant Testing

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- 17.5.4.6 Comparison Samples
- 17.5.5 Collection of Gaseous Samples
- 17.5.6 Collection of Electrical Equipment and System Components
- 17.5.7 Collection of Appliances or Small Electrical Equipment

**501-17.6** ***The Investigator candidate shall identify and describe different types of evidence containers.***

- 17.6.1 General
- 17.6.2 Liquid and Solid Accelerant Evidence Containers
  - 17.6.2.1 Metal Cans
  - 17.6.2.2 Glass Jars
  - 17.6.2.3 Special Evidence Bags
  - 17.6.2.4 Common Plastic Bags

**501-17.7** ***The Investigator candidate shall understand the benefits and limitations of utilizing Canine-Handler Teams.***

- 17.7.1 Preferred Designation
- 17.7.2 Other Designations for IGL Canines
- 17.7.3 Investigators' Discretion
- 17.7.4 Handlers' Expertise
- 17.7.5 Canine-Handler Teams
- 17.7.6 Purpose of Canine-Handler Team
- 17.7.7 Limitations on the Use of Alerts by Canine-Handler Teams
- 17.7.8 Canine-Handler Teams and Accelerant Detection
- 17.7.9 Coordinating the Investigation with the Handler
- 17.7.10 Safety of Canine, Handler, and Others

**501-17.8** ***The Investigator candidate shall identify the ASTM standards related to physical evidence.***

**501-17.9** ***The Investigator candidate shall describe the proper methods of transportation and storage of physical evidence.***

- 17.9.1 Hand Delivery
- 17.9.2 Shipment
- 17.9.3 Storage of Evidence

**501-17.10** ***The Investigator candidate shall identify and describe the evidence chain of custody of physical evidence.***

- 17.10.1 The Value of Physical Evidence

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17.10.2 Chain of Custody

**501-17.11** ***The Investigator candidate shall identify types of analytical methods and tests applicable to certain fire investigations, and the capabilities and limitations of the services that perform the analysis.***

17.11.1 Evidence Collection or Inspections Involving Alteration  
Without Changes to the Evidentiary Value of the Artifacts

17.11.2 Test Methods

17.11.3 Sufficiency of Samples

17.11.4 Comparative Examination and Testing

**501-17.12** ***The Investigator candidate shall describe the proper procedure for evidence disposition.***

17.12.1 Proper Authorization

17.12.2 Written Record of Authorization

## **SECTION 18**

### **ORIGIN DETERMINATION**

#### **4.2 Scene Examination.**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.2\*** Conduct an exterior survey, given standard equipment and tools, so that evidence is identified and preserved, fire damage is interpreted, hazards are identified to avoid injuries, accessibility to the property is determined, and all potential means of ingress and egress are discovered.

**(A) Requisite Knowledge.** The types of building construction and the effects of fire on construction materials, types of evidence commonly found in the perimeter, evidence preservation methods, the effects of fire suppression, fire behavior and spread, fire patterns, and a basic awareness of the dangers of hazardous materials.

**(B) Requisite Skills.** Assess fire ground and structural condition, observe the damage from and effects of the fire, and interpret fire patterns.

**NFPA 1033 4.2.3** Conduct an interior survey, given standard equipment and tools, so that areas of potential evidentiary value requiring further examination are identified and preserved, the evidentiary value of contents is determined, and hazards are identified in order to avoid injuries.

**(A) Requisite Knowledge.** The types of building construction and interior finish and the effects of fire on those materials, the effects of fire suppression, fire behavior and spread, evidence preservation methods, fire patterns, effects of building contents on fire growth, the relationship of building contents to the overall investigation, weather conditions at the time of the fire, and fuel moisture.

**(B) Requisite Skills.** Assess structural conditions, observe the damage and effects of the fire, discover the impact of fire suppression efforts on fire flow and heat propagation, and evaluate protected areas to determine the presence and/or absence of contents.

**NFPA 1033 4.2.5** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that fire development is determined, methods and effects of suppression are evaluated, false origin area patterns are recognized, and all areas of origin are correctly identified.

**(A) Requisite Knowledge.** Fire behavior and spread based on fire chemistry, fire dynamics, and physics, fire suppression effects, building construction.

**(B) Requisite Skills.** Ability to interpret variations of fire patterns on different materials with consideration given to heat release rate, form, and ignitability; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.5\*** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

**(A) Requisite Knowledge:** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, time lines, link analysis, fault tree analysis, and data reduction matrixing).

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**(B) Requisite Skills:** Analytical and assimilation skills.

**References:**

J&B, chapter 13  
Kirk's, chapters 1 and 5  
IFSTA-3, chapter 12

**501-18.1**     **The Investigator candidate shall identify witness information and/or electronic data, fire patterns, and fire dynamics used in origin determination.**

- 18.1.1     Importance
- 18.1.2     Pillars of Origin Determination

**501-18.2**     **The Investigator candidate shall identify and describe the overall methodology of conducting a scene assessment.**

- 18.2.1     Testing any Origin Hypothesis
- 18.2.2     Sequence of Activities
- 18.2.3     Sequential Pattern Analysis
- 18.2.4     Systematic Procedure
- 18.2.5     Recommended Methodology

**501-18.3**     **The Investigator candidate shall identify the data collection process for origin determination.**

- 18.3.1     Initial Scene Assessment
  - 18.3.1.1     Safety Assessment
  - 18.3.1.2     Scope of the Examination
  - 18.3.1.3     Order of the Examination
  - 18.3.1.4     Surrounding Areas
  - 18.3.1.5     Structure Exterior
  - 18.3.1.6     Structure Interior
  - 18.3.1.7     Post-Fire Alterations
  - 18.3.1.8     Determination of the Safety of the Fire Scene
- 18.3.2     Excavation and Reconstruction
  - 18.3.2.1     Scope of Excavation and Reconstruction
  - 18.3.2.2     Safety
  - 18.3.2.3     Excavation
  - 18.3.2.4     Heavy Equipment
  - 18.3.2.5     Avoiding Spoliation
  - 18.3.2.6     Avoiding Contamination

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- 18.3.2.7 Washing Floors
- 18.3.2.8 Contents
- 18.3.3 Additional Data Collection Activities for Origin Determination
  - 18.3.3.1 Pre-Fire Conditions
  - 18.3.3.2 Description of Fuels
  - 18.3.3.3 Structure Dimensions
  - 18.3.3.4 Weather Conditions
  - 18.3.3.5 Electrical Systems
  - 18.3.3.6 Electrical Loads
  - 18.3.3.7 HVAC Systems
  - 18.3.3.8 Fuel Gas Systems
  - 18.3.3.9 Liquid Fuel Systems
  - 18.3.3.10 Fire Protection Systems
  - 18.3.3.11 Fire Protection Systems Data
  - 18.3.3.12 Security Cameras
  - 18.3.3.13 Intrusion Alarm Systems
  - 18.3.3.14 Witness Observations

**501-18.4** ***The Investigator candidate shall recognize the importance of analyzing the following data.***

- 18.4.1 Fire Patterns Analysis
  - 18.4.1.1 Consideration of All Patterns
  - 18.4.1.2 Sequence of Patterns
  - 18.4.1.3 Pattern Generation
  - 18.4.1.4 Ventilation
  - 18.4.1.5 Movement and Intensity Patterns
  - 18.4.1.6 Evaluation of Every Pattern
- 18.4.2 Heat and Flame Vector Analysis
  - 18.4.2.1 Complementary Vectors
  - 18.4.2.2 Heat Source
  - 18.4.2.3 Additional Tools for Pattern Visualization
- 18.4.3 Analysis of Sequential Events
- 18.4.4 Fire Dynamics
- 18.4.5 Origin Matrix Analysis

**501-18.5** ***The Investigator candidate shall identify the process of developing origin hypotheses.***

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- 18.5.1 Initial Hypothesis
- 18.5.2 Modifying the Initial Hypothesis

**501-18.6** ***The Investigator candidate shall identify means and methods for testing the validity of the origin hypothesis.***

- 18.6.1 Means of Hypothesis Testing
- 18.6.2 Analytical Techniques and Tools
  - 18.6.2.1 Time Line Analysis
  - 18.6.2.2 Fire Modeling
  - 18.6.2.3 Experimental Testing

**501-18.7** ***The Investigator candidate shall select a final hypothesis.***

- 18.7.1 Defining the Area of Origin
- 18.7.2 Inconsistent Data
- 18.7.3 Case File Review

**501-18.8** ***The Investigator candidate shall identify when there is insufficient data to define the origin.***

- 18.8.1 Large Area Adequate for Determination
- 18.8.2 Justification of a Large Area of Origin
- 18.8.3 Eyewitness Evidence of Origin Area

## **SECTION 19**

### **FIRE CAUSE DETERMINATION**

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.5\*** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

**(A) Requisite Knowledge.** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, time lines, link analysis, fault tree analysis, and data reduction matrixing).

