CERTIFICATION CURRICULUM MANUAL

CHAPTER FIVE

FIRE INVESTIGATOR

NFPA 1033, 2009 Edition

EFFECTIVE JUNE 1, 2011

Texas Commission on Fire Protection
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RECOMMENDED 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

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 (7th ed.) (2009). Stillwater, OK: Fire Protection Publications. International Fire Service Training Association.

Fire Investigator (2nd ed.) (2010). Stillwater OK: Fire Protection Publications. International Fire Service Training Association (IFSTA).

Fire Investigation, Clifton Park, NY. 2009. 1st edition. Delmar Publishing

NFPA 921: Guide for Fire and Explosion Investigations (2008 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.

NFPA 1033: Standard for Professional Qualifications for Fire Investigator (2009 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.

Rules of Criminal Evidence, latest edition. (On 02/01/11, this information was available online at http://www.courts.state.tx.us/rules/tre-toc.asp).

Texas Code of Criminal Procedure, latest edition. (On 02/01/11, this information was available online at http://www.statutes.legis.state.tx.us/).

Texas Commission on Fire Protection, *Fire Investigator Curriculum.*

Standards Manual for Fire Protection Personnel. Austin, TX: Texas Commission on Fire Protection.

Texas Family Code, latest edition. (On 02/01/11, this information was available online at http://www.statutes.legis.state.tx.us/).

Texas Insurance Code, latest edition. (On 02/01/11, this information was available online at http://www.statutes.legis.state.tx.us/).

Texas Penal Code, latest edition. (On 02/01/11, this information was available online at http://www.statutes.legis.state.tx.us/).

Texas Public Information Act Handbook, latest edition. (On 02/01/11, this information was available online at

http://www.oag.state.tx.us/AG_publications/pdfs/publicinfo_hb.pdf. It is available through the Texas Attorney General's office.)

United States Code Annotated, latest edition. (On 02/01/11, this information was available online at http://www.gpo.gov/fdys/).

United States Constitution. (On 02/01/11, this information was available online at http://www.archives.gov/exhibits/charters/charters.html).

Recommended References

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

Texts

DeHaan, John D., *Kirk's Fire Investigation*, (6th ed.) (2006). Upper Saddle River, NJ: Brady/Prentice Hall.

Fire in Texas, Texas State Fire Marshals Office. Department of Insurance, TEXFIRS section.

NFPA 472: Standard for Professional Competence of Responders to Hazardous Materials Incidents (2008 ed.). Quincy, MA: National Fire Protection Association. NFPA Publications.

Factury Mutual Insurance – Fire Investigators Handbook

The VIN number book - Passenger Vehicle Identification Manual (2010, 81st edition) National Insurance Crime Bureaau, 1111 E. Touhy Avenue, Suite 400, Des Plaines, IL 60018-2805

TX State FMO Lab submittal guide (Forensic Arson Laboratory Guidelines for Evidence) (http://www.tdi.state.tx.us/fire/documents/fmlabguideline.pdf)

US DOJ (Fire and Arson Scene Evidence) (http://www.ncjrs.gov/pdffiles1/nij/181584.pdf)

Investigation of Motor Vehicles. 4th ed. Lee S. Cole. (Lee Books)

Instructor/Course Resource

- NFPA User's Manual for NFPA 921,
- Forensic Fire Scene Reconstruction (2nd Edition), David J. Icove & John D. DeHaan
- Along with all the other references on our curriculum list

CHAPTER FIVE
FIRE INVESTIGATOR
COURSE OUTLINE

SECTION	SUBJECT	RECOMMENDED HOURS
501-1	Commission on Fire Protection Rules and Regulations	0
501-2	INTENTIONALLY LEFT BLANK	0
501-3	Definitions	0
501-4	Basic Methodology	2
501-5	Basic Fire Science	8
501-6	Fire Patterns	8
501-7	Building Systems	4
501-8	Electricity and Fire	8
501-9	Building Fuel Gas Systems	4
501-10	Fire-Related Human Behavior	2
501-11	Legal Considerations	8
501-12	Safety	2
501-13	Sources of Information	8
501-14	Planning the Investigation	2
501-15	Documentation of the Investigation	8
501-16	Physical Evidence	4
501-17	Origin Determination	8
501-18	Fire Cause Determination	4
501-19	Analyzing the Incident for Cause and Responsibility	8
501-20	Failure Analysis and Analytical Tools	8
501-21	Explosions	4
501-22	Incendiary Fires	8
501-23	Fire and Explosion Deaths and Injuries	4
501-24	Appliances	2
501-25	Motor Vehicle Fires	8
501-26	Wildfire Investigations	3
501-27	Management of Complex Investigations	2
501-28	Marine Fire Investigations	3
501-29	Practical Exercises	20
	TOTAL HOURS RECOMMENDED	**150**

* The recommended hours for skills evaluation 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.

CHAPTER FIVE
FIRE INVESTIGATOR
COURSE PHASE OUTLINE

SECTION	SUBJECT	RECOMMENDED HOURS
FIRE INVESTIGATOR I – PHASE I		
501-4	Basic Methodology	2
501-14	Planning the Investigation	2
501-13	Sources of Information	4
501-11	Legal Considerations	6
501-12	Safety	2
501-5	Basic Fire Science	4
501-6	Fire Patterns	6
501-7	Building Systems	4
501-9	Building Fuel Gas Systems	2
501-17	Origin Determination	6
501-15	Documentation of the Investigation	6
501-16	Physical Evidence	4
501-29	Practical Exercises*	6
	Total Recommended Hours	**54**
FIRE INVESTIGATOR II – PHASE II		
501-18	Fire Cause Determination	4
501-10	Fire-Related Human Behavior	2
501-21	Explosions	4
501-23	Fire and Explosion Deaths and Injuries	3
501-8	Electricity and Fire	6
501-22	Incendiary Fires	6
501-19	Analyzing the Incident for Cause and Responsibility	6
501-20	Failure Analysis and Analytical Tools	6
501-24	Appliances	2
501-25	Motor Vehicle Fires	3
501-28	Marine Fire Investigations	2
501-26	Wildfire Investigations	2
501-27	Management of Complex Investigations	2
501-29	Practical Exercises*	8
	Total Recommended Hours	**56**
COMPLETER – PHASE III		
	Investigator I and II Review	8
501-29	Practical Exercises*	32
	Total Recommended Hours	**40**
TOTAL HOURS RECOMMENDED		**150**

*The recommended hours for skills evaluation 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

	LOCATION IN CURRICULUM MANUAL	
Objective	**Curriculum Manual Section**	**SKILL**
4.1	**GENERAL**	
4.1.1	1	None
4.1.2	4	None
4.1.3	12	None
4.1.4	13	None
4.1.5	11	None
4.1.6	14 , 27	None
4.2	**SCENE EXAMINATION**	
4.2.1	14,16	1
4.2.2	12, 17	2, 27
4.2.3	17	3
4.2.4	5 , 6	4
4.2.5	5, 6, 7	5
4.2.6	5, 14, 16	6
4.2.7	6	7
4.2.8	7, 8, 9, 13, 24	8
4.2.9	21	6
4.3	**DOCUMENTING THE SCENE**	
4.3.1	15, 16	9
4.3.2	15	10
4.3.3	11, 15	11
4.4	**EVIDENCE COLLECTION/PRESERVATION**	
4.4.1	16, 23	12
4.4.2	11, 16	12
4.4.3	16	12
4.4.4	11, 16	13
4.4.5	16	14
4.5	**INTERVIEW**	
4.5.1	13	15
4.5.2	13	16
4.5.3	13	17
4.6	**POST-INCIDENT INVESTIGATION**	
4.6.1	19, 20	18
4.6.2	15, 19, 20	19
4.6.3	11, 13	20
4.6.4	10, 22	21
4.6.5	17, 18, 19, 20	22
4.7	**PRESENTATIONS**	
4.7.1	29	23
4.7.2	29	24
4.7.3	11, 29	25
4.7.4	29	26
Annex A	**EXPLANATORY MATERIAL**	
A.1.1	25, 26, 28	None

SUPPLEMENT TO THE
FIRE INVESTIGATOR CURRICULUM

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

TCFP	NFPA 1033	Text References	Page/ Chap.
501-1	4.1	NFPA 1033: Professional Qualifications for Fire Investigator	
501-2		***INTENTIONALLY LEFT BLANK***	
501-3	1.3.8	NFPA 921: Guide to Fire and Explosives Investigation	Chap. 3
501-4	4.1.2	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator	Chap. 4 215-217
501-5	4.2.4 4.2.5 4.2.6	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator Delmar Fire Investigation	Chap. 5 Chap. 3, 11, 14, 15, 16 135, 141,143-144, 146, 154-155, 249, 265, 281-283
501-6	4.2.4 4.2.5 4.2.7	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator Delmar Fire Investigation	Chap. 6 Chap. 14, 15, 16 222, 255-257, 269, 308
501-7	4.2.5 4.2.8 4.2.2	NFPA 921: Guide for Fire and Explosion Investigation IFSTA, Fire Inspection and Code Enforcement Emergency Response Guidebook Delmar Fire Investigation IFSTA Fire Investigator	Chap. 7 567-569, 579, 585-586, 591-604, 609, 838-843 220-223, 244 Chap. 6
501-8	4.2.8	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator	Chap. 8 Chap. 6
501-9	4.2.8	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator	Chap. 9 Chap. 6
501-10	4.6.4	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator	Chap. 10 Chap. 16
501-11	4.1.5 4.3.3 4.4.2 4.4.4 4.6.3 4.7.3	NFPA 921: Guide for Fire and Explosion Investigation Delmar Fire Investigation	Chap. 11 100-104, 111-112,117-118, 122-125, 162, 168, 327-329, 377, 452, 480, 502-503, 519

		IFSTA Fire Investigator	Chap. 10, 11
501-12	4.1.3 4.2.2	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 12
		Delmar Fire Investigation	33, 37, 42-43, 45-47, 137, 143,154-155, 157, 168, 299-302, 483
		IFSTA Fire Investigator	Chap. 13, 14, 16
501-13	4.1.4 4.2.8 4.5.1 4.5.2 4.5.3 4.6.3	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 13
		IFSTA Fire Investigator	Chap. 6, 12
		Delmar Fire Investigation	421, 445-459, 483-484
501-14	4.1.6 4.2.1 4.2.6	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 14
		IFSTA Fire Investigator	Chap. 2, 15
501-15	4.3.1 4.3.2 4.3.3 4.6.2	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 15
		IFSTA Fire Investigator	Chap. 10 315, 345 Appendix E
		Delmar Fire Investigation	427-428, 431, 434-437
501-16	4.2.1 4.2.6 4.3.1 4.4.1 4.4.2 4.4.3 4.4.4 4.4.5	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 16
		Delmar Fire Investigation	165, 168, 172, 177, 181-186, 207, 254-255, 249, 258-259, 318, 338, 341
		IFSTA Fire Investigator	Chap 11, 15, 16
501-17	4.2.2 4.2.3 4.6.5	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 17
		Delmar Fire Investigation	65, 135-136, 138-139, 142, 144, 149-150,162, 175-176, 220-223, 269-271, 281- 285, 293, 303, 308, 318, 328-329, 429
		IFSTA, Fire Inspection and Code Enforcement	123-129, 169, 179, 189-190
		IFSTA Fire Investigator	Chap. 3, 5, 7, 11, 14
501-18	4.6.5	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 18
		IFSTA Fire Investigator	Chap. 14, 16
		Delmar Fire Investigation	168, 327-328
501-19	4.6.1 4.6.2 4.6.5	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 19
		IFSTA Fire Investigator	Chap. 8, 16, 17
		Delmar Fire Investigation	133-134, 326, 492-493
501-20	4.6.1	NFPA 921: Guide for Fire and Explosion Investigation	Chap. 20