**(B) Requisite Skills.** Analytical and assimilation skills.

#### **References:**

**J&B, chapter 14**

**Kirk's, chapters 1 and 5**

**IFSTA-3, chapter 13**

#### **501-19.1     The Investigator candidate shall define fire cause and identify fire cause factors.**

- 19.1.1     Fire Cause Factors
- 19.1.2     First Fuel Ignited
- 19.1.3     Ignition Source
- 19.1.4     Oxidant
- 19.1.5     Ignition Sequence

#### **501-19.2     The Investigator candidate shall utilize the scientific method as the overall methodology.**

- 19.2.1     Consideration of Data
- 19.2.2     Sequence of Activities
- 19.2.3     Point and Area of Origin

#### **501-19.3     The Investigator candidate shall identify the data that needs to be collected for fire cause determination.**

- 19.3.1     Identify Fuels in the Area of Origin
- 19.3.2     Identify Source and Form of the Heat of Ignition
- 19.3.3     Identify Items and Activities in Area of Origin
- 19.3.4     Identify the Oxidant
- 19.3.5     Identify Ignition Sequence Data

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**501-19.4**     ***The Investigator candidate shall demonstrate the proper use of the scientific method to analyze the data.***

- 19.4.1     Fuel Analysis
  - 19.4.1.1     Geometry and Orientation
  - 19.4.1.2     Ignition Temperature
  - 19.4.1.3     Quantity of Fuel
- 19.4.2     Ignition Source Analysis
- 19.4.3     Oxidant
- 19.4.4     Ignition Sequence

**501-19.5**     ***The Investigator candidate shall develop cause hypotheses.***

- 19.5.1     Devices Present
- 19.5.2     Potential Ignition Sources
- 19.5.3     Relationship to the Fuel
- 19.5.4     Competency

**501-19.6**     ***The Investigator candidate shall test the cause hypothesis for validity.***

- 19.6.1     Scientific Method
- 19.6.2     Deductive Reasoning
- 19.6.3     Hypotheses Testing Questions
- 19.6.4     Means of Hypothesis Testing
  - 19.6.4.1     Scientific Literature
  - 19.6.4.2     Fundamental Principles of Science
  - 19.6.4.3     Physical Experiments or Testing
  - 19.6.4.4     Cognitive Experiments
  - 19.6.4.5     Time Lines
  - 19.6.4.6     Fault Trees
  - 19.6.4.7     Additional Techniques
- 19.6.5     Appropriate Use of the Process of Elimination
  - 19.6.5.1     Cause Undetermined
  - 19.6.5.2     Ignition Source vs. Fire Cause

**501-19.7**     ***The Investigator candidate shall demonstrate the proper selection of a final hypothesis.***

- 19.7.1     Establishing the Cause
- 19.7.2     Inconsistent Data
- 19.7.3     Safety Devices and Features
- 19.7.4     Undetermined Fire Cause

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**501-19.8**     ***The Investigator candidate shall use a set of prescribed incident classification systems when classification is required of the investigator.***

- 19.8.1     Incident Classification for Statistical Purposes
  - (1)     National Fire Incident Reporting System (NFIRS or NERIS)
  - (2)     NFPA 901 – Standard Classifications for Fire and Emergency Services Incident Reporting
  - (3)     BATS – Bombs Arson Tracking System
  - (4)     UCR – Uniform Crime Reporting Program
  - (5)     The Canadian Code Structure
  - (6)     NIBRS – National Incident Based Reporting System
- 19.8.2     Fire Cause Classification for Reports

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## **SECTION 20**

### **ANALYZING THE INCIDENT FOR CAUSE AND RESPONSIBILITY**

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

- (2) Fire Investigation:
  - (a) Fire Analysis
  - AND
  - (e) Failure Analysis and Analytical Tools

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.1** Gather reports and records, 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.

**(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.

**(B) Requisite Skills.** Ability to identify the reports and documents necessary for the investigation, implement the chain of custody, and organizational skills.

**NFPA 1033 4.6.2** Evaluate the investigative file, given all available file information, so that areas for further investigation are identified, the relationship between gathered documents and information is interpreted, and corroborative evidence and information discrepancies are discovered.

**(A) Requisite Knowledge.** File assessment and/or evaluation methods, including accurate documentation practices, and requisite investigative elements.

**(B) Requisite Skills.** Information assessment, correlation, and organizational skills.

**NFPA 1033 4.6.3** Coordinate expert resources, given the investigative file, reports, and documents, so that the expert’s competencies are matched to the specific investigation needs, financial expenditures are justified, and utilization clearly furthers the investigative goals of determining cause or affixing responsibility.

**(A) Requisite Knowledge.** How to assess one’s own expertise, qualification to be called for expert testimony, types of expert resources (e.g., forensic, CPA, polygraph, financial, human behavior disorders, and engineering), and methods to identify expert resources.

**(B) Requisite Skills.** Ability to apply expert resources to further the investigation by networking with other investigators to identify experts, questioning experts relative to their qualifications, and developing a utilization plan for use of expert resources.

**NFPA 1033 4.6.4** Establish evidence as to motive and/or opportunity, given an incendiary fire, so that the evidence is supported by documentation and meets the evidentiary requirements of the jurisdiction.

**(A) Requisite Knowledge.** Types of motives common to incendiary fires, methods used to discover opportunity, and human behavioral patterns relative to fire-setting

**(B) Requisite Skills.** Financial analysis, records gathering and analysis, interviewing, and interpreting fire scene information and evidence for relationship to motive and/or opportunity.

**NFPA 1033 4.6.5** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

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- (A) **Requisite Knowledge.** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, time lines, link analysis, fault tree analysis, and data reduction matrixing).  
(B) **Requisite Skills.** Analytical and assimilation skills.

**References:**  
J&B, chapter 15  
Kirk's, chapters 1 and 5  
IFSTA-3, chapter 13

**501-20.1**     **The Investigator candidate shall describe methods for analyzing the incident for cause and responsibility.**

- 20.1.1     General
- 1) The Cause of the Fire or Explosion
  - 2) The Cause of Damage to Property Resulting from the Incident
  - 3) The Cause of Bodily Injury or Loss of Life
  - 4) The Degree to Which Human Fault Contributed to Any One or More of the Causal Issues Described in 20.1.1(1), 20.1.1(2), and 20.1.1(3)
- 20.1.2     Based On the Scope of the Assignment, an Individual Investigator May Not have Responsibility or be Required to Address All of the Aspects of this Chapter
- 20.1.3     The Cause of a Fire or the Causes of Damage or Casualties May Be Grouped in Broad Categories for General Discussion, For Assignment of Legal Responsibility or Culpability, or for Reporting Purposes

**501-20.2**     **The Investigator candidate shall identify the cause of the fire or explosion.**

- 20.2.1     The Device or Equipment
- 20.2.2     Competent Ignition Source
- 20.2.3     Material First Ignited
- 20.2.4     Human Circumstances

**501-20.3**     **The Investigator candidate shall describe the causes of damage to property resulting from the incident.**

- 20.3.1     Considerations
- 20.3.2     Fire/Smoke Spread
- 20.3.2.1     Compartmentation
  - 20.3.2.2     Change of Occupancy/Hazard
  - 20.3.2.3     Detection/Alarm Systems
  - 20.3.2.4     Human Behavior

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- 20.3.2.5 Fire Suppression
- 20.3.2.6 Fuel Loads
- 20.3.2.7 Housekeeping
- 20.3.2.8 Ventilation
- 20.3.2.9 Code Violations
- 20.3.2.10 Structural Failure
- 20.3.3 Other Consequential Damage

**501-20.4** ***The Investigator candidate shall describe the causes of bodily injury or loss of life. See NFPA 921 chapters 11 and 24.***

- 20.4.1 Fire/Smoke Spread
  - 20.4.1.1 Toxicity
  - 20.4.1.2 Hazardous Materials
  - 20.4.1.3 Compartmentation
  - 20.4.1.4 Change of Occupancy/Hazard
  - 20.4.1.5 Detection/Alarm systems
  - 20.4.1.6 Human Behavior
  - 20.4.1.7 Fire Suppression
  - 20.4.1.8 Housekeeping
  - 20.4.1.9 Fuel Loads
  - 20.4.1.10 Ventilation
  - 20.4.1.11 Code Violations
  - 20.4.1.12 Means of Egress/Refuge
  - 20.4.1.13 Structural Failure
  - 20.4.1.14 Intentional Acts
- 20.4.2 Emergency Preparedness

**501-20.5** ***The Investigator candidate shall describe the determination of responsibility.***

- 20.5.1 Nature of Responsibility
- 20.5.2 Definition of Responsibility
- 20.5.3 Assessing of Responsibility
- 20.5.4 Degrees of Responsibility

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## SECTION 21

### FAILURE ANALYSIS AND ANALYTICAL TOOLS

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

(2) Fire Investigation:

(e) Failure Analysis and Analytical Tools

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.1** Gather reports and records, 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.