	4.6.2 4.6.5	IFSTA Fire Investigator Delmar Fire Investigation	Chap. 8, 16, 17 133-134, 326, 492-493
501-21	4.2.9	NFPA 921: Guide for Fire and Explosion Investigation IFSTA Fire Investigator Delmar Fire Investigation	Chap. 21 Chap. 4 141-143
501-22	4.6.4	NFPA 921: Guide for Fire and Explosion Investigation Delmar Fire Investigation IFSTA Fire Investigator	Chap.22 378, 379, 387-390 Chap. 16
501-23	4.4.1	NFPA 921: Guide for Fire and Explosion Investigation	Chap.23
501-24	4.2.8	NFPA 921: Guide for Fire and Explosion Investigation	Chap.24
501-25	Annex 1.1	NFPA 921: Guide for Fire and Explosion Investigation	Chap.25
501-26	Annex 1.1	NFPA 921: Guide for Fire and Explosion Investigation	Chap.26
501-27	4.1.6	NFPA 921: Guide for Fire and Explosion Investigation	Chap.27
501-28	Annex 1.1	NFPA 921: Guide for Fire and Explosion Investigation	Chap.28
501-29	4.7.1 4.7.2 4.7.3 4.7.4	State Designated Performance Evaluation Sheets IFSTA Fire Investigator Delmar Fire Investigation	Skills 24-26 Chap. 17 15, 492-493, 497-509

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

COMMISSION ON FIRE PROTECTION

RULES AND REGULATIONS

4.1 General
NFPA 1033 4.1.1 The fire investigator shall meet the job performance requirements defined in Sections 4.2 through 4.7.

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,* 2009 edition.

1.1.2 NFPA 921 *Guide for Fire and Explosion Investigations,* 2008 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 5.

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 5.

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.*

1.2.3.1 Basic
1.2.3.2 Intermediate
1.2.3.3 Advanced
1.2.3.4 Master

SECTION 2

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SECTION 3

DEFINITIONS

501-3.1 ***The Investigator candidate shall define the terms used in Chapter 3 of NFPA 921, Guide for Fire and Explosion Investigation (2008 Edition).***

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.

501-4.1 ***The Investigator candidate shall identify the need for following a systematic approach to fire investigation***.

501-4.2 ***The Investigator candidate shall describe the nature of fire investigations, utilizing the systematic approach of the scientific method.***

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

4.3.1 Recognize the need

4.3.2 Define the problem

4.3.3 Collect data

4.3.4 Analyze the data

4.3.5 Developing a hypothesis (inductive reasoning)

4.3.6 Test the hypothesis (deductive reasoning)

4.3.7 Avoid presumption

4.3.8 Expectation bias

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

4.4.1 Receiving the assignment

4.4.2 Preparing for the investigation

4.4.3 Conducting the investigation

4.4.4 Collecting and preserving evidence

4.4.5 Analyzing the incident

4.4.6 Conclusions

501-4.5 ***The Investigator candidate shall follow the proper reporting procedures established by their respective jurisdiction***.

SECTION 5

BASIC FIRE SCIENCE

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

NFPA 1033 4.2.4 Interpret fire patterns, given standard equipment and tools and some structural or content remains, so that each individual pattern is evaluated with respect to the burning characteristics of the material involved.
(A) Requisite Knowledge. Fire dynamics, fire development, and the interrelationship of heat release rate, form, and ignitibility of materials.
(B) Requisite Skills. 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 4.2.6 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.

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

5.1.1 General

5.1.2 Identify and describe the elements of the “fire tetrahedron.”

5.1.2.1 Define “fuel” and describe the three phases in which fuel exists.

5.1.2.1.1 Solid
5.1.2.1.2 Liquid
5.1.2.1.3 Gas

5.1.2.2 Describe the action of oxidizing agents.

5.1.2.3 Describe the relationship of heat in the combustion process.

5.1.2.4 Describe the uninhibited chemical chain reaction of combustion and identify the two mechanisms by which combustion of solids can occur.

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 General

5.2.2 The Investigator candidate shall define and describe phase changes and thermal decomposition.

5.2.3 The Investigator candidate shall describe combustion reactions, premixed burning, diffusion flames, and transactions from premixed burning to diffusion flame burning.

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

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

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

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
  - 5.6.6.1.1 Walls
  - 5.6.6.1.2 Ceilings
- 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

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.***

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 smoke spread in buildings.***

SECTION 6

FIRE PATTERNS

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

NFPA 1033 4.2.4 Interpret fire patterns, given standard equipment and tools and some structural or content remains, so that each individual pattern is evaluated with respect to the burning characteristics of the material involved.
(A) Requisite Knowledge. Fire dynamics, fire development, and the interrelationship of heat release rate, form, and ignitibility of materials.
(B) Requisite Skills. 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 the area 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, items potentially critical to cause determination and photo documentation are returned to their prefire location, and 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. 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.

501-6.1 The Investigator candidate shall define fire patterns.

501-6.2 The Investigator candidate shall be able to identify fire effects

6.2.1 Identify fire patterns

6.2.2 Temperature estimation using fire effects

6.2.3 Mass loss of material

6.2.4 Char
- 6.2.4.1 Introduction
- 6.2.4.2 Surface effect of char
- 6.2.4.3 Appearance of char
- 6.2.4.4 Rate of wood charring
- 6.2.4.5 Depth of char
- 6.2.4.6 Nature of char

6.2.5 Spalling

6.2.6 Oxidation

6.2.7 Color changes

6.2.8 Melting of materials

6.2.9 Thermal expansion and deformation of materials

6.2.10 Deposition of smoke on surfaces

6.2.11 Clean burn

6.2.12 Calcination

6.2.13 Window glass
- 6.2.13.1 Breaking of glass
- 6.2.13.2 Tempered glass
- 6.2.13.3 Staining of glass

6.2.14 Collapsed furniture springs

6.2.15 Distorted light bulbs

6.2.16 Rainbow effect

6.2.17 Victim injuries

501-6.3 ***The Investigator candidate shall be able to identify the following fire patterns.***

6.3.1 Introduction
- 6.3.1.1 Dynamics of pattern production
- 6.3.1.2 Lines or areas of demarcation

6.3.2 Causes of fire patterns

6.3.2.1 Plume-generated patterns
6.3.2.2 Ventilation-generated patterns
6.3.2.3 Hot gas layer-generated patterns
6.3.2.4 Full room involvement-generated patterns
6.3.2.5 Suppression-generated patterns

6.3.3 Locations of patterns

6.3.4 Location of objects
6.3.4.1 Heat shadowing
6.3.4.2 Protected areas

6.3.5 Penetrations of horizontal surfaces

6.3.6 Depth of char patterns with fuel gases

6.3.7 Pattern geometry

501-6.4 ***The Investigator candidate shall be able to identify the two fire patterns.***

6.4.1 Types of fire patterns
6.4.1.1 Fire spread (movement) patterns
6.4.1.2 Heat (intensity) patterns

SECTION 7

BUILDING SYSTEMS

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought 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 ignitibility; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

NFPA 1033 4.2.8 Inspect the performance of building systems, including detection, suppression, HVAC, utilities, 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/or 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.

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

501-7.2 The Investigator candidate shall understand 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 conditions

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.***

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
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
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

7.3.4 Mill construction

7.3.5 Non-combustible construction
- 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

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

501-7.5 ***The Investigator candidate shall describe the types and characteristics of automatic sprinkler systems.***

1) Identify various types of automatic sprinkler systems
   a) Wet pipe
   b) Dry pipe
   c) Pre-action
   d) Deluge
   e) Residential

2) Identify reasons for unsatisfactory performance of an automatic sprinkler system.

3) Describe fire sprinkler components and operations.

501-7.6 ***The Investigator candidate shall describe the types, operations, capabilities and the effects of proper application of "special agent" fire extinguishing systems.***

1) Dry chemical

2) Wet chemical

3) Halogenated agent

4) Carbon dioxide

5) Foam

6) Gaseous agent

501-7.7 ***The Investigator candidate shall identify the classes and capabilities of standpipe and hose systems.***

1) Class I systems

2) Class II systems

3) Class III systems

501-7.8 ***The Investigator candidate shall identify alarm-initiating devices.***

1) Local system

2) Auxiliary system

3) Remote station

4) Proprietary system

5) Central station system

501-7.9 ***The Investigator candidate shall identify fire detection systems.***

1) Smoke

2) Flame

3) Heat

4) Gas

501-7.10 ***The Investigator candidate shall describe Heating Ventilation and Air Conditioning (HVAC) system components and their relation to smoke and fire spread.***

1) Smoke dampers
2) Automatic shutoffs
3) Ductwork
4) Pipe and duct chases

SECTION 8

ELECTRICITY AND FIRE

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

NFPA 1033 4.2.8 Inspect the performance of building systems, including detection, suppression, HVAC, utilities, 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/or 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.

501-8.1 The Investigator candidate shall understand the importance of electricity to the fire investigation process.

501-8.2 The Investigator candidate shall describe basic electrical theory.

8.2.1 General

8.2.2 Comparing electricity to hydraulics

8.2.3 Ampacity

8.2.4 Conductivity of conductors

8.2.5 Ohm's Law

8.2.6 Electrical power

8.2.7 Ohm's Law's Wheel

8.2.8 Applying Ohm's Law

501-8.3 The Investigator candidate shall describe the typical building electrical systems and its components.

8.3.1 General

8.3.2 Electrical service
- 8.3.2.1 Single phase service
- 8.3.2.2 Three phase service

8.3.3 Meter and base

8.3.4 Significance

501-8.4 The Investigator candidate shall identify the functions of service equipment.

8.4.1 To provide means for turning off power to electrical system

8.4.2 To provide protection against electrical malfunctions

8.4.3 To divide the power distribution into several branch circuits

501-8.5 The Investigator candidate shall understand the principle of grounding.

8.5.1 General

8.5.2 Floating neutral (open neutral)

501-8.6 The Investigator candidate shall understand the components of overcurrent protection.

8.6.1 General

8.6.2 Fuses
- 8.6.2.1 Operations
- 8.6.2.2 Plug fuses
- 8.6.2.3 Type S fuses
- 8.6.2.4 Time-delay fuses
- 8.6.2.5 Cartridge fuses

8.6.3 Circuit breakers
- 8.6.3.1 Operations

8.6.3.2 Main breakers
8.6.3.3 Branch circuit breakers
8.6.3.4 Ground fault circuit interrupters (GFCI)
8.6.3.5 Arc fault circuit interrupters (AFCI)

8.6.4 Circuit breaker panels

501-8.7 The Investigator candidate shall describe a branch circuit and its components.