**(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.

**(B) Requisite Skills.** Ability to identify the reports and documents necessary for the investigation, implement the chain of custody, and organizational skills.

**NFPA 1033 4.6.2** Evaluate the investigative file, given all available file information, so that areas for further investigation are identified, the relationship between gathered documents and information is interpreted, and corroborative evidence and information discrepancies are discovered.

**(A) Requisite Knowledge.** File assessment and/or evaluation methods, including accurate documentation practices, and requisite investigative elements.

**(B) Requisite Skills.** Information assessment, correlation, and organizational skills.

**NFPA 1033 4.6.3** Coordinate expert resources, given the investigative file, reports, and documents, so that the expert’s competencies are matched to the specific investigation needs, financial expenditures are justified, and utilization clearly furthers the investigative goals of determining cause or affixing responsibility.

**(A) Requisite Knowledge.** How to assess one’s own expertise, qualification to be called for expert testimony, types of expert resources (e.g., forensic, CPA, polygraph, financial, human behavior disorders, and engineering), and methods to identify expert resources.

**(B) Requisite Skills.** Ability to apply expert resources to further the investigation by networking with other investigators to identify experts, questioning experts relative to their qualifications, and developing a utilization plan for use of expert resources.

**NFPA 1033 4.6.4** Establish evidence as to motive and/or opportunity, given an incendiary fire, so that the evidence is supported by documentation and meets the evidentiary requirements of the jurisdiction.

**(A) Requisite Knowledge.** Types of motives common to incendiary fires, methods used to discover opportunity, and human behavioral patterns relative to fire-setting.

**(B) Requisite Skills.** Financial analysis, records gathering and analysis, interviewing, and interpreting fire scene information and evidence for relationship to motive and/or opportunity.

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**NFPA 1033 4.6.5** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

**(A) Requisite Knowledge.** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, timelines, link analysis, fault tree analysis, and data reduction matrixing).

**(B) Requisite Skills.** Analytical and assimilation skills.

**References: J&B, chapter 15**  
**Kirk's, chapters 1 and 5**  
**IFSTA-3, chapter 13**

**501-21.1**     ***The Investigator candidate shall describe failure analysis and the use of analytical tools.***

- 21.1.1     Methods Used
- 21.1.2     Investigation Aspects
- 21.1.3     Future Direction

**501-21.2**     ***The Investigator candidate shall describe time lines available for use in analyzing fire cause.***

- 21.2.1     General
- 21.2.2     Hard Time (Actual)
- 21.2.3     Soft Time (Estimated)
- 21.2.4     Benchmark Events
- 21.2.5     Multiple Timelines

**501-21.3**     ***The Investigator candidate shall describe system analysis techniques.***

- 21.3.1     Fault Trees
- 21.3.2     Failure Mode and Effects Analysis

**501-21.4**     ***The Investigator candidate shall describe the purpose for mathematical modeling.***

- 21.4.1     General and Limitations of Mathematical Modeling
- 21.4.2     Heat Transfer Analysis
- 21.4.3     Flammable Gas Concentrations
- 21.4.4     Hydraulic Analysis
- 21.4.5     Thermodynamic Chemical Equilibrium Analysis
- 21.4.6     Structural Analysis

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- 21.4.7 Egress Analysis
- 21.4.8 Fire Dynamics Analysis
- 21.4.9 Guidelines for Selection and Use of a Fire Model

**501-21.5**     ***The Investigator candidate shall describe the role of fire testing.***

- 21.5.1 Role of Fire Testing
- 21.5.2 Fire Test Methods
- 21.5.3 Limitations of Fire Testing

**501-21.6**     ***The Investigator candidate shall identify the data required for modeling and testing.***

- 21.6.1 Materials and Contents
- 21.6.2 Ventilation

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## SECTION 22 EXPLOSIONS

**NFPA 1033 4.1.7** In order to successfully complete the tasks identified in the JPRs of Sections 4.2 through 4.7, the fire investigator shall remain current in the subjects listed as “requisite knowledge” as they relate to fire investigations, which include the following:

- (1) Fire Science:
  - (d) Explosion Dynamics

### **4.2 Scene Examination.**

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.9** Discriminate the effects of explosions from other types of damage, given standard equipment and tools, so that an explosion is identified and its evidence is preserved.

- (A) Requisite Knowledge.** Different types of explosions and their causes, characteristics of an explosion, and the difference between low- and high-order explosions.
- (B) Requisite Skills.** Identify explosive effects on glass, walls, foundations, and other building materials; distinguish between low- and high-order explosion effects; and analyze damage to document the blast zone and origin.

### **References:**

**J&B-6, chapter 16**  
**Kirk's, chapter 3**  
**IFSTA-3, chapter 11**

### **501-22.1     The Investigator candidate shall define the term “explosion.”**

- 22.1.1     Damage and Effects
- 22.1.2     Overpressure and Unconfined Pressure

### **501-22.2     The Investigator candidate shall identify the different types of explosions.**

- 22.2.1     Mechanical Explosions
- 22.2.2     Boiling Liquid Expanding Vapor Explosion (BLEVE)
- 22.2.3     Chemical Explosions
- 22.2.4     Electrical Explosions
- 22.2.5     Nuclear Explosions

### **501-22.3     The Investigator candidate shall distinguish between the characterization of explosion damage.**

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- 22.3.1 Low-Order Damage
- 22.3.2 High-Order Damage

**501-22.4** ***The Investigator candidate shall be able to describe the effects of explosions.***

- 22.4.1 Blast Overpressure and Wave Effect
  - 22.4.1.1 General
  - 22.4.1.2 Positive Pressure Phase
  - 22.4.1.3 Negative Pressure Phase
  - 22.4.1.4 Shape of Blast Wave (Front)
  - 22.4.1.5 Rate of Pressure Rise versus Maximum Pressure
- 22.4.2 Shrapnel Effect (Projectiles)
- 22.4.3 Thermal Effect
- 22.4.4 Seismic Effect (Ground Shock)

**501-22.5** ***The Investigator candidate shall identify the factors controlling explosion effects.***

- 22.5.1 Fuel
- 22.5.2 Turbulence
- 22.5.3 Nature of Confining Space
- 22.5.4 Location and Magnitude of Ignition Source
- 22.5.5 Venting
- 22.5.6 Blast Pressure Wave (Blast Pressure Front) Modification by Reflection
- 22.5.7 Blast Pressure Front Modification by Refraction and Blast Focusing

**501-22.6** ***The Investigator candidate shall be able to identify a seated explosion.***

- 22.6.1 General
- 22.6.2 Explosives
- 22.6.3 Boiler and Pressure Vessels
- 22.6.4 Confined Fuel Gas and Liquid Vapor
- 22.6.5 Boiling Liquid Expanding Vapor Explosion (BLEVE)

**501-22.7** ***The Investigator candidate shall be able to identify a non-seated explosion.***

- 22.7.1 Fuel Gases
- 22.7.2 Pool Flammable/Combustible Liquids

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- 22.7.3 Dusts
- 22.7.4 Backdraft (Smoke Explosion)

**501-22.8**     ***The Investigator candidate shall be able to describe the characteristics of gas/vapor combustion explosions.***

- 22.8.1 Ignition of Gases and Vapors
- 22.8.2 Interpretation of Explosion Damage
  - 22.8.2.1 Fuel-to-Air Ratio
  - 22.8.2.2 Specific Gravity
- 22.8.3 Underground Migration of Fuel Gases
- 22.8.4 Multiple Explosions

**501-22.9**     ***The Investigator candidate shall describe the characteristics of dust explosions.***

- 22.9.1 General
- 22.9.2 Particle Size
- 22.9.3 Concentration
- 22.9.4 Turbulence in Dust Explosions
- 22.9.5 Moisture
- 22.9.6 Minimum Temperature and Ignition Energy for Dust
- 22.9.7 Multiple Explosions

**501-22.10**     ***The Investigator candidate shall be able to describe backdraft (smoke explosions).***

- 22.10.1 Insufficient Oxygen
- 22.10.2 Introduction of Oxygen

**501-22.11**     ***The Investigator candidate shall be able to identify an unconfined vapor cloud explosion.***

- 22.11.1 Turbulence Generation Ahead Of and With the Flame Front
- 22.11.2 Fuel Properties
- 22.11.3 Blast Waves
- 22.11.4 Chemical Processing Plants

**501-22.12**     ***The Investigator candidate shall be able to distinguish the two types of explosives.***

- 22.12.1 Low Explosives
- 22.12.2 High Explosives

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**501-22.13** ***The Investigator candidate shall describe the complexity of the investigation of explosive incidents.***