8.7.1 Conductors

8.7.2 Size of conductors

8.7.3 Copper conductors

8.7.4 Aluminum conductors

8.7.5 Insulation

501-8.8 The Investigator candidate shall identify and describe the different types of outlets and devices found in a branch circuit.

8.8.1 Switches

8.8.2 Receptacles

8.8.3 Other outlets, devices or equipment

501-8.9 The Investigator candidate shall describe how the use of improper electrical components can create sufficient heat for ignition.

8.9.1 General

8.9.2 Resistance heating

8.9.3 Overcurrent and overload

8.9.4 Arcs
8.9.4.1 General
8.9.4.2 High voltage
8.9.4.3 Static electricity
8.9.4.4 Parting arcs
8.9.4.5 Arcing across a carbonized path

8.9.5 Sparks

8.9.6 High resistance faults

501-8.10 ***The Investigator candidate shall identify and describe types of damage encountered in electrical systems.***

8.10.1 General

8.10.2 Short circuit and ground fault parting arcs

8.10.3 Arcing through a carbonized path due to thermal means (arcing through char)

8.10.4 Overheating connections

8.10.5 Overload

8.10.6 Effects not caused by electricity
- 8.10.6.1 Conductor surface colors
- 8.10.6.2 Melting by fire
- 8.10.6.3 Alloying
- 8.10.6.4 Mechanical gouges

501-8.11 ***The Investigator candidate shall identify arc melting of electrical conductors.***

8.11.1 Melting caused by electrical arcing

8.11.2 Melting caused by fire

8.11.3 Considerations and cautions

8.11.4 Undersized conductors

8.11.5 Nicked or stretched conductors

8.11.6 Collecting evidence

8.11.7 Deteriorated insulation

8.11.8 Over driven or misdriven staple

8.11.9 Short circuit

8.11.10 Beaded conductor

501-8.12 ***The Investigator candidate shall describe the role of static electricity in an ignition sequence.***

8.12.1 Introduction to static electricity

8.12.2 Generation of static electricity
- 8.12.2.1 General
- 8.12.2.2 Ignitable liquids
- 8.12.2.3 Charges on the surface of a liquid
- 8.12.2.4 Switch loading
- 8.12.2.5 Sprain operations
- 8.12.2.6 Gases
- 8.12.2.7 Dusts and fibers
- 8.12.2.8 Static electric discharge from the human body
- 8.12.2.9 Clothing

8.12.3 Incendive arc

8.12.4 Ignition energy

8.12.5 Controlling accumulations of static electricity
- 8.12.5.1 Humidification
- 8.12.5.2 Bonding and grounding

8.12.6 Conditions necessary for static arc ignition

8.12.7 Investigating static electric ignitions

8.12.8 Lightning
- 8.12.8.1 General
- 8.12.8.2 Lightning bolt characteristics
- 8.12.8.3 Lightning strikes
- 8.12.8.4 Lightning damage
- 8.12.8.5 Lightning detection networks

SECTION 9

BUILDING FUEL GAS SYSTEMS

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

NFPA 1033 4.2.8 Inspect the performance of building systems, including detection, suppression, HVAC, utilities, 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/or 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.

501-9.1 ***The Investigator candidate shall be familiar with building fuel gas systems.***

9.1.1 Impact of fuel gases on fire and explosions investigations.

9.1.2 Additional fire spread.

501-9.2 ***The Investigator candidate shall identify the different fuel gases***.

9.2.1 Natural gas

9.2.2 Commercial propane

9.2.3 Other fuel gases
- 9.2.3.1 Commercial butane
- 9.2.3.2 Propane HD5
- 9.2.3.3 Manufactured gases

9.2.4 Odorization

501-9.3 ***The Investigator candidate shall identify different natural gas systems.***

9.3.1 Transmission pipelines

9.3.2 Distribution pipelines (mains)

9.3.3 Service lines

9.3.4 Metering

501-9.4 ***The Investigator candidate shall identify different LP-Gas Systems.***

9.4.1 LP-Gas storage containers
- 9.4.1.1 Tanks
- 9.4.1.2 Cylinders

9.4.2 Container appurtenances
- 9.4.2.1 Pressure relief devices
- 9.4.2.2 Connections for flow control
- 9.4.2.3 Liquid level gauging devices
- 9.4.2.4 Pressure gauges

9.4.3 Pressure regulation

9.4.4 Vaporizers

501-9.5 ***The Investigator candidate shall identify common fuel gas system components.***

9.5.1 Pressure regulations (reduction)

9.5.2 Service piping systems

9.5.3 Valves

9.5.4 Gas burners
- 9.5.4.1 Manual ignition
- 9.5.4.2 Pilot lights
- 9.5.4.3 Pilotless igniters

501-9.6 ***The Investigator candidate shall identify the common piping in buildings.***

9.6.1 Size of piping

9.6.2 Piping materials

9.6.3 Joints and fittings

9.6.4 Piping installation

9.6.5 Main shut-off valves

9.6.6 Prohibited locations

9.6.7 Electrical bonding and grounding

501-9.7 The Investigator candidate shall identify common appliance and equipment requirements.

9.7.1 Installation

9.7.2 Venting and air supply

9.7.3 Appliance controls

501-9.8 The Investigator candidate shall identify common fuel gas utilization equipment.

9.8.1 Air heating

9.8.2 Water heating

9.8.3 Cooking

9.8.4 Refrigeration and cooling

9.8.5 Engines

9.8.6 Illumination

9.8.7 Incinerators, toilets, and exhaust afterburners

501-9.9 The Investigator candidate shall be familiar with investigating fuel gas systems.

9.9.1 Systematic analysis

9.9.2 Compliance with codes and standards

9.9.3 Leakage

9.9.4 Pressure testing

9.9.5 Locating leaks

9.9.6 Testing flow rates and pressures

9.9.7 Underground migrations of fuel gases

SECTION 10

FIRE-RELATED HUMAN BEHAVIOR

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.

501-10.1 ***The Investigator candidate shall understand that the analysis of fire related human behavior will often be an integral part of the investigation.***

501-10.2 ***The Investigator candidate shall understand the history of research as related to fire related human behavior.***

501-10.3 ***The Investigator candidate shall identify and describe general considerations of human response to fires.***

- 10.3.1 Individual
  - 10.3.1.1 Physical limitations
  - 10.3.1.2 Cognitive comprehension limitations
  - 10.3.1.3 Familiarity and physical setting
- 10.3.2 Groups
  - 10.3.2.1 Group size
  - 10.3.2.2 Group structure
  - 10.3.2.3 Group permanence
  - 10.3.2.4 Roles and norms
- 10.3.3 Characteristics of the physical setting
  - 10.3.3.1 Location of exits
  - 10.3.3.2 Number of exits
  - 10.3.3.3 Height of the structure
  - 10.3.3.4 Fire alarm systems
  - 10.3.3.5 Fire suppression systems

10.3.4 Characteristics of the fire
- 10.3.4.1 Presence of flame
- 10.3.4.2 Presence of smoke
- 10.3.4.3 Effects of toxic gases and oxygen depletion

501-10.4 The Investigator candidate shall identify and describe the factors related to fire initiation.

10.4.1 Factors involved in accidental fires
- 10.4.1.1 Improper maintenance operations
- 10.4.1.2 Housekeeping
- 10.4.1.3 Product labels, instructions and warnings
- 10.4.1.4 Purpose of labels
- 10.4.1.5 Purpose of instructions
- 10.4.1.6 Purpose of warnings
- 10.4.1.7 Key elements of a proper warning
- 10.4.1.8 Standards on labels, instructions and warnings

10.4.2 Recalls

10.4.3 Other considerations

10.4.4 Violations of fire safety codes and standards

501–10.5 The Investigator candidate shall identify and describe the factors related to children and fire.

10.5.1 Child fire setters
- 10.5.1.1 Curiosity
- 10.5.1.2 Age 2 - 6

10.5.2 Juvenile fire setters
- 10.5.2.1 Broken family environment
- 10.5.2.2 Physical trauma
- 10.5.2.3 Emotional trauma
- 10.5.2.4 Age 7 - 13

10.5.3 Adolescent fire setters
- 10.5.3.1 Stress
- 10.5.3.2 Anxiety
- 10.5.3.3 Anger
- 10.5.3.4 Symptom of another problem
- 10.5.3.5 Age 14 – 16

10.5.4 Common to all ages

10.5.4.1 Frustration
10.5.4.2 Anger
10.5.4.3 Revenge
10.5.4.4 Attention

501-10.6 Incendiary fires, see SECTION 501- 22.4.

501-10.7 The Investigator candidate shall identify and describe human factors related to fire spread.

500-10.8 The Investigator candidate shall identify the basic concepts in recognition and response to fires.

10.8.1 Perception of the danger (sensory clues)

10.8.2 Decision to act (response)

10.8.3 Action taken

10.8.4 Escape factors

10.8.5 Information received from survivors

SECTION 11

LEGAL CONSIDERATIONS

4.1 General

NFPA 1033 4.1.5* The fire investigator shall adhere to all applicable legal and regulatory requirements.

4.2 Scene Examination.

Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

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.

4.4 Evidence Collection/Preservation.

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

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 4.4.4 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.

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. 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.

501-11.1 The Investigator candidate shall be familiar with legal consideration impacts for every phase of the fire investigation.

501-11.2 The Investigator candidate shall ensure that constitutional considerations are observed.

11.2.1 Amendment Four

11.2.2 Amendment Five

11.2.3 Amendment Six

11.2.4 Amendment Seven

11.2.5 Amendment Eight

501-11.3 The Investigator candidate shall observe all legal considerations during the investigation.

11.3.1 Authority to conduct the investigation

11.3.2 Right of entry

11.3.3 Method of entry
- 11.3.3.1 Consent
- 11.3.3.2 Exigent circumstance
- 11.3.3.3 Administrative search warrant
- 11.3.3.4 Criminal search warrant

11.3.4 The questioning of suspects

11.3.5 Spoliation of evidence
- 11.3.5.1 Responsibility
- 11.3.5.2 Documentation
- 11.3.5.3 Remedies for spoliation
- 11.3.5.4 Notification to interested parties
- 11.3.5.5 Documentation prior to alteration
- 11.3.5.6 Alteration and movement of evidence
- 11.3.5.7 Notification prior to destructive testing by persons other than public authorities

501-11.4 The Investigator candidate shall understand pretrial legal considerations.

11.4.1 Introduction

11.4.2 Forms of discovery
- 11.4.2.1 Request to produce
- 11.4.2.2 Interrogatories
- 11.4.2.3 Depositions
  - 11.4.2.3.1 Procedure
  - 11.4.2.3.2 Discovery depositions
  - 11.4.2.3.3 Trial depositions
  - 11.4.2.3.4 Reports

11.4.3 Motions

501-11.5 The Investigator candidate shall be familiar with trial procedures in criminal and civil cases.