- 22.13.1 Specialized Training
- 22.13.2 Local and Federal Regulations

**501-22.14** ***The Investigator candidate shall be able to investigate the explosion scene.***

- 22.14.1 General
- 22.14.2 Securing the Scene
  - 22.14.2.1 Establishing the Scene
  - 22.14.2.2 Obtain Background Information
  - 22.14.2.3 Establish the Scene Search Pattern
  - 22.14.2.4 Safety at the Explosion Scene
- 22.14.3 Initial Scene Assessment
  - 22.14.3.1 General
  - 22.14.3.2 Identify Explosion or Fire
  - 22.14.3.3 Document Damage
  - 22.14.3.4 Seated or Non-Seated Explosion
  - 22.14.3.5 Identify Type of Explosion
  - 22.14.3.6 Identify Potential General Fuel Type
  - 22.14.3.7 Establish the Origin
  - 22.14.3.8 Establish Ignition Source
- 22.14.4 Detailed Scene Assessment
  - 22.14.4.1 Identify Damage Effects of Explosion
  - 22.14.4.2 Identify Pre-Blast and Post-Blast Fire Damage
  - 22.14.4.3 Locate and Identify Articles of Evidence
  - 22.14.4.4 Identify Force Vectors

**501-22.15** ***The Investigator candidate shall analyze the origin (epicenter) of an explosion scene.***

- 22.15.1 Analysis of Explosion Dynamics
- 22.15.2 Explosion Dynamics Diagram
- 22.15.3 Epicenter
- 22.15.4 Series of Explosions
- 22.15.5 Secondary Explosions

**501-22.16** ***The Investigator candidate shall analyze a fuel source.***

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- 22.16.1 Available Fuel Sources
- 22.16.2 Chemical Analysis
- 22.16.3 Air Samples
- 22.16.4 Fuel Identification
- 22.16.5 Gas Piping
- 22.16.6 Odorant Verification

**501-22.17** ***The Investigator candidate shall analyze the ignition source.***

- 1) Minimum Ignition Energy of the Fuel
- 2) Ignition Energy of the Potential Ignition Source
- 3) Ignition Temperature of the Fuel
- 4) Temperature of the Ignition Source
- 5) Location of the Ignition Source
- 6) Simultaneous Presence of the Fuel and Ignition Source
- 7) Witness Accounts

**501-22.18** ***The Investigator candidate shall analyze to establish cause.***

- 22.18.1 General
- 22.18.2 Time Line Analysis
- 22.18.3 Damage Pattern Analysis
  - 23.18.3.1 Debris Analysis
  - 23.18.3.2 Relative Structural Damage Analysis
- 22.18.4 Correlation of Explosion Type and Energy with Damage Incurred
- 22.18.5 Analysis of Damaged Items and Structures
- 22.18.6 Correlation of Thermal Effects

## **SECTION 23**

### **INCENDIARY FIRES**

#### **4.6 Post-Incident Investigation.**

Duties shall include the investigation of all factors beyond the fire scene at the time of the origin and cause determination.

**NFPA 1033 4.6.4** Establish evidence as to motive and/or opportunity, given an incendiary fire, so that the evidence is supported by documentation and meets the evidentiary requirements of the jurisdiction.

- (A) **Requisite Knowledge.** Types of motives common to incendiary fires, methods used to discover opportunity, and human behavioral patterns relative to fire-setting.
- (B) **Requisite Skills.** Financial analysis, records gathering and analysis, interviewing, and interpreting fire scene information and evidence for relationship to motive and/or opportunity.

**NFPA 1033 4.6.5** Formulate an opinion concerning origin, cause, or responsibility for the fire, given all investigative findings, so that the opinion regarding origin, cause, or responsibility for a fire is supported by the data, facts, records, reports, documents, and evidence.

- (A) **Requisite Knowledge:** Analytical methods and procedures (e.g., hypothesis development and testing, systems analysis, time lines, link analysis, fault tree analysis, and data reduction matrixing).
- (B) **Requisite Skills:** Analytical and assimilation skills.

**References:**  
J&B, chapter 15  
Kirk's, chapter 11  
IFSTA-3, chapter 13

**501-23.1**     **The Investigator candidate shall define “incendiary” fires.**

- a)            A Fire that is Intentionally Ignited in an Area or Under Circumstances Where and When There Should Not Be a Fire (3.3.124 NFPA 921 2024 edition)

**501-23.2**     **The Investigator candidate shall identify and describe indicators of incendiary fires.**

- 23.2.1     Multiple Fires
- 23.2.2     Trailers
- 23.2.3     Lack of Expected Fuel Load and Ignition Sources
- 23.2.4     Unusual Fuel Load or Configuration
- 23.2.5     Burn Injuries
- 23.2.6     Incendiary Devices
- 23.2.7     Assessment of Fire Growth and Fire Damage

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**501-23.3**     ***The Investigator candidate shall identify and explain potential indicators of incendiary fires not directly related to combustion.***

- 23.3.1     Remote Locations with View Blocked or Obscured
- 23.3.2     Forced Entry
- 23.3.3     Fires Near Service Equipment and Appliances
- 23.3.4     Removal or Replacement of Contents Prior to the Fire
  - 23.3.4.1     Replacement
  - 23.3.4.2     Removal
  - 23.3.4.3     Absence of Personal Items Prior to the Fire
- 23.3.5     Entry Blocked or Obstructed
- 23.3.6     Sabotage to the Structure or Fire Protection Systems
  - 23.3.6.1     Definition of Sabotage
  - 23.3.6.2     Damage to Fire-Resistive Assemblies
  - 23.3.6.3     Damage to Fire Protection Systems
- 23.3.7     Open Windows and Exterior Doors

**501-23.4**     ***The Investigator candidate shall identify and describe other evidentiary factors associated with incendiary fires.***

- 23.4.1     Evidentiary Factors That Should Be Recorded and Examined
- 23.4.2     Analysis of Confirmed Incendiary Fires
  - 23.4.2.1     Geographic Areas, or Clusters
  - 23.4.2.2     Temporal Frequency
  - 23.4.2.3     Materials and Method
- 23.4.3     Evidence of Other Crimes, Crime Concealment
- 23.4.4     Indications of Financial Stress
- 23.4.5     Existing or History of Code Violations
- 23.4.6     Owner with Fires at Other Properties
- 23.4.7     Over-Insurance
- 23.4.8     Timed Opportunity
  - 23.4.8.1     Fires During Severe Natural Conditions
  - 23.4.8.2     Fires During Civil Unrest
  - 23.4.8.3     Fire Department Unavailable
- 23.4.9     Motives for Fire-Setting Behavior
  - 23.4.9.1     Define “Motive”
  - 23.4.9.2     Motive Versus Intent
  - 23.4.9.3     Classifications of Motive
    - 23.4.9.3.1     Introduction

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- 23.4.9.3.2 Vandalism
  - 23.4.9.3.2.1 Willful and Malicious Mischief
  - 23.4.9.3.2.2 Peer or Group Pressure
- 23.4.9.3.3 Excitement
  - a. Thrill Seeking
  - b. Attention Seeking
  - c. Recognition
  - d. Sexual Gratification or Perversion
- 23.4.9.3.4 Revenge
  - a. Personal Retaliation
  - b. Societal Retaliation
  - c. Institutional Retaliation
  - d. Group Retaliation
- 23.4.9.3.5 Crime Concealment
  - a. Murder Concealment
  - b. Burglary Concealment
  - c. Destruction of Records or Documents
- 23.4.9.3.6 Profit
- 23.4.9.3.7 Extremism
  - a. Terrorism
  - b. Riot/Civil Disturbance

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## SECTION 24 FIRE AND EXPLOSION DEATHS AND INJURIES

### 4.4 Evidence Collection/Preservation.

Duties shall include using proper physical and legal procedures to identify, document, collect and preserve evidence required within the investigation.

**NFPA 1033 4.4.1** Utilize proper procedures for managing victims and fatalities, given a protocol and appropriate personnel, so that all evidence is discovered and preserved and the protocol procedures are followed.

- (A) **Requisite Knowledge.** Types of evidence associated with fire victims and fatalities and evidence preservation methods.
- (B) **Requisite Skills.** Observational skills and the ability to apply protocols to given situations.

### References:

J&B, chapter 12 and 15  
Kirk's, chapter 12  
IFSTA-3, chapter 10  
Konefal, Fire Death Scene Investigation  
ASTM E678

**501-24.1**     **The Investigator candidate shall demonstrate the ability to utilize specialized skills associated with death and injuries from fire and explosions.**

- a)        Toxicology
- b)        Pathology
- c)        Human Behavior

**501-24.2**     **The Investigator candidate shall identify the mechanisms of death and injury.**

- 24.2.1    Carbon Monoxide
- 24.2.2    Cyanide
- 24.2.3    Other Toxic Gases
- 24.2.4    Hyperthermia
- 24.2.5    Skin Burns
- 24.2.6    Inhalation of Hot Gases
- 24.2.7    Soot and Smoke
- 24.2.8    Hypoxia
- 24.2.9    Sublethal Inhalation Exposure Effects on the Individual
  - 24.2.9.1    Narcotic Gases
  - 24.2.9.2    Irritant Gases

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- 24.2.9.3 Smoke
- 24.2.10 Explosion-Related Injuries
  - 24.2.10.1 Blast Pressure Injuries
  - 24.2.10.2 Shrapnel Injuries
  - 24.2.10.3 Thermal Injuries
  - 24.2.10.4 Building Collapse Injuries

**501-24.3** ***The Investigator candidate shall describe the consumption of the body by fire.***

- 24.3.1 Skin
- 24.3.2 Muscle
- 24.3.3 Bone
- 24.3.4 Fat

**501-24.4** ***The Investigator candidate shall describe the postmortem changes that a deceased body will undergo when exposed to heat and to death.***

- 24.4.1 Lividity
- 24.4.2 Rigor Mortis

**501-24.5** ***The Investigator candidate shall describe the considerations to be made before the investigation of a fatal fire.***

- 24.5.1 Notification
- 24.5.2 The Fire Department
- 24.5.3 Team Investigation
- 24.5.4 Safety
- 24.5.5 Scene Documentation
- 24.5.6 Victim Documentation
- 24.5.7 Recovery of Bodies and Evidence
  - 24.5.7.1 Layering of Debris
  - 24.5.7.2 Sifting of Debris
  - 24.5.7.3 Body Removal
  - 24.5.7.4 Victim Clothing
- 24.5.8 Collection of Other Physical Evidence

**501-24.6** ***The Investigator candidate shall describe the steps of investigating fire scenes with injuries.***

- 24.6.1 Notification Laws
- 24.6.2 Scene Documentation

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- 24.6.3 Victim Documentation
- 24.6.4 Victim Timeline
- 24.6.5 Physical Evidence

**501-24.7**     ***The Investigator candidate shall describe the documentation of an explosion incident where injury and/or death has occurred.***

- 24.7.1 Collecting Physical Evidence from Explosions

**501-24.8**     ***The Investigator candidate shall describe post scene investigation of injuries.***

- 24.8.1 Burns
  - 24.8.1.1 Degree of Burns
  - 24.8.1.2 Body Area (Distribution)
- 24.8.2 Inhalation Medical Evidence
- 24.8.3 Hospital Tests and Documentation
- 24.8.4 Access to Medical Evidence

**501-24.9**     ***The Investigator candidate shall describe the fire death pathological and toxicological examination.***

- 24.9.1 The Coroner or Medical Examiner
- 24.9.2 Identifying the Remains
  - 24.9.2.1 Human vs. Animal Remains
  - 24.9.2.2 Visual Identification
  - 24.9.2.3 Identification by Clothing and Personal Effects
  - 24.9.2.4 Fingerprint Identification
  - 24.9.2.5 X-ray Identification
  - 24.9.2.6 DNA Identification
- 24.9.3 X-ray Examination
- 24.9.4 Carbon Monoxide Levels
- 24.9.5 Cyanide Levels
- 24.9.6 Presence of Other Toxicants
- 24.9.7 Smoke and Soot Exposure
- 24.9.8 Burns
- 24.9.9 Physical Trauma and Wounds
- 24.9.10 Stomach Contents
- 24.9.11 Internal Body Temperature
- 24.9.12 Pre-Existing Medical Conditions
- 24.9.13 Death Pre-Fire

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24.9.14 Death from a Medical Condition

**501-24.10** ***The Investigator candidate shall analyze the data developed from the death or injury investigation and correlate it with the other data from the investigation.***

- 24.10.1 Timeline Development
- 24.10.2 Victim Activity
- 24.10.3 Prefire Victim Impairment
- 24.10.4 Medical History
- 24.10.5 Fire Pattern
- 24.10.6 Burns
- 24.10.7 Clothing
- 24.10.8 Applications of Toxicology in Fire Investigation
  - 24.10.8.1 Toxicological Analysis Techniques
  - 24.10.8.2 Physiological Models
    - 24.10.8.2.1 The Steward Equation
    - 24.10.8.2.2 The Steward Equation Displayed
    - 24.10.8.2.3 The Colburn Forster Kane (CFK) Equation
    - 24.10.8.2.4 The Colburn Forster Kane (CFK) Equation Displayed
    - 24.10.8.2.5 Fire Modeling Program

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## SECTION 25 APPLIANCES

### 4.2 Scene Examination.

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.8** Inspect and analyze the performance of building systems, including fire protection, detection and suppression systems, HVAC, electricity and electrical systems, fuel gas systems, and building compartmentation, given standard and special equipment and tools, so that a determination can be made as to the need for expert resources; an operating system's impact on fire growth and spread is considered in identifying origin areas; defeated and failed systems are identified; and the system's potential as a fire cause is recognized.

**(A) Requisite Knowledge.** Different types of detection, suppression, HVAC, utility, and building compartmentation such as fire walls and fire doors; types of expert resources for building systems; the impact of fire on various systems; common methods used to defeat a system's functional capability; and types of failures.

**(B) Requisite Skills.** Determine the system's operation and its effect on the fire; identify alterations to, and failure indicators of, building systems; and evaluate the impact of suppression efforts on building systems.

### References:

J&B, chapter 7  
Kirk's, chapter 4  
IFSTA-3, chapter 9

### **501-25.1** ***The Investigator candidate shall analyze appliances as it relates to investigation of the cause of fires.***

- 25.1.1 Appliances as Ignition Sources
- 25.1.2 Appliance Components
- 25.1.3 Listed Appliance

### **501-25.2** ***The Investigator candidate shall record the scene involving an appliance.***

- 25.2.1 Recording Specific Appliances
- 25.2.2 Measurements of the Location of the Appliances
- 25.2.3 Positions of Appliance Controls
- 25.2.4 Document Appliance Information
- 25.2.5 Gathering All of the Parts from the Appliance

### **501-25.3** ***The Investigator candidate shall analyze the origin of fires involving appliances.***

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- 25.3.1 Relationship of the Appliance to the Origin
- 25.3.2 Fire Patterns
- 25.3.3 Plastic Appliance Components
- 25.3.4 Reconstruction of the Area of Origin

**501-25.4** ***The Investigator candidate shall analyze the cause of fires involving appliances.***

- 25.4.1 How the Appliance Generated Heat
- 25.4.2 The Use and Design of the Appliance
- 25.4.3 Electrical Appliances as Ignition Sources
- 25.4.4 Photographing Appliance Disassembly
- 25.4.5 Obtaining Exemplar Appliances
- 25.4.6 Testing Exemplar Appliances

**501-25.5** ***The Investigator candidate shall describe each of the common parts or components that might be found in various appliances.***

- 25.5.1 Appliance Housings
- 25.5.2 Power Sources
  - 25.5.2.1 Power Cords
  - 25.5.2.2 Voltages Less than 120
  - 25.5.2.3 Batteries
  - 25.5.2.4 Overcurrent Protection
- 25.5.3 Switches
  - 25.5.3.1 Manual Switches
  - 25.5.3.2 Automatic Switches
- 25.5.4 Solenoids and Relays
- 25.5.5 Transformers
- 25.5.6 Motors
- 25.5.7 Heating Elements
- 25.5.8 Lighting
  - 25.5.8.1 Fluorescent Lighting Systems
  - 25.5.8.2 High Intensity Discharge Lighting Systems
- 25.5.9 Miscellaneous Components

**501-25.6** ***The Investigator candidate shall describe the operation and components of common residential appliances.***

- 25.6.1 Range or Oven
- 25.6.2 Coffee Makers

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- 25.6.3 Toaster
- 25.6.4 Electric Can Opener
- 25.6.5 Refrigerator
- 25.6.6 Dishwasher
- 25.6.7 Microwave Oven
- 25.6.8 Portable Space Heater
- 25.6.9 Electric Blanket
- 25.6.10 Window Air Conditioner Unit
- 25.6.11 Hair Dryer and Hair Curler
- 25.6.12 Clothes Iron
- 25.6.13 Clothes Dryer
- 25.6.14 Consumer Electronics
- 25.6.15 Lighting

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## SECTION 26 MOTOR VEHICLE FIRES

### Annex A Explanatory Material

**NFPA 1033 A.1.1** The intent of this standard applies to all fire investigation, including outside, wildland, vehicle, and structural fires.