- 11.5.1 Rules of evidence
- 11.5.2 Type of evidence
  - 11.5.2.1 Demonstrative evidence
    - 11.5.2.1.1 Photographs/ illustrative forms of evidence
    - 11.5.2.1.2 Samples
  - 11.5.2.2 Documentary evidence
  - 11.5.2.3 Testimonial evidence
    - 11.5.2.3.1 Fact witness
    - 11.5.2.3.2 Expert witness
    - 11.5.2.3.3 Admissibility of expert testimony
    - 11.5.2.3.4 Relevance
    - 11.5.2.3.5 Qualifications of expert
    - 11.5.2.3.6 Reliability of opinion
- 11.5.3 Forms of examination
  - 11.5.3.1 Direct examination
  - 11.5.3.2 Cross-examination
- 11.5.4 Forms of testimony
  - 11.5.4.1 Affidavits
  - 11.5.4.2 Answers to interrogatories
  - 11.5.4.3 Depositions and trial testimony
- 11.5.5 Burden of proof
- 11.5.6 Criminal prosecution
  - 11.5.6.1 Arson
  - 11.5.6.2 Arson statutes
  - 11.5.6.3 Factors to be considered
  - 11.5.6.4 Other fire related criminal acts
  - 11.5.6.5 Arson-reported statutes
- 11.5.7 Civil litigation
  - 11.5.7.1 Negligence
  - 11.5.7.2 Codes, regulations, and standards
  - 11.5.7.3 Product liability
  - 11.5.7.4 Strict liability

SECTION 12

SAFETY

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 and evaluating the fire scene, or evidence 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 act or activity that brought 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 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.

501-12.1 The Investigator candidate shall describe the safety issues as they relate to the fire investigation.

12.1.1 Investigating the scene alone

12.1.2 Hazard and risk assessment
- 12.1.2.1 Identify the hazards
  - 12.1.2.1.1 Physical hazard
  - 12.1.2.1.2 Structural hazard
  - 12.1.2.1.3 Electrical hazard
  - 12.1.2.1.4 Chemical hazard
  - 12.1.2.1.5 Biological hazard
  - 12.1.2.1.6 Mechanical hazard
- 12.1.2.2 Determining the risk of the hazard
- 12.1.2.3 Control the hazard
  - 12.1.2.3.1 Engineering controls
  - 12.1.2.3.2 Administrative controls
  - 12.1.2.3.3 Proper selection and use of Personal Protective Equipment (PPE)

12.1.3 Safety clothing and equipment

12.1.4 Fire scene hazards

12.1.5 Personal health and safety

12.1.6 Investigator fatigue

501-12.2 ***The Investigator candidate shall describe factors that have an influence on scene safety.***

12.2.1 Status of suppression

12.2.2 Structural stability

12.2.3 Utilities

12.2.4 Electrical hazards

12.2.5 Standing water

12.2.6 Safety of bystanders

12.2.7 Safety of the fire scene atmosphere

501-12.3 ***The Investigator candidate shall describe safety issues associated with criminal acts or acts of terrorism.***

12.3.1 Secondary devices

12.3.2 Residue chemicals

12.3.3 Biological and radiological terrorism

12.3.4 Exposure to tools and equipment

501-12.4 ***Describe safety consideration in off-scene investigation activities.***

****Note****

The following part of Section 12 is not contained in NFPA 921, *Guide for Fire and Explosion Investigation*. The reference for this material is found in IFSTA, *Fire Inspection and Code Enforcement*. *See also the* Emergency Response Guidebook *(ERG).*

501-12.5 ***The Investigator candidate shall demonstrate knowledge of safety principles applicable to hazardous materials response.***

501-12.6 ***The Investigator candidate shall identify the difference between hazardous materials incidents and other emergencies.***

501-12.7 ***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
   b) Health

501-12.8 ***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) Reactivity - Yellow color

2) Special hazards that may be indicated
   a) ~~W~~
   b) OX

3) Five degrees of hazard - (4-0)

501-12.9 The Investigator candidate shall identify the following information from material safety data sheets (MSDS).

1) The Investigator candidate shall list four organizations from which to obtain a “Material Safety Data Sheet” (MSDS)
   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 MSDS chapters

SECTION 13

SOURCES OF INFORMATION

4.1 General

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

4.2 Scene Examination.

Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

NFPA 1033 4.2.8 Inspect the performance of building systems, including detection, suppression, HVAC, utilities, 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/or 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.

4.5 Interview.

Duties shall include obtaining information regarding the overall fire investigation from others through verbal communication.

NFPA 1033 4.5.1 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.

(A) Requisite Knowledge. 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.

(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. Adjust interviewing strategies based on deductive reasoning, interpret verbal and nonverbal communications, apply legal requirements applicable, 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 4.6.3 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.

501-13.1 The Investigator candidate shall identify sources of information and assistance available to the Investigator during a fire investigation.

13.1.1 Purpose of obtaining information.

13.1.2 Reliability of information obtained.

501-13.2 The Investigator candidate shall describe the legal considerations on sources of information.

13.2.1 Freedom of Information Act

13.2.2 Privileged communications

13.2.3 Confidential communications

501-13.3 ***The Investigator candidate shall describe the different forms of information.***

13.3.1 Verbal information

13.3.2 Written information

13.3.3 Visual information

13.3.4 Electronic information

501-13.4 ***The Investigator candidate shall be able to gather both useful and accurate information through the process of interviewing.***

13.4.1 Purpose of interviews

13.4.2 Preparation for the interview

13.4.3 Document the interview

13.4.4 Interview approaches
- 13.4.4.1 Those without an interest in the outcome
- 13.4.4.2 Those with an interest in the outcome
- 13.4.4.3 Suspects

13.4.5 Basic information

13.4.6 Active skills important to an interviewer

13.4.7 The two most common interviewing mistakes

13.4.8 “Non-verbal” indicators

13.4.9 Evaluating the interview

13.4.10 Identifying data correlation methods

501-13.5 ***The Investigator candidate shall identify government sources of information useful during a fire investigation.***

13.5.1 Municipal

13.5.2 County

13.5.3 State

13.5.4 Federal

501-13.6 ***The Investigator candidate shall identify private sources of information useful during a fire investigation.***

13.6.1 National Fire Protection Association

13.6.2 Society of Fire Protection Engineers

13.6.3 American Society for Testing and Materials

13.6.4 American National Standards Institute

13.6.5 National Association of Fire Investigators

13.6.6 International Association of Arson Investigators

13.6.7 Regional fire investigation organizations

13.6.8 Real estate industry

13.6.9 Abstract and title companies

13.6.10 Financial institutions

13.6.11 Insurance industry

13.6.12 Educational institutions

13.6.13 Utility companies

13.6.14 Trade organizations

13.6.15 Local television stations

13.6.16 Lightning detection networks

13.6.17 Other private sources

SECTION 14

PLANNING THE INVESTIGATION

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.

4.2 Scene Examination.

Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought 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. 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.

501-14.1 ***The Investigator candidate shall identify the resources at their disposal and those available from outside sources before those resources are needed.***

501-14.2 ***The Investigator candidate shall identify basic information necessary to plan and conduct an investigation.***

14.2.1 Location

14.2.2 Date and time of incident

14.2.3 Weather conditions

14.2.4 Size and complexity of the incident

14.2.5 Type and use of structure

14.2.6 Nature and extent of damage

14.2.7 Security of the scene

14.2.8 Purpose of the investigation

501-14.3 ***The Investigator candidate shall be able to organize the basic investigation functions that are commonly performed in each investigation.***

501-14.4 ***The Investigator candidate shall identify the goals of a pre-investigation team meeting.***

14.4.1 Equipment and facilities

14.4.2 Personal safety equipment
- 14.4.2.1 Eye protection
- 14.4.2.2 Flashlight
- 14.4.2.3 Gloves
- 14.4.2.4 Helmet or hard hat
- 14.4.2.5 Respiratory protection (type depending on exposure)
- 14.4.2.6 Safety boots or shoes
- 14.4.2.7 Turnout gear or coveralls

14.4.3 Tools and equipment
- 14.4.3.1 Absorption material
- 14.4.3.2 Axe
- 14.4.3.3 Broom
- 14.4.3.4 Camera and film
- 14.4.3.5 Claw hammer
- 14.4.3.6 Directional compass
- 14.4.3.7 Evidence-collecting container
- 14.4.3.8 Evidence labels (sticky)
- 14.4.3.9 Hand towels
- 14.4.3.10 Hatchet
- 14.4.3.11 Hydrocarbon detector
- 14.4.3.12 Ladder
- 14.4.3.13 Lighting
- 14.4.3.14 Magnet
- 14.4.3.15 Marking pens

14.4.3.16 Paint brushes
14.4.3.17 Paper towels/wiping cloths
14.4.3.18 Pen knife
14.4.3.19 Pliers/wire cutters
14.4.3.20 Pry bar
14.4.3.21 Rake
14.4.3.22 Rope
14.4.3.23 Rulers
14.4.3.24 Saw
14.4.3.25 Screwdrivers (multiple types)
14.4.3.26 Shovel
14.4.3.27 Sieve
14.4.3.28 Soap and hand cleaner
14.4.3.29 Styrofoam cups
14.4.3.30 Tape measure
14.4.3.31 Tape recorder
14.4.3.32 Tongs
14.4.3.33 Tweezers
14.4.3.34 Twine
14.4.3.35 Voltmeter/ohmmeter
14.4.3.36 Water
14.4.3.37 Writing/drawing equipment
14.4.3.38 Scene tape
14.4.3.40 Evidence marking devices

501-14.5 ***The Investigator candidate shall identify the specialized personnel and technical consultants that may be needed to provide technical assistance.***

14.5.1 General

14.5.2 Materials engineer or scientist

14.5.3 Mechanical engineer

14.5.4 Electrical engineer

14.5.5 Chemical engineer/chemist

14.5.6 Fire science and engineering
14.5.6.1 Fire protection engineer
14.5.6.2 Fire engineering technologist
14.5.6.3 Fire engineering technician

14.5.7 Industry expert

14.5.8 Attorneys

14.5.9 Insurance agent/adjuster

14.5.10 Canine teams

SECTION 15

DOCUMENTATION OF THE INVESTIGATION

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 4.6.2 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.

501-15.1 The Investigator candidate shall describe the purpose of recording the fire scene.

501-15.2 The Investigator candidate shall describe the purpose of fire scene photography and the importance of timing.