#### 4.1 General

**NFPA 1033 4.1.3** Because fire investigators are required to perform activities in adverse conditions, site safety assessments shall be completed on all scenes and regional and national safety standards shall be followed and included in organizational policies and procedures.

#### 4.2 Scene Examination.

Duties shall include inspecting, evaluating, and analyzing the fire scene or evidence of the scene, and conducting a comprehensive review of documentation generated during the examination(s) of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material(s) ignited, and action or activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

**NFPA 1033 4.2.4** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that each pattern is identified and analyzed with respect to the burning characteristics of the material involved, the stage of fire development, the effects of ventilation within the context of the scene, the relationship with all patterns observed, and the understanding of the methods of heat transfer that led to the formation of the patterns identified and analyzed, and the sequence in which the patterns were produced is determined.

**(A) Requisite Knowledge.** Fire dynamics, fire development, and the interrelationship of heat release rate, form, and ignitability of materials.

**(B) Requisite Skills.** Ability to interpret the effects of burning characteristics on different types of materials.

**NFPA 1033 4.2.5** Interpret and analyze fire patterns, given standard equipment and tools and some structural or content remains, so that fire development is determined, methods and effects of suppression are evaluated, false origin area patterns are recognized, and all areas of origin are correctly identified.

**(A) Requisite Knowledge.** Fire behavior and spread based on fire chemistry, fire dynamics, and physics, fire suppression effects, building construction.

**(B) Requisite Skills.** Interpret variations of fire patterns on different materials with consideration given to heat release rate, form, and ignitability; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

**NFPA 1033 4.2.6** Examine and remove fire debris, given standard equipment and tools, so that all debris is checked for fire cause evidence, potential ignition source(s) is identified, and evidence is preserved without investigator-inflicted damage or contamination.

**(A) Requisite Knowledge.** Basic understanding of ignition processes, characteristics of ignition sources, and ease of ignition of fuels; debris-layering techniques; use of tools and equipment during the debris search; types of fire cause evidence commonly found in various degrees of damage; and evidence-gathering methods and documentation.

**(B) Requisite Skills.** Employ search techniques that further the discovery of fire cause evidence and ignition sources, use search techniques that incorporate documentation, and collect and preserve evidence.

References:  
J&B, chapter 17  
Kirk's, chapter 7

**501-26.1**     **The Investigator candidate shall describe the factors related to the investigation of fires involving motor vehicles.**

- 26.1.1     Fire or Damage Patterns
- 26.1.2     Amount of Combustibles in Vehicles
- 26.1.3     Relatively Small Compartment Size

**501-26.2**     **The Investigator candidate shall describe the differences, in safety related concerns, that burned vehicles pose as compared to those found in structure fires.**

- 26.2.1     Undercarriage
- 26.2.2     Undeployed Restraint Systems
- 26.2.3     Fuel Leaks

**501-26.3**     **The Investigator candidate shall describe and identify the different types of fuels that may be involved in vehicle fires.**

- 26.3.1     Ignitable Liquids
  - 26.3.1.1     Hot Surface Ignition
- 26.3.2     Gaseous Fuels
- 26.3.3     Solid Fuels

**501-26.4**     **The Investigator candidate shall describe and identify the different ignition sources that can be present in vehicle fires.**

- 26.4.1     Open Flames
- 26.4.2     Electrical Sources
  - 26.4.2.1     Recreational Vehicles
  - 26.4.2.2     Overloaded Wiring
  - 26.4.2.3     Electrical High Resistance Connections
  - 26.4.2.4     Electrical Short Circuits and Arcs - Electric Discharge
  - 26.4.2.5     Arc, Carbon, Tracking
  - 26.4.2.6     Lamp Bulbs and Filaments
  - 26.4.2.7     External Electrical Sources Used in Vehicles
- 26.4.3     Hot Surfaces
- 26.4.4     Mechanical Sparks
- 26.4.5     Smoking Materials

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**501-26.5** ***The Investigator shall identify the different types of systems that a motor vehicle may possess and their respective functions.***

- 26.5.1 Fuel Systems
  - 26.5.1.1 Vacuum/Low-Pressure Carbureted Systems
  - 26.5.1.2 High-Pressure Fuel-Injected Systems
  - 26.5.1.3 Diesel Fuel System
  - 26.5.1.4 Natural Gas
  - 26.5.1.5 Propane Fuel
  - 26.5.1.6 Turbochargers
- 26.5.2 Emission Control System
- 26.5.3 Motor Vehicle Electrical Systems
- 26.5.4 Mechanical Power Systems
- 26.5.5 Mechanical Power Distribution
- 26.5.6 Accessories to the Mechanical Power System
- 26.5.7 Hydraulic Braking System
- 26.5.8 Windshield Washer Systems

**501-26.6** ***The Investigator candidate shall identify the different body systems that can be found within or upon motor vehicles.***

- 26.6.1 Interior Finishes and Accessories
- 26.6.2 Cargo Areas

**501-26.7** ***The Investigator candidate shall identify and employ the proper technique for investigating motor vehicle fires.***

- 26.7.1 Vehicle Identification
- 26.7.2 Vehicle Fire Scene History
- 26.7.3 Vehicle Particulars
- 26.7.4 Documenting the Vehicle at the Fire Scene
- 26.7.5 Documenting the Vehicle Away from the Scene

**501-26.8** ***The Investigator candidate shall identify factors related to the examination of motor vehicles after they have burned.***

- 26.8.1 General
- 26.8.2 Examination of Vehicle Systems
- 26.8.3 Switches, Handles, and Levers

**501-26.9** ***The Investigator candidate shall define total burns as it relates to motor vehicle fires and describe the actions that should be taken when these types of fires are encountered.***

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- 26.9.1 Total Burns
- 26.9.2 Prefire Conditions

**501-26.10** **The Investigator candidate shall identify factors related to incendiary vehicle fires.**

- 26.10.1 Drive Train Fluids
- 26.10.2 Ignition Lock Cylinder Wafer

**501-26.11** **The Investigator shall identify components of the vehicle's ignition system as they relate to the fire investigation.**

- 26.11.1 Inspection of Cut Key-Style Ignition Lock
  - 26.11.1.1 Ignition Lock Cylinder
  - 26.11.1.2 Post-Fire Recovery of the Lock Cylinder
  - 26.11.1.3 Detail Examination of Ignition Locks
  - 26.11.1.4 Unrecovered Ignition Lock Remains

**501-26.12** **The Investigator candidate shall identify factors concerning vehicle fires in structures and evaluate them as a potential source of fire ignition.**

- 26.12.1 External to the Vehicle
- 26.12.2 Status of Repair

**501-26.13** **The Investigator candidate shall identify and describe the factors relative to the investigation of recreational vehicle fires.**

- 26.13.1 General
- 26.13.2 Confined Spaces
- 26.13.3 Recreational Vehicle (RV)
- 26.13.4 Unique Systems or Components
- 26.13.5 Systems
- 26.13.6 Construction
- 26.13.7 Recreational Vehicle Examinations
- 26.13.8 Ignition Sources
- 26.13.10 Recreational Vehicle Information
- 26.13.11 Recreational Vehicles in Structures, Parks, and Campgrounds

**501-26.14** **The Investigator candidate shall identify the factors related to fire investigations involving heavy equipment.**

- 26.14.1 Medium- and Heavy-Duty Trucks, and Buses
- 26.14.2 Mass Transit Vehicles
- 26.14.3 Earth-Moving Equipment

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- 26.14.4 Forestry/Logging Equipment
- 26.14.5 Landfill Equipment
- 26.14.6 Agricultural Equipment

**501-26.15** ***The Investigator candidate shall identify the factors related to fire investigations involving self-propelled agricultural equipment and drawn implements.***

- 26.15.1 Agricultural Equipment Investigation Safety
- 26.15.2 Equipment Classification and Description
- 26.15.3 Unique Safety Concerns
- 26.15.4 Unique Fire Cause Concerns
- 26.15.5 Fuels
- 26.15.6 Ignition Sources

**501-26.16** ***The Investigator candidate shall identify factors related to the investigation of fires involving Hybrid Electric Vehicles (HEV) and Electric Vehicles (EV).***

- 26.16.1 HEV and EV Investigation Safety
- 26.16.2 HEV and EV Electrical Systems
- 26.16.3 Investigation of HEV and EV Fires

**501-26.17** ***The Investigator candidate shall identify factors related to towing or vehicle transport as it relates to fire investigations.***

- 26.17.1 NFPA Response Guides for Alternative Fuel Vehicles
- 26.17.2 Transportation Safety of Vehicles, including HEVs or EVs

**501-26.18** ***The Investigator candidate shall identify factors related to the investigation of fires involving hydrogen fueled vehicles.***

- 26.18.1 Hydrogen-Fueled Vehicle Investigation Safety
- 26.18.2 Natural-Gas-Fueled Vehicle Investigation Safety
- 26.18.3 Liquefied-Propane-Fueled Vehicle Investigation Safety
- 26.18.4 Pressure Vessels

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## **SECTION 27**

### **WILDFIRE INVESTIGATIONS**

**Annex A Explanatory Material**

**NFPA 1033 A.1.1** The intent of this standard applies to all fire investigation, including outside, wildland, vehicle, and structural fires.