15.2.1 General

15.2.2 Timing

15.2.3 Basics
- 15.2.3.1 General
- 15.2.3.2 Types of cameras
- 15.2.3.3 Film
- 15.2.3.4 Digital photography
- 15.2.3.5 Lenses
- 15.2.3.6 Filters
- 15.2.3.7 Lighting
- 15.2.3.8 Special types of photography

15.2.4 Composition and technique
- 15.2.4.1 General
- 15.2.4.2 Sequential photos
- 15.2.4.3 Mosaics
- 15.2.4.4 Photo diagram
- 15.2.4.5 Assisting photographer
- 15.2.4.6 Photography and the courts

15.2.5 Video

15.2.6 Suggested activities to be documented
- 15.2.6.1 During the fire
- 15.2.6.2 Crowd or people photographs
- 15.2.6.3 Fire suppression photographs
- 15.2.6.4 Exterior photographs
- 15.2.6.5 Structural photographs
- 15.2.6.6 Interior photographs
- 15.2.6.7 Utility and appliance photographs
- 15.2.6.8 Evidence photographs
- 15.2.6.9 Victim photographs
- 15.2.6.10 Witness viewpoint photographs
- 15.2.6.11 Aerial photographs

15.2.7 Photography tips

15.2.8 Presentation of photographs

501-15.3 ***The Investigator candidate shall describe the importance of note taking.***

15.3.1 Forms of incident field notes

15.3.2 Forms for collecting data

15.3.3 Dictation of field notes

501-15.4 ***The Investigator candidate shall understand the importance of diagrams and drawings.***

15.4.1 Types of drawings
- 15.4.1.1 Sketches
- 15.4.1.2 Diagrams

15.4.2 Selection of drawings

15.4.3 Drawing tools and equipment

15.4.4 Diagram elements
- 15.4.4.1 General information
- 15.4.4.2 Identification of compass orientation
- 15.4.4.3 Scale
- 15.4.4.4 Symbols
- 15.4.4.5 Legends

15.4.5 Drawings
- 15.4.5.1 Site or area plan
- 15.4.5.2 Floor plans
- 15.4.5.3 Elevations
- 15.4.5.4 Details and selections
- 15.4.5.5 Exploded view diagrams
- 15.4.5.6 Three-dimensional representations
- 15.4.5.7 Specialized fire investigation diagrams

15.4.6 Prepared design and construction drawings
- 15.4.6.1 General
- 15.4.6.2 Architectural and engineering drawings
- 15.4.6.3 Architectural and engineering schedules
- 15.4.6.4 Specifications
- 15.4.6.5 Appliance and building equipment

501-15.5 ***The Investigator candidate must understand the purpose of the report to effectively communicate the observations analyses and conclusions made during an investigation.***

15.5.1 Descriptive information

15.5.2 Pertinent facts

15.5.3 Opinions and conclusions

****Note: The following part of Section 15 does not come from NFPA 921****

501-15.6 ***The Investigator candidate shall identify and describe the process of preparing and completing a final, accurate and concise report.***

1) National Fire Incident Reporting System (NFIRS) forms

2) Fire reports required by the AHJ

SECTION 16

PHYSICAL EVIDENCE

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought 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. 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.

501-16.1 The Investigator candidate shall be familiar with the recommended and accepted methods of processing physical evidence.

501-16.2 The Investigator candidate shall define physical evidence.

501-16.3 The Investigator candidate shall describe the importance of preservation of the fire scene and physical evidence.

16.3.1 General

16.3.2 Fire patterns as physical evidence

16.3.3 Artifact evidence

16.3.4 Protecting evidence

16.3.5 Role and responsibility of fire protection personnel in protecting the fire scene
- 16.3.5.1 General
- 16.3.5.2 Preservation
- 16.3.5.3 Caution in fire suppression operations
  - 16.3.5.3.1 Use of water lines and hose streams
  - 16.3.5.3.2 Overhaul
  - 16.3.5.3.3 Salvage
  - 16.3.5.3.4 Movement of knobs and switches
  - 16.3.5.3.5 Use of power tools
  - 16.3.5.3.6 Limiting access of firefighters and other emergency personnel

16.3.6 Roles and responsibility of the fire investigator

16.3.7 Practical considerations

501-16.4 The Investigator candidate shall describe contamination of physical evidence.

16.4.1 Contamination of evidence containers

16.4.2 Contamination during collection

16.4.3 Contamination by firefighters

501-16.5 The Investigator candidate shall describe methods of collection.

16.5.1 General

16.5.2 Documenting the collection of physical evidence

16.5.3 Collection of traditional forensic physical evidence

16.5.4 Collection of evidence for accelerant testing
- 16.5.4.1 Liquid accelerant characteristics
- 16.5.4.2 Canine/handler teams
- 16.5.4.3 Collection of liquid samples for ignitable liquid testing
- 16.5.4.4 Collection of liquid evidence absorbed by solid materials
- 16.5.4.5 Collection of solid samples for accelerant testing
- 16.5.4.6 Comparison samples
- 16.5.4.7 Canine teams

16.5.5 Collection of gaseous samples

16.5.6 Collection of electrical equipment and system components

16.5.7 Collection of appliances and small electrical equipment

501-16.6 The Investigator candidate shall identify and describe different types of evidence containers.

16.6.1 General

16.6.2 Liquid and solid accelerant evidence containers
- 16.6.2.1 Metal cans
- 16.6.2.2 Glass jars
- 16.6.2.3 Special evidence bags
- 16.6.2.4 Common plastic bags

501-16.7 The Investigator candidate shall describe the methods of identifying physical evidence.

501-16.8 The Investigator candidate shall describe the proper methods of transportation and storage of physical evidence.

16.8.1 Hand delivery

16.8.2 Shipment

16.8.3 Storage of evidence

501-16.9 ***The Investigator candidate shall identify and describe the evidence chain of custody of physical evidence.***

501-16.10 ***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.***

16.10.1 Laboratory examination and testing

16.10.2 Test methods

16.10.3 Sufficiency of samples

16.10.4 Comparative examination and testing

501-16.11 ***The Investigator candidate shall describe the proper procedure for evidence disposition.***

SECTION 17

ORIGIN DETERMINATION

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought 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 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.

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.

501-17.1 ***The Investigator candidate shall identify the following sources used in origin determination***.

17.1.1 Witness information

17.1.2 Fire patterns

17.1.3 Arc mapping

17.1.4 Fire dynamics

501-17.2 ***The Investigator candidate shall identify and describe the overall methodology of conducting a scene assessment.***

17.2.1 Scientific method

17.2.2 Sequence of activities

17.2.3 Sequential pattern analysis

17.2.4 Systematic procedure

17.2.5 Recommended methodology

501-17.3 ***The Investigator candidate shall identify the data collection process for origin determination***.

17.3.1 Initial scene assessment
- 17.3.1.1 Safety assessment
- 17.3.1.2 Scope of the examination
- 17.3.1.3 Order of the examination
- 17.3.1.4 Surrounding areas
- 17.3.1.5 Structure exterior
- 17.3.1.6 Structure interior
- 17.3.1.7 Post-fire alterations

17.3.2 Excavation and reconstruction

17.3.3 Additional data collection activities for origin determination
- 17.3.3.1 Pre-fire conditions
- 17.3.3.2 Description of fuels
- 17.3.3.3 Structure dimensions
- 17.3.3.4 Building systems and ventilation
- 17.3.3.5 Weather conditions
- 17.3.3.6 Electrical systems
- 17.3.3.7 Electrical loads
- 17.3.3.8 HVAC systems

17.3.3.9 Fuel gas systems
17.3.3.10 Liquid fuel systems
17.3.3.11 Fire protection systems
17.3.3.12 Fire protection systems data
17.3.3.13 Security cameras
17.3.3.14 Intrusion alarm systems
17.3.3.15 Witness observations

501-17.4 ***The Investigator candidate shall recognize the importance of analyzing the following data***.

17.4.1 Fire patterns analysis
17.4.1.1 Consideration of all patterns
17.4.1.2 Sequence of patterns
17.4.1.3 Pattern generation
17.4.1.4 Ventilation
17.4.1.5 Movement and intensity patterns

17.4.2 Heat and flame vector analysis
17.4.2.1 Complementary vectors
17.4.2.2 Heat source
17.4.2.3 Additional tools for pattern visualization

17.4.3 Depth of char analysis
17.4.3.1 Depth of char diagram
17.4.3.2 Measuring depth of char
17.4.3.3 Location of measurements
17.4.3.4 Missing wood
17.4.3.5 Depth of char surveys with fuel gases

17.4.4 Depth of calcination survey
17.4.4.1 Depth of calcination diagram
17.4.4.2 Measuring depth of calcination

17.4.5 Arc surveys or arc mapping
17.4.5.1 Suggested procedure
17.4.5.2 Arc survey diagrams
17.4.5.3 Locating arc sites
17.4.5.4 Documenting arc sites
17.4.5.5 Arc survey evidence collection
17.4.5.6 Arc survey utilization

17.4.6 Analysis of sequential events

17.4.7 Fire dynamics

501-17.5 ***The Investigator candidate shall identify the process of developing an origin hypothesis***.

17.5.1 Initial hypothesis

17.5.2 Modifying the initial hypothesis

500-17.6 ***The Investigator candidate shall identify the proper scientific method of testing of origin hypotheses.***

17.6.1 Means of hypothesis testing

17.6.2 Analytical techniques and tools
- 17.6.2.1 Time line analysis
- 17.6.2.2 Fire modeling
- 17.6.2.3 Experimental testing

500-17.7 ***The Investigator candidate shall select a final hypothesis***.

17.7.1 Defining the area of origin

17.7.2 Inconsistent data

17.7.3 Case file review

501-17.8 ***The Investigator candidate shall identify when there is insufficient data to define the origin.***

17.8.1 Large area adequate for determination

17.8.2 Justification of a large area of origin

17.8.3 Eyewitness evidence of origin area

SECTION 18

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.

501-18.1 The Investigator candidate shall define "fire cause."

501-18.2 The Investigator candidate shall identify and describe the process of elimination and its limitations.

501-18.3 The Investigator candidate shall describe the source and form of heat of ignition.

18.3.1 Source of ignition energy

18.3.2 Define a competent ignition source

18.3.3 Describe the three phases of ignition.
- 18.3.3.1 Generation
- 18.3.3.2 Transmission
- 18.3.3.3 Heating

18.3.4 Describe common types of heat-producing devices, substances, or circumstances that could cause ignition.

501-18.4 The Investigator candidate shall identify and describe the first material ignited.

18.4.1 Surface-to-mass ratio

18.4.2 Initial fuel ignited

18.4.3 Gases and vapors reaction

501-18.5 ***The Investigator candidate shall determine the ignition sequence.***

501-18.6 ***The Investigator candidate shall formulate an opinion of fire cause that will withstand the challenge of reasonable examination.***

18.6.1 Probable

18.6.2 Possible

SECTION 19

ANALYSIZING THE INCIDENT FOR CAUSE AND RESPONSIBILITY

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. 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 4.6.5 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 describe methods for analyzing the incident for cause and responsibility.***

19.1.1 Cause of the fire or explosion

19.1.2 Cause of damage to property

19.1.3 Cause of bodily injury or loss of life

19.1.4 Degree to which human fault contributed

501-19.2 The Investigator candidate shall describe the causes of fires or explosions.

19.2.1 Classification of the cause
- 19.2.1.1 Accidental fire cause
- 19.2.1.2 Natural fire cause
- 19.2.1.3 Incendiary fire cause
- 19.2.1.4 Undetermined fire cause

501-19.3 The Investigator candidate shall describe the causes of damage to property from the Incident.

19.3.1 Considerations

19.3.2 Fire and smoke spread
- 19.3.2.1 Compartmentation
- 19.3.2.2 Change of occupancy/hazard
- 19.3.2.3 Detection/alarm systems
- 19.3.2.4 Human behavior
- 19.3.2.5 Fire suppression
- 19.3.2.6 Fuel loads
- 19.3.2.7 Housekeeping
- 19.3.2.8 Ventilation
- 19.3.2.9 Code violations
- 19.3.2.10 Structural failure

19.3.3 Other consequential damage

501-19.4 The Investigator candidate shall describe the causes of bodily injury or loss of life.

19.4.1 Fire and smoke spread
- 19.4.1.1 Toxicity
- 19.4.1.2 Hazardous materials
- 19.4.1.3 Compartmentation
- 19.4.1.4 Change of occupancy/hazard
- 19.4.1.5 Detection/alarm systems
- 19.4.1.6 Human behavior
- 19.4.1.7 Fire suppression
- 19.4.1.8 Housekeeping
- 19.4.1.9 Fuel loads
- 19.4.1.10 Ventilation
- 19.4.1.11 Code violations
- 19.4.1.12 Means of egress/refuge
- 19.4.1.13 Structural failure

19.4.1.14 Intentional acts

19.4.2 Emergency preparedness

501-19.5 The Investigator candidate shall describe the determination of responsibility.

19.5.1 Nature of responsibility

19.5.2 Definition of responsibility

19.5.3 Assessing of responsibility

19.5.4 Degrees of responsibility

SECTION 20

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. 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 4.6.5 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.

501-20.1 ***The Investigator candidate shall describe the failure analysis and analytical tools.***

501-20.2 ***The Investigator candidate shall describe time lines for use in analyzing fire cause.***

20.2.1 General

20.2.2 Hard time (actual)

20.2.3 Soft time (estimated)

20.2.4 Benchmark events

20.2.5 Multiple time lines

501-20.3 ***The Investigator candidate shall describe system analysis techniques.***

20.3.1 Fault trees

20.3.2 Failure mode and effects analysis (FMEA)

501-20.4 ***The Investigator candidate shall describe the purpose for mathematical modeling.***

20.4.1 General and limitations of mathematical modeling

20.4.2 Heat transfer analysis

20.4.3 Flammable gas concentrations

20.4.4 Hydraulic analysis

20.4.5 Thermodynamic chemical equilibrium analysis

20.4.6 Structural analysis

20.4.7 Egress analysis

20.4.8 Fire dynamics analysis
- 20.4.8.1 Specialized fire dynamic routines
- 20.4.8.2 Zone models
- 20.4.8.3 Field, computational fluid dynamics models (CFD)

500-20.5 ***The Investigator candidate shall describe the role of fire testing.***

20.5.1 Role of fire testing

20.5.2 Fire test methods

20.5.3 Limitations of fire testing

501-20.6 ***The Investigator candidate shall identify the data required for modeling and testing.***

20.6.1 Materials and contents

20.6.2 Ventilation

SECTION 21

EXPLOSIONS

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought 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.

501-21.1 ***The Investigator candidate shall define the term "explosion" and describe the various types of explosions.***

501-21.2 ***The Investigator candidate shall identify the different types of explosions.***

21.2.1 Mechanical explosion

21.2.2 Boiling liquid expanding vapor explosion (BLEVE)

21.2.3 Chemical explosion

21.2.4 Combustion explosion

21.2.5 Electrical explosion

21.2.6 Nuclear explosion

501-21.3 ***The Investigator candidate shall distinguish between the two types of explosions***.

21.3.1 Low-order damage

21.3.2 High-order damage

501-21.4 ***The Investigator candidate shall be able to describe the effects of explosions.***

21.4.1 Blast pressure front effect
- 21.4.1.1 General
- 21.4.1.2 Positive pressure phase
- 21.4.1.3 Negative pressure phase
- 21.4.1.4 Shape of blast front
- 21.4.1.5 Rate of pressure rise

21.4.2 Shrapnel effect

21.4.3 Thermal effect

21.4.4 Seismic effect

501-21.5 The Investigator candidate shall identify the factors controlling explosion effects.

21.5.1 Blast pressure front modification by reflection

21.5.2 Blast pressure front modification by refraction

501-21.6 The Investigator candidate shall be able to identify a seated explosion.

21.6.1 General

21.6.2 Explosives

21.6.3 Boiler and pressure vessels

21.6.4 Confined fuel gas and liquid vapor

21.6.5 Boiling liquid expanding vapor explosion (BLEVE)

501-21.7 The Investigator candidate shall be able to identify a non-seated explosion.

21.7.1 Fuel gases

21.7.2 Pool flammable/combustible liquids

21.7.3 Dusts

21.7.4 Backdraft or smoke explosion

501-21.8 ***The Investigator candidate shall be able to describe the characteristics of gas/vapor explosions.***

21.8.1 Minimum ignition energy

21.8.2 Interpretation of explosion damage
- 21.8.2.1 Fuel-air ratio
- 21.8.2.2 Vapor density
- 21.8.2.3 Turbulence
- 21.8.2.4 Nature of confining space
- 21.8.2.5 Location and magnitude of ignition source
- 21.8.2.6 Venting

21.8.3 Underground migration of fuel gases

21.8.4 Multiple explosions

501-21.9 ***The Investigator candidate shall describe the characteristics of dust explosions.***

21.9.1 General

21.9.2 Particle size

21.9.3 Concentration

21.9.4 Turbulence in dust explosions

21.9.5 Moisture

21.9.6 Minimum Ignition energy for dust

21.9.7 Multiple explosions

501-21.10 ***The Investigator candidate shall be able to define backdraft or smoke explosions.***

501-21.11 ***The Investigator candidate shall be able to identify an outdoor vapor cloud explosion.***

501-21.12 ***The Investigator candidate shall be able to distinguish the two types of explosives.***

21.12.1 Low explosives

21.12.2 High explosives

21.12.3 Investigation of explosive incidents

501-21.13 The Investigator candidate shall be able to investigate the explosion scene.

21.13.1 General

21.13.2 Securing the scene
- 21.13.2.1 Establishing the scene
- 21.13.2.2 Obtain background information
- 21.13.2.3 Establish the scene search pattern
- 21.13.2.4 Safety at the explosion scene

21.13.3 Initial scene assessment
- 21.13.3.1 General
- 21.13.3.2 Identify explosion or fire
- 21.13.3.3 Low or high-order damage
- 21.13.3.4 Seated or nonseated explosion
- 21.13.3.5 Identify type of explosion
- 21.13.3.6 Identify potential general fuel type
- 21.13.3.7 Establish the origin
- 21.13.3.8 Establish the fuel source and explosion type
- 21.13.3.9 Establish ignition source

21.13.4 Detailed scene assessment
- 21.13.4.1 Identify damage effects of explosion
- 21.13.4.2 Identify preblast and postblast fire damage
- 21.13.4.3 Locate and identify articles of evidence
- 21.13.4.4 Identify force vectors

501-21.14 The Investigator candidate shall be able to analyze the origin (epicenter) of an explosion scene.

501-21.15 The Investigator candidate shall be able to analyze a fuel source.

501-21.16 The Investigator candidate shall be able to analyze the ignition source.

501-21.17 The Investigator candidate shall be able to analyze to establish cause.

21.17.1 General

21.17.2 Time line analysis

21.17.3 Damage pattern analysis
- 21.17.3.1 Debris analysis
- 21.17.3.2 Relative structural damage analysis

21.17.4 Correlation of blast yield with damage incurred

21.17.5 Analysis of damaged items and structures

21.17.6 Correlation of thermal effects

SECTION 22

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.

501-22.1 The Investigator candidate shall define "incendiary" fires.

501-22.2 The Investigator candidate shall identify and describe indicators of incendiary fires.

22.2.1 Multiple fires

22.2.2 Trailers

22.2.3 Lack of expected fuel load and ignition sources

22.2.4 Exotic accelerants

22.2.5 Unusual fuel load or configuration

22.2.6 Burn injuries

22.2.7 Incendiary devices
- 22.2.7.1 Examples of incendiary devices
- 22.2.7.2 Delay devices
- 22.2.7.3 Presence of ignitable liquids in area of origin

22.2.8 Assessment of fire growth and fire damage

501-22.3 The Investigator candidate shall identify and explain potential indicators of incendiary fires not directly related to combustion.

22.3.1 Remote locations with view blocked or obscured

22.3.2 Fires near service equipment and appliances

22.3.3 Removal or replacement of contents prior to the fire
- 22.3.3.1 Replacement
- 22.3.3.2 Removal
- 22.3.3.3 Absences of personal items prior to the fire

22.3.4 Entry blocked or obstructed

22.3.5 Sabotage to the structure or fire protection systems
- 22.3.5.1 Definition of “sabotage”
- 22.3.5.2 Damage to fire-resistive assemblies
- 22.3.5.3 Damage to fire protection systems

22.3.6 Open windows and exterior doors

501-22.4 ***The Investigator candidate shall identify and describe other evidentiary factors associated with incendiary fires.***

22.4.1 Evidentiary factors that should be recorded and examined

22.4.2 Analysis of confirmed incendiary fires
- 22.4.2.1 Geographic areas or clusters
- 22.4.2.2 Temporal frequency
- 22.4.2.3 Materials and method

22.4.3 Evidence of other crimes and crime concealment

22.4.4 Indicators of financial stress

22.4.5 Existing or history of code violations

22.4.6 Owner with fires at other properties

22.4.7 Over-insurance

22.4.8 Timed opportunity
- 22.4.8.1 Fires during severe natural conditions
- 22.4.8.2 Fires during civil unrest
- 22.4.8.3 Fire department unavailable

22.4.9 Motives for fire setting behavior
- 22.4.9.1 Define “motive”

- 22.4.9.2 Motive verses intent
- 22.4.9.3 Classifications of motive
  - 22.4.9.3.1 Introduction
  - 22.4.9.3.2 Vandalism
    - a. Willful and malicious mischief
    - b. Peer or group pressure
  - 22.4.9.3.3 Excitement
    - a. Thrill seeking
    - b. Attention seeking
    - c. Recognition
    - d. Sexual gratification or perversion
  - 22.4.9.3.4 Revenge
    - a. Personal retaliation
    - b. Societal retaliation
    - c. Institutional retaliation
    - d. Group retaliation
  - 22.4.9.3.5 Crime Concealment
    - a. Murder concealment
    - b. Burglary concealment
    - c. Destruction of records or documents
  - 22.4.9.3.6 Profit
  - 22.4.9.3.7 Extremism
    - a. Terrorism
    - b. Riot/civil disturbance

SECTION 23

FIRE AND EXPLOSION DEATHS AND INJURIES

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.

501-23.1 ***The Investigator candidate shall be prepared to deal with death and injuries from fire and explosions.***

501-23.2 ***The Investigator candidate shall identify the elements of a death scene investigation.***

23.2.1 Fire suppression

23.2.2 Documentation

23.2.3 Notification

23.2.4 Recovery of bodies and evidence

501-23.3 ***The Investigator candidate shall describe death-related pathological and toxicological examinations.***

23.3.1 X-rays

23.3.2 Carbon monoxide levels

23.3.3 Presence of other toxic products

23.3.4 Smoke and soot exposure

23.3.5 Burns

23.3.6 Consumption of the body by fire

501-23.4 ***The Investigator candidate shall describe the fundamental issues of death investigations.***

23.4.1 Remains identification

23.4.2 Victim identification

23.4.3 Cause of death

23.4.4 Manner of death

23.4.5 Victim activity

23.4.6 Postmortem changes

501-23.5 ***The Investigator candidate shall describe the mechanism of death.***

23.5.1 Carbon monoxide

23.5.2 Thermal effects
- 23.5.2.1 Hyperthermia
- 23.5.2.2 Inhalation of hot gases

23.5.3 Other toxic gases

23.5.4 Soot and smoke

23.5.5 Hypoxia

501-23.6 ***The Investigator candidate shall describe postmortem tests and documentation.***

23.6.1 Blood

23.6.2 Internal tissue

23.6.3 External tissue

23.6.4 Stomach contents

23.6.5 Airways

23.6.6 Internal body temperatures

23.6.7 X-rays

23.6.8 Clothing and personal effects

23.6.9 Photographs

23.6.10 Diagrams of burn and injuries

23.6.11 Documentation of major physical trauma and wounds

23.6.12 Sexual assault evidence

23.6.13 Collection and preservation of other physical evidence

501-23.7 The Investigator candidate shall describe fire and explosion injuries.