**References:**

**J&B, chapter 18**

**Kirk's, chapter 7**

**501-27.1**     **The Investigator candidate shall identify the specialized techniques, practices, equipment, and terminology associated with the investigation of wildfires.**

- a)           Unique Nature of Wildfire Investigations
- b)           Methodology

**501-27.2**     **The Investigator candidate shall establish the scope of a wildfire incident.**

- a)           Responsibility of Investigation
- b)           Analyzing Wildfire Incidents
- c)           Rendering Opinions

**501-27.3**     **The Investigator candidate shall define the purpose of a wildfire investigation.**

- a)           Establish Guidelines
- b)           Recommendations

**501-27.4**     **The Investigator candidate shall apply terminology specific to wildfire investigations.**

- a)           Terminology
- b)           See Section 3.5 of NFPA 921 (2024 edition)

**501-27.5**     **The Investigator candidate shall follow the Basic Methodology of a wildfire investigation.**

- 27.5.1     Investigation
- 27.5.2     Methodology for Origin Determination
- 27.5.3     Sequence of Investigation Activities
- 27.5.4     Pattern Analysis
- 27.5.5     Systematic Procedure

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27.5.6 Guidance for Processing a Wildfire Scene

**501-27.6** ***The Investigator candidate shall apply Fire Science principles as related to wildfire investigations.***

- 27.6.1 Behavior at the Fire Origin
- 27.6.2 Fire Shape
- 27.6.3 References
- 27.6.4 Wildland Fuels
- 27.6.5 Weather
- 27.6.6 Topography
- 27.6.7 Degree of Damage
- 27.6.8 Die-Out

**501-27.7** ***The Investigator candidate shall evaluate fire pattern indicators for determining direction of fire travel.***

- 27.7.1 Wildfire V- and U-Shaped Pattern Indicators
- 27.7.2 Angle-of-Char Fire Pattern Indicators
- 27.7.3 Angle-of-Char, Grass Clumps
- 27.7.4 Grass Stems
- 27.7.5 White Ash Deposit Pattern Indicators
- 27.7.6 Cupping and Taper Indicators
- 27.7.7 Protection Fire Pattern Indicators
- 27.7.8 Staining and Sooting Fire Pattern Indicators
- 27.7.9 Spalling Fire Pattern Indicator
- 27.7.10 Foliage Freeze
- 27.7.11 Curling

**501-27.8** ***The Investigator candidate shall assess safety at a wildfire incident.***

- 27.8.1 Safety Assessment
- 27.8.2 Hazards

**501-27.9** ***The Investigator candidate shall determine the origin area.***

- 27.9.1 Systematic Approach
- 27.9.2 Initial Area of Investigation
- 27.9.3 General Origin Area
- 27.9.4 Processing the General Origin Area
- 27.9.5 Specific Origin and Ignition Areas

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**501-27.10**    **The Investigator candidate shall determine the cause of wildfires.**

27.7.1    Ignition Sources

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## **SECTION 28**

### **MANAGEMENT OF COMPLEX INVESTIGATIONS**

**NFPA 1033 4.1 General**

**NFPA 1033 4.1.6** The fire investigator shall understand the organization and operation of the investigative team within an incident management system.

**References:**  
J&B, chapter 12

**501-28.1**     **The Investigator candidate shall distinguish those issues that are unique to managing investigations that are complex due to size, scope, or duration.**

- 28.1.1     Governmental Inquiry
- 28.1.2     Intent
- 28.1.3     Purpose
- 28.1.4     Interested Parties
- 28.1.5     Chapter Definitions

**501-28.2**     **The Investigator candidate shall describe the basic information and documents associated with complex investigations.**

- a)           Blueprints
- b)           Building Plans
- c)           Site Plans
- d)           Schematics
- e)           Manuals

**501-28.3**     **The Investigator candidate shall recognize the importance of communications among interested parties.**

- 28.3.1     Notice to Interested Parties
  - 28.3.1.1     Entity in Control
  - 28.3.1.2     All Interested Parties
  - 28.3.1.3     Roster of Interested Parties
  - 28.3.1.4     Notification of Changes
  - 28.3.1.5     Making Notification
  - 28.3.1.6     Content of Notification
  - 28.3.1.7     Subsequent Notifications
- 28.3.2     Meetings

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- 28.3.2.1 Preliminary Meeting
- 28.3.2.2 Meetings as the Investigation Progresses
- 28.3.3 Website
- 28.3.4 Additional Dissemination of Information

**501-28.4** ***The Investigator candidate shall recognize the complexity of the investigation and ensure that all known interested parties are afforded an opportunity to investigate the incident and protect their respective interests, understandings or agreements.***

- 28.4.1 Purposes
- 28.4.2 Scheduling
- 28.4.3 Cost Sharing
- 28.4.4 Nondisclosure Agreements
- 28.4.5 Protocols
- 28.4.6 Information Sharing
- 28.4.7 Interviews
- 28.4.8 Amendments to Agreements
- 28.4.9 Disagreements

**501-28.5** ***The Investigator candidate shall identify and describe the components of managing a complex investigation.***

- 28.5.1 Organizational Models
- 28.5.2 Control of the Site and Scene
  - 28.5.2.1 Securing the Site and Scene
  - 28.5.2.2 Delegation of Control
  - 28.5.2.3 Transfer of Control
  - 28.5.2.4 Site and Scene Access
  - 28.5.2.5 Site-Specific Restrictions or Requirements
  - 28.5.2.6 Scene Integrity
  - 28.5.2.7 Release of Information

**501-28.6** ***The Investigator candidate shall recognize the unique components of handling evidence of a complex investigation.***

- 28.6.1 Evidence Control
  - 29.6.1.1 Evidence Custodian
  - 29.6.1.2 Interested Party Responsibility
- 28.6.2 Evidence Removal from the Scene
- 28.6.3 Evidence Storage
- 28.6.4 Evidence Inspections

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- 28.6.4.1 Nondestructive Inspections
- 28.6.4.2 Destructive Inspections
- 28.6.4.3 Testing of Evidence

**501-28.7**     ***The Investigator candidate shall identify logistical support needs involving the complex investigation.***

- 28.7.1     Transportation
- 28.7.2     Equipment
- 28.7.3     Investigation Site Security
- 28.7.4     Decontamination
- 28.7.5     Environmental
- 28.7.6     Communications
- 28.7.7     Sanitary and Comfort Needs
- 28.7.8     Trash Disposal and Removal
- 28.7.9     Snow and Ice Removal
- 28.7.10    Lighting
- 28.7.11    Evidence Storage

**501-28.8**     ***The Investigator candidate shall distinguish the unique characteristics of safety at the complex investigation site.***

- 28.8.1     Continual Safety Monitoring

## SECTION 29 MARINE FIRE INVESTIGATION

### Annex A Explanatory Material

**NFPA 1033 A.1.1** The intent of this standard applies to all fire investigation, including outside, wildland, vehicle, and structural fires.

### References:

J&B, chapter 17

Kirk's, chapter 7

**501-29.1**     **The Investigator candidate shall identify the factors related to the investigations of fires involving recreational boats.**

- a)            Motor Vessels
- b)            Sailing Vessels
- c)            Yachts
- d)            Other Watercraft

**501-29.2**     **The Investigator candidate shall define the following terms as they relate to Power Boat and Sailboat terminology.**

- 29.2.1     Accommodation Space
- 29.2.2     Adrift
- 29.2.3     Afloat
- 29.2.4     Aft
- 29.2.5     Aground
- 29.2.6     Allison
- 29.2.7     Beam
- 29.2.8     Below
- 29.2.9     Berth
- 29.2.10    Bilge
- 29.2.11    Boat
- 29.2.12    Bulkhead
- 29.2.13    Cabin
- 29.2.14    Capsize
- 29.2.15    Chain plate
- 29.2.16    Confined Space
- 29.2.17    Deck
- 29.2.18    Dewater