23.7.1 Physical evidence
- 23.7.1.1 Clothing
- 23.7.1.2 Furnishings
- 23.7.1.3 Ignition sources
- 23.7.1.4 Notification laws

23.7.2 Medical evidence (burns)
- 23.7.2.1 Degree of burn
- 23.7.2.2 Body area (distribution)
- 23.7.2.3 Documentation
- 23.7.2.4 Mechanism of burn injury

23.7.3 Medical evidence (inhalation)
- 23.7.3.1 Sub-lethal inhalation exposure effects on the individual
- 23.7.3.2 Narcotic gases
- 23.7.3.3 Irritant gases
- 23.7.3.4 Smoke
- 23.7.3.5 Hospital tests and documentation

23.7.4 Access to medical evidence

501-23.8 The Investigator candidate shall describe the mechanism of inhalation injuries.

23.8.1 Elimination of carbon monoxide by oxygen/air

23.8.2 Explosion-related injuries

23.8.2.1 Blast pressure injuries
23.8.2.2 Shrapnel injuries
23.8.2.3 Thermal injuries
23.8.2.4 Seismic effect injuries

SECTION 24

APPLIANCES

4.2 Scene Examination.
Duties shall include inspecting and evaluating the fire scene, or evidence 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 act or activity that brought ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire.

NFPA 1033 4.2.8 Inspect the performance of building systems, including detection, suppression, HVAC, utilities, 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/or 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.

501-24.1 ***The Investigator candidate shall analyze appliances as it relates to investigation of the cause of fires.***

501-24.2 ***The Investigator candidate shall be able to record the scene involving an appliance.***

24.2.1 Recording specific appliances

24.2.2 Measurements of the location of the appliances

24.2.3 Positions of appliance controls

24.2.4 Document appliance information

24.2.5 Gathering all of the parts from the appliance

501-24.3 ***The Investigator candidate shall analyze the origin of appliances.***

24.3.1 Relationship of the appliance to the origin

24.3.2 Fire patterns

24.3.3 Plastic appliance components

24.3.4 Reconstruction of the area of origin

501-24.4 The Investigator candidate shall analyze the cause involving appliances.

24.4.1 How the appliance generated heat

24.4.2 The use and design of the appliance

24.4.3 Electrical appliances as ignition sources

24.4.4 Photographing appliance disassembly

24.4.5 Obtaining exemplar appliances

24.4.6 Testing exemplar appliances

501-24.5 The Investigator candidate shall describe each of the common parts or components that might be found in various appliances.

24.5.1 Appliance housings

24.5.2 Power sources
- 24.5.2.1 Power cords
- 24.5.2.2 Voltages less than 120
- 24.5.2.3 Batteries
- 24.5.2.4 Overcurrent protection

24.5.3 Switches
- 24.5.3.1 Manual switches
- 24.5.3.2 Automatic switches

24.5.4 Solenoids and relays

24.5.5 Transformers

24.5.6 Motors

24.5.7 Heating elements

24.5.8 Lighting

24.5.8.1 Fluorescent lighting systems
24.5.8.2 High intensity discharge lighting systems

24.5.9 Miscellaneous components

501-24.6 ***The Investigator candidate shall describe the operation and components of common residential appliances.***

24.6.1 Range or oven

24.6.2 Coffee makers

24.6.3 Toaster

24.6.4 Electric can opener

24.6.5 Refrigerator

24.6.6 Dishwasher

24.6.7 Microwave oven

24.6.8 Portable space heater

24.6.9 Electric blanket

24.6.10 Window air conditioner unit

24.6.11 Hair dryer and hair curler

24.6.12 Clothes iron

24.6.13 Clothes dryer

24.6.14 Consumer electronics

24.6.15 Lighting

SECTION 25

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.

501-25.1 ***The Investigator candidate shall describe the factors related to investigation of fires involving motor vehicles.***

501-25.2 ***The Investigator candidate shall describe the role vehicle investigation safety.***

501-25.3 ***The Investigator candidate shall describe and identify the different fuels in vehicle fires.***

25.3.1 Ignitable liquids

25.3.2 Gaseous fuels

25.3.3 Solid fuels

501-25.4 ***The Investigator candidate shall describe and identify the different ignition sources.***

25.4.1 Open flames

25.4.2 Electrical sources
- 25.4.2.1 Recreational vehicles
- 25.4.2.2 Overloaded wiring
- 25.4.2.3 Electrical high resistance connections
- 25.4.2.4 Electrical short circuits and arcs (electric discharge)
- 25.4.2.5 Arc (carbon) tracking
- 25.4.2.6 Lamp bulbs and filaments
- 25.4.2.7 External electrical sources used in vehicles

25.4.3 Hot surfaces

25.4.4 Mechanical sparks

25.4.5 Smoking materials

501-25.5 ***The Investigator shall identify the different types of systems and their function.***

25.5.1 Fuel system
- 25.5.1.1 Vacuum/low pressure carbureted systems
- 25.5.1.2 High-pressure fuel-injected systems
- 25.5.1.3 Diesel fuel system
- 25.5.1.4 Natural gas
- 25.5.1.5 Propane fuel
- 25.5.1.6 Turbochargers

25.5.2 Emission control system

25.5.3 Motor vehicle electrical systems

25.5.4 Mechanical power systems
- 25.5.4.1 Lubrication systems
- 25.5.4.2 Liquid cooling systems
- 25.5.4.3 Air-cooled systems
- 25.5.4.4 Electric motors

25.5.5 Mechanical power distribution
- 25.5.5.1 Mechanically geared transmissions
- 25.5.5.2 Hydraulically geared transmission

25.5.6 Accessories to the mechanical power system

25.5.7 Hydraulic braking system

25.5.8 Windshield washer systems

501-25.6 The Investigator candidate shall indentify the different body systems on motor vehicles.

25.6.1 Interior finishes and accessories

25.6.2 Cargo areas

501-25.7 The Investigator candidate shall identify the methods of recording the motor vehicle fire scene.

25.7.1 Vehicle identification

25.7.2 Vehicle fire scene history

25.7.3 Vehicle particulars

25.7.4 Documenting the scene

25.7.5 Documenting the vehicle away from the scene

501-25.8 ***The Investigator candidate shall describe the methods of motor vehicle examination.***

25.8.1 General

25.8.2 Examination of vehicle systems

25.8.3 Switches, handles, and levers

501-25.9 ***The Investigator candidate shall define "total burns" as it relates to motor vehicle fires.***

501-25.10 ***The Investigator candidate shall identify Special Considerations for Incendiary Vehicle Fires.***

501-25.11 ***The Investigator candidate shall be able to examine vehicle fires in structures.***

501-25.12 ***The Investigator candidate shall be able to incorporate the many similarities between recreational vehicles and motor homes and to houses and mobile homes.***

501-25.13 ***The Investigator candidate shall identify heavy equipment.***

25.13.1 Medium and heavy-duty trucks and buses

25.13.2 Mass transit vehicles

25.13.3 Earth-moving equipment

25.13.4 Forestry/logging equipment

25.13.5 Landfill equipment

25.13.6 Agricultural equipment

501-25.14 ***The Investigator candidate shall identify and gather information specific to the hybrid vehicle.***

25.14.1 Hybrid vehicle investigation safety

25.14.2 Hybrid vehicle technology

25.14.3 Investigation of hybrid vehicle fires

501-25.15 The Investigator candidate shall identify and document the nature of post incident damage prior to towing.

SECTION 26

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.

501-26.1 ***The Investigator candidate shall identify agencies that provide technical assistance and expertise related to wildfires.***

26.1.1 Texas Forest Service/United States Forest Service

26.1.2 State and/or federal park agencies

501-26.2 ***The Investigator candidate shall identify and describe wildfire fuels.***

26.2.1 Flammability analysis

26.2.2 Ground fuels
- 26.2.2.1 Duff
- 26.2.2.2 Roots
- 26.2.2.3 Dead leaves and coniferous litter
- 26.2.2.4 Grass, weeds and other small plants
- 26.2.2.5 Fine dead wood
- 26.2.2.6 Downed logs, stumps and large limbs
- 26.2.2.7 Low brush and reproduction vegetation

26.2.3 Aerial fuels
- 26.2.3.1 Tree branches and crowns
- 26.2.3.2 Snags
- 26.2.3.3 Tree moss
- 26.2.3.4 High brush

501-26.3 ***The Investigator candidate shall identify and describe factors affecting wildfire spread.***

26.3.1 Lateral confinement

26.3.2 Wind influence
- 26.3.2.1 Meteorological
- 26.3.2.2 Diurnal winds
- 26.3.2.3 Fire winds

26.3.3 Fire head

26.3.4 Fire heel

26.3.5 Fuel influence
- 26.3.5.1 Species of vegetation
- 26.3.5.2 Fuel size
- 26.3.5.3 Moisture content
- 26.3.5.4 Oil content
- 26.3.5.5 Fuel types

26.3.6 Topography
- 26.3.6.1 Slope
- 26.3.6.2 Aspect

26.3.7 Weather
- 26.3.7.1 Weather history
- 26.3.7.2 Temperature
- 26.3.7.3 Relative humidity

26.3.8 Suppression
- 26.3.8.1 Fire breaks
- 26.3.8.2 Air drops
- 26.3.8.3 Firing out
- 26.3.8.4 Class A foam

26.3.9 Other natural mechanisms of fire spread
- 26.3.9.1 Wind-borne embers and firebrands
- 26.3.9.2 Fire storms

26.3.10 Wildland-urban interface

26.3.11 Animals

501-26.4 ***The Investigator candidate shall identify, describe and interpret indicators used in determining the direction of travel of a wildfire.***

26.4.1 Wildfire V-shaped patterns

26.4.2 Degree of damage

26.4.3 Grass stems

26.4.4 Brush
- 26.4.4.1 Ash deposits
- 26.4.4.2 Cupping
- 26.4.4.3 Die-out patterns

26.4.5 Trees
- 26.4.5.1 Trunk char
- 26.4.5.2 Crown damage

26.4.6 Non-combustibles
- 26.4.6.1 Exposed and protected fuels
- 26.4.6.2 Staining and sooting
- 26.4.6.3 Loss of material

501-26.5 The Investigator candidate shall identify methods of conducting an origin investigation of a wildfire.

26.5.1 Initial area of investigation
- 26.5.1.1 Observations of reporting parties
- 26.5.1.2 Observations of initial attack crews
- 26.5.1.3 Observations of airborne personnel
- 26.5.1.4 Observations of other witnesses
- 26.5.1.5 Satellite imaging and remote sensing

26.5.2 Search techniques
- 26.5.2.1 Protection of fire scene
- 26.5.2.2 Identifying evidence
- 26.5.2.3 Analyzing fire spread
- 26.5.2.4 Origin area
  - 26.5.2.4.1 Segment division
  - 26.5.2.4.2 Loop technique
  - 26.5.2.4.3 Grid technique
  - 26.5.2.4.4 Lane technique

26.5.3 Search equipment
- 26.5.3.1 Magnifying glass
- 26.5.3.2 Magnet
- 26.5.3.3 Straight edge
- 26.5.3.4 Probe
- 26.5.3.5 Comb
- 26.5.3.6 Handheld lights
- 26.5.3.7 Air blower
- 26.5.3.8 Metal detectors
- 26.5.3.9 Sifting screen
- 26.5.3.10 Global Positioning Satellite (GPS) Recorder

501-26.6 ***The Investigator candidate shall identify and describe the importance of security of the area or point of origin of a wildfire.***

500-26.7 ***The Investigator candidate shall identify causes of wildfires.***

26.7.1 Natural causes
- 26.7.1.1 Lightening
- 26.7.1.2 Spontaneous heating

26.7.2 Human fire causes
- 26.7.2.1 Campsite
- 26.7.2.2 Smoking
- 26.7.2.3 Debris burning
- 26.7.2.4 Sunlight and glass refraction
- 26.7.2.5 Incendiary
- 26.7.2.6 Prescribed fire (controlled burn)
- 26.7.2.7 Machinery and vehicles
- 26.7.2.8 Railroad
- 26.7.2.9 Juveniles
- 26.7.2.10 Fireworks

26.7.3 Utilities
- 26.7.3.1 Electricity
- 26.7.3.2 Oil and gas drilling

501-26.8 ***The Investigator candidate shall understand that evidence preservation, collection, and documentation is similar at wildfires as with any other fire.***

501-26.9 ***The Investigator candidate shall identify special safety considerations associated with investigation of wildfires.***

26.9.1 Hazards

26.9.2 Personal protective equipment

501-26.10 ***The Investigator candidate shall aware of sources of information on wildfire fire investigation***

SECTION 27

MANAGEMENT OF COMPLEX INVESTIGATIONS

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.

501-27.1 ***The Investigator candidate shall be able to address those issues that are unique to managing investigations that are complex due to size, scope, or duration.***

27.1.1 Governmental inquiry

27.1.2 Intent

27.1.3 Purpose

27.1.4 Interested parties

27.1.5 Definitions

501-27.2 ***The Investigator candidate shall be familiar with the basic information and documents.***

501-27.3 ***The Investigator candidate shall understand the importance of communications among interested parties.***

27.3.1 Notice to interested parties
- 27.3.1.1 Entity in control
- 27.3.1.2 All interested parties
- 27.3.1.3 Roster of interested parties
- 27.3.1.4 Notification of changes
- 27.3.1.5 Making notification
- 27.3.1.6 Content of notification
- 27.3.1.7 Subsequent notifications

27.3.2 Meetings
- 27.3.2.1 Preliminary meeting
- 27.3.2.2 Meetings as the investigation progresses
- 27.3.2.3 Website
- 27.3.2.4 Additional dissemination of information

501-27.4 ***The Investigator candidate shall understand the complexity of the investigation and to ensure that all known interested***

parties are afforded an opportunity to investigate the incident and protect their respective interests, understandings or agreements.

27.4.1 Purposes

27.4.2 Scheduling

27.4.3 Cost sharing

27.4.4 Non-disclosure agreements

27.4.5 Protocols

27.4.6 Information sharing

27.4.7 Interviews

27.4.8 Amendments to agreement

27.4.9 Disagreements

501-27.5 The Investigator candidate shall identify and describe the component of managing a complex investigation.

27.5.1 Organizational models

27.5.2 Control of the site and scene
- 27.5.2.1 Securing the site and scene
- 27.5.2.2 Delegation of control
- 27.5.2.3 Transfer of control
- 27.5.2.4 Site and scene access
  - 27.5.2.4.1 Control of the site
  - 27.5.2.4.2 Establishing procedures for access
  - 27.5.2.4.3 Monitoring entry to the site
  - 27.5.2.4.4 Access control
  - 27.5.2.4.5 Escorts
  - 27.5.2.4.6 Public sector concerns
  - 27.5.2.4.7 Occupant access and control
  - 27.5.2.4.8 Decontamination in and out
- 27.5.2.5 Site-specific restrictions or requirements
- 27.5.2.6 Scene integrity
- 27.5.2.7 Release of information

501-27.6 ***The Investigator candidate shall understand the unique components of handling evidence of a complex investigation.***

27.6.1 Evidence control
- 27.6.1.1 Evidence custodian
- 27.6.1.2 Interested party responsibility

27.6.2 Evidence removal from the scene

27.6.3 Evidence storage

27.6.4 Evidence inspections
- 27.6.4.1 Non-destructive inspections
- 27.6.4.2 Destructive inspections
- 27.6.4.3 Testing of evidence

501-27.7 ***The Investigator candidate shall be able to supply logistical support while facilitating the complex investigation.***

27.7.1 Transportation

27.7.2 Equipment

27.7.3 Investigation site security

27.7.4 Decontamination

27.7.5 Environmental

27.7.6 Communications

27.7.7 Sanitary and comfort needs

27.7.8 Trash disposal and removal

27.7.9 Snow and ice removal

27.7.10 Lighting

27.7.11 Evidence storage

501-27.8 ***The Investigator candidate shall understand the unique characteristics of safety at the complex investigation.***

SECTION 28

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.

501-28.1 ***The Investigator candidate shall understand the factors related to the investigations of fires involving recreational boats, generally defined as less than 65 feet in length.***

501-28.2 ***The Investigator candidate shall define the following terms***.

28.2.1 Accommodation space

28.2.2 Adrift

28.2.3 Afloat

28.2.4 Aground

28.2.5 Below

28.2.6 Boat

28.2.7 Bulkhead

28.2.8 Cabin

28.2.9 Capsize

28.2.10 Deck

28.2.11 Dock

28.2.12 Dorade vent

28.2.13 Fender

28.2.14 Forward

28.2.15 Gallery

28.2.16 Gear

28.2.17 Hatch

28.2.18 Hold

28.2.19 Hull

28.2.20 Inboard

28.2.21 Inboard/outboard

28.2.22 Outboard

28.2.23 Overboard

28.2.24 Shore power

28.2.25 Sole

28.2.26 Starboard

28.2.27 Superstructure

28.2.28 Topside

28.2.29 Transom

28.2.30 Underway

28.2.31 Vessel

28.2.32 Waterline

501-28.3 ***The Investigator candidate shall understand the importance of boat investigation safety***.

28.3.1 Safety assessment

28.3.2 Inspection of boats on land

28.3.3 Inspection of boats afloat

28.3.4 Underwater inspections

28.3.5 Specific safety concerns
- 28.3.5.1 Confined spaces
- 28.3.5.2 Airborne particulates
- 28.3.5.3 Identify and assess energy sources
  - 28.3.5.3.1 Batteries
  - 28.3.5.3.2 Inverters
  - 28.3.5.3.3 Shore power
- 28.3.5.4 Fuel leaks
- 28.3.5.5 Sewage holding tank
- 28.3.5.6 Hydrogen gas
- 28.3.5.7 Other hydrocarbon contaminants
- 28.3.5.8 Stability
- 28.3.5.9 Damage to the structure of the boat
- 28.3.5.10 Wharves, docks, and jetties
- 28.3.5.11 Submerged boat
- 28.3.5.12 Visual distress signals and pyrotechnics

28.3.6 Openings

501-28.4 ***The Investigator candidate shall identify the different marine systems and functions***.

28.4.1 Fuel systems: propulsion and auxiliary
- 28.4.1.1 Vacuum/low pressure carbureted
- 28.4.1.2 High pressure/marine fuel injection
- 28.4.1.3 Diesel

28.4.2 Fuel systems: cooking and heating
- 28.4.2.1 Liquefied petroleum gases
- 28.4.2.2 Compressed natural gas
- 28.4.2.3 Alcohol
- 28.4.2.4 Solid fuels
- 28.4.2.5 Diesel

28.4.3 Turbochargers/super chargers

28.4.4 Exhaust system

28.4.5 Electrical system

28.4.6 Engine cooling system

28.4.7 Ventilation

28.4.8 Transmissions

28.4.9 Accessories

501-28.5 ***The Investigator candidate shall identify the exterior construction of the vessel.***

28.5.1 Hull construction

28.5.2 Superstructure construction material

28.5.3 Deck

28.5.4 Exterior accessories

501-28.6 ***The Investigator candidate shall identify the interior construction of the vessel.***

28.6.1 Construction materials

28.6.2 Finishes
- 28.6.2.1 Accommodation furnishings
- 28.6.2.2 Interior accessories
- 28.6.2.3 Engine/machinery compartments
- 28.6.2.4 Flammable/explosive vapor detectors
- 28.6.2.5 Storage and holds
- 28.6.2.6 Fuel tanks

501-28.7 ***The Investigator candidate shall identify the propulsion system of the vessel***.

28.7.1 Electric systems

28.7.2 Fuels for boats with motorized propulsion systems
- 28.7.2.1 Fuel systems
- 28.7.2.2 Appliance fuel systems
- 28.7.2.3 Electric generators

28.7.3 Other fuel systems used for propulsion

501-28.8 ***The Investigator candidate shall identify common ignition sources found in marine vessels***.

28.8.1 Open flames

28.8.2 Electrical sources

28.8.2.1 Overloaded wiring
28.8.2.2 Electrical short circuiting and arcs
28.8.2.3 Electrical connections
28.8.2.4 Lightning
28.8.2.5 Static electricity and incendive arcs

28.8.3 Hot surfaces
28.8.3.1 Manifolds
28.8.3.2 Exhaust systems
28.8.3.3 Cooking surfaces
28.8.3.4 Heating systems

28.8.4 Mechanical
28.8.4.1 Bearing failures
28.8.4.2 Friction

28.8.5 Smoking materials

501-28.9 ***The Investigator candidate shall properly document the boat fire scene.***

28.9.1 On land

28.9.2 In water
28.9.2.1 Moored
28.9.2.2 Anchored and underway
28.9.2.3 Underwater

28.9.3 Boat identification
28.9.3.1 Hull Identification Number (HIN)
28.9.3.2 Registration numbers
28.9.3.3 US Coast Guard documentation numbers
28.9.3.4 Boat name and hailing port
28.9.3.5 Boat history
28.9.3.6 Fire scene history

28.9.4 Boat particulars

501-28.10 ***The Investigator candidate shall identify the components of the boat examination***.

28.10.1 General

28.10.2 Examination of boat systems

501-28.11 ***The Investigator candidate shall describe marine fire investigations of boats in structures***.

501-28.12 ***The Investigator candidate shall describe legal considerations to marine fire investigations***.

SECTION 29

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, documentation, and a specific audience, so that the report accurately reflects the investigative findings, is concise, expresses the investigator's opinion, contains facts and data that the investigator relies on in rendering an opinion, contains the reasoning of the investigator by which each opinion was reached, and meets the needs or 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.

NFPA 1033 4.7.4 Conduct public informational presentations, given relevant data, so that information is accurate, is appropriate to the audience, and clearly supports the information needs of the audience.

(A) Requisite Knowledge. Types of data available regarding the fire loss problem and the issues about which the community must know.

(B) Requisite Skills. Ability to assemble, organize, and present information.