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- 29.2.19 Docking Facility
- 29.2.20 Dorade Vent
- 29.2.21 Fender
- 29.2.22 Forward
- 29.2.23 Freeboard
- 29.2.24 Galley
- 29.2.25 Gear
- 29.2.26 Gunwale
- 29.2.27 Hard (On the Hard)
- 29.2.28 Hatch
- 29.2.29 Hold
- 29.2.30 Hull
- 29.2.31 Inboard
- 29.2.32 Inboard/Out-Drive (I/O)
- 29.2.33 Lazarette
- 29.2.34 Moor
- 29.2.35 Mooring
- 29.2.36 Outboard
- 29.2.37 Overboard
- 29.2.38 Port
- 29.2.39 Raw Water
- 29.2.40 Rub Rail
- 29.2.41 Ship
- 29.2.42 Shore Power
- 29.2.43 Shroud
- 29.2.44 Sole
- 29.2.45 Starboard
- 29.2.46 Superstructure
- 29.2.47 Topside
- 29.2.48 Transom
- 29.2.49 Underway
- 29.2.50 Vessel
- 29.2.51 Waterline
- 29.2.52 Wharf

**501-29.3**     ***The Investigator candidate shall recognize the importance of boat investigation safety.***

- 29.3.1     Safety Assessment

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- 29.3.2 Inspection of Boats on Land
- 29.3.3 Inspection of Boats Afloat
- 29.3.4 Underwater Inspections
- 29.3.5 Specific Safety Concerns
  - 29.3.5.1 Confined Spaces
    - 29.3.5.1.1 Automatic Fire Suppression Systems Inactive/Deactivated
  - 29.3.5.2 Airborne Particulates
  - 29.3.5.3 Identify and Assess Energy Sources
    - 29.3.5.3.1 Batteries
    - 29.3.5.3.2 Inverters
    - 29.3.5.3.3 Shore Power
  - 29.3.5.4 Fuel Leaks
  - 29.3.5.5 Sewage Holding Tank
  - 29.3.5.6 Hydrogen Gas
  - 29.3.5.7 Other Hydrocarbon Contaminants
  - 29.3.5.8 Stability
  - 29.3.5.9 Damage to the Structure of the Vessel
  - 29.3.5.10 Wharves, Docks, and Jetties
  - 29.3.5.11 Submerged Vessel
  - 29.3.5.12 Visual Distress Signals and Pyrotechnics
- 29.3.6 Openings

**501-29.4** ***The Investigator candidate shall identify the different marine systems and functions.***

- 29.4.1 Fuel Systems: Propulsion and Auxiliary
  - 29.4.1.1 Vacuum/Low Pressure Carbureted
  - 29.4.1.2 Gasoline High-Pressure/Marine Fuel Injection Systems, Including Return Systems
  - 29.4.1.3 Diesel High-Pressure/Marine Fuel Injection Systems, Including Return Systems
- 29.4.2 Fuel Systems: Cooking and Heating
  - 29.4.2.1 Liquefied Petroleum Gases
  - 29.4.2.2 Compressed Natural Gas
  - 29.4.2.3 Alcohol
  - 29.4.2.4 Solid Fuels
  - 29.4.2.5 Diesel
- 29.4.3 Turbochargers/Super Chargers

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- 29.4.4 Exhaust System
  - 29.4.4.1 Dry Exhaust Systems
  - 29.4.4.2 Wet Exhaust Systems
  - 29.4.4.3 De-watered Exhaust Systems
- 29.4.5 Electrical Systems
  - 29.4.5.1 Alternating Current (AC)
  - 29.4.5.2 Direct Current (DC)
- 29.4.6 Engine Cooling Systems
- 29.4.7 Ventilation
- 29.4.8 Transmissions
  - 29.4.8.1 Mechanical Gear Transmissions
  - 29.4.8.2 Hydraulic-Geared Transmissions
- 29.4.9 Accessories

**501-29.5** ***The Investigator candidate shall identify the exterior construction of the vessel.***

- 29.5.1 Hull Construction
- 29.5.2 Superstructure Construction Material
- 29.5.3 Deck
- 29.5.4 Exterior Accessories

**501-29.6** ***The Investigator candidate shall identify the interior construction of the vessel.***

- 29.6.1 Construction Materials
- 29.6.2 Finishes
- 29.6.3 Accommodation Furnishings
- 29.6.4 Interior Accessories
- 29.6.5 Engine/Machinery Compartments
- 29.6.6 Flammable/Explosive Vapor Detectors
- 29.6.7 Storage and Holds
- 29.6.8 Fuel Tanks

**501-29.7** ***The Investigator candidate shall identify the propulsion system of the vessel.***

- 29.7.1 Electric Systems
- 29.7.2 Fuels for Boats with Motorized Propulsion Systems
  - 29.7.2.1 Fuel Systems
    - 29.7.2.1.1 Engines

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- 29.7.2.1.1.1 Outboard Engines (Outboard Motors)
- 29.7.2.1.1.2 Inboard Gasoline Engines and Storage Tanks
- 29.7.2.1.1.3 Diesel Engines
- 29.7.2.1.1.4 Propulsion System Fluids
- 29.7.2.2 Appliance Fuel Systems
- 29.7.2.3 Electric Generators
- 29.7.3 Other Fuel Systems Used for Propulsion

**501-29.8** ***The Investigator candidate shall identify common ignition sources found in marine vessels.***

- 29.8.1 Open Flames
- 29.8.2 Electrical Sources
  - 29.8.2.1 Overloaded Wiring
  - 29.8.2.2 Electrical Short Circuiting and Arcs
  - 29.8.2.3 Electrical Connections
  - 29.8.2.4 Lightning
  - 29.8.2.5 Static Electricity and Incendive Arcs
- 29.8.3 Hot Surfaces
  - 29.8.3.1 Engine Surfaces
  - 29.8.3.2 Exhaust Systems
  - 29.8.3.3 Cooking Surfaces
  - 29.8.3.4 Heating Systems
- 29.8.4 Mechanical
  - 29.8.4.1 Bearing Failures
  - 29.8.4.2 Friction
- 29.8.5 Smoking Materials

**501-29.9** ***The Investigator candidate shall describe proper documentation of the boat fire scene.***

- 29.9.1 On Land
- 29.9.2 In Water
  - 29.9.2.1 Moored
  - 29.9.2.2 Anchored and Underway
  - 29.9.2.3 Underwater
  - 29.9.2.4 Shore Power System(s)
- 29.9.3 Vessel Identification

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- 29.9.3.1 Hull Identification Number (HIN)
- 29.9.3.2 Registration Numbers
- 29.9.3.3 U.S. Coast Guard Documentation Numbers
- 29.9.3.4 Vessel Name and Hailing Port
- 29.9.3.5 Vessel History
- 29.9.3.6 Fire Scene History
  - 29.9.3.6.1 Actions Before the Fire
  - 29.9.3.6.2 Actions During the Fire
  - 29.9.3.6.3 Actions After the Fire
- 29.9.4 Vessel Particulars

**501-29.10** ***The Investigator candidate shall identify the steps of a proper vessel examination.***

- 29.10.1 General
- 29.10.2 Examination of Vessel Systems

**501-29.11** ***The Investigator candidate shall describe marine fire investigations of vessels in structures.***

- 29.11.1 Vessels Within Garages and Carport
- 29.11.2 Storage of Vessels in Buildings
- 29.11.3 Vessels Moored Afloat

**501-29.12** ***The Investigator candidate shall describe legal considerations related to marine fire investigations.***

## **SECTION 30**

### **PRACTICAL EXERCISES**

#### **4.7 Presentations.**

Duties shall include the presentation of findings to those individuals not involved in the actual investigations.

**NFPA 1033 4.7.1** Prepare a written report, given investigative findings, so that the report accurately reflects the facts, data, and scientific principles on which the investigator relied; clearly identifies and expresses the investigator's opinions and conclusions; and contains the reasoning by which each opinion or conclusion was reached in order to meet the requirements of the intended audience(s).

**(A) Requisite Knowledge.** Elements of writing, typical components of a written report, and types of audiences and their respective needs or requirements.

**(B) Requisite Skills.** Writing skills, ability to analyze information and determine the reader's needs or requirements.

**NFPA 1033 4.7.2** Express investigative findings verbally, given investigative findings, notes, a time allotment, and a specific audience, so that the information is accurate, the presentation is completed within the allotted time, and the presentation includes only need-to-know information for the intended audience.

**(A) Requisite Knowledge.** Types of investigative findings, the informational needs of various types of audiences, and the impact of releasing information.

**(B) Requisite Skills.** Communication skills and ability to determine audience needs and correlate findings.

**NFPA 1033 4.7.3** Testify during legal proceedings, given investigative findings, contents of reports, and consultation with legal counsel, so that all pertinent investigative information and evidence are presented clearly and accurately, and the investigator's demeanor and attire are appropriate to the proceedings.

**(A) Requisite Knowledge.** Types of investigative findings, types of legal proceedings, professional demeanor requirements, and an understanding of due process and legal proceedings.

**(B) Requisite Skills.** Communication and listening skills and ability to differentiate facts from opinion and determine accepted procedures, practices, and etiquette during legal proceedings.

**501-30.1** ***The Investigator candidate shall demonstrate proficiency in all required skills in the TCFP Fire Investigator Skills Manual.***