

- 9. Matters referred from the Fire Fighter Advisory Committee (FFAC), including but not limited to:**
- C. Discussion and possible action on recommendations from the Curriculum and Testing Committee with regard to the Fire Investigator Curriculum, HazMat Awareness and HazMat Operations reference lists.**

CERTIFICATION CURRICULUM MANUAL

CHAPTER FIVE

FIRE INVESTIGATOR

NFPA 1033 2009 Edition

Effective June 1, 2011



Texas Commission on Fire Protection
P.O. Box 2286 Austin, Texas 78768-2286 (512) 936-3838

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

~~Noll, Gregory G., et al., *Hazardous Materials: Managing the Incident.* (3rd ed.) (2005). Chester, MD: Red Hat Publishing Company Inc.~~

~~*Hazardous Materials Response Handbook.* (4th ed.) (2002). Quincy, MA: NFPA Publications. National Fire Protection Association.~~

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.

Factory Mutual Insurance – Fire Investigators Handbook

The VIN number book - Passenger Vehicle Identification Manual (2010, 81st edition) National Insurance Crime Bureau, 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

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**CHAPTER FIVE
FIRE INVESTIGATOR
COURSE PHASE OUTLINE**

| SECTION | SUBJECT | RECOMMENDED HOURS |
|----------------|---|--------------------------|
| | PHASE I | |
| | Commission on Fire Protection Rules and Regulations | |
| 500-3 | Definitions | |
| 500-4 | Basic Methodology | 2 |
| 500-5 | Basic Fire Science | 8 |
| 500-6 | Fire Patterns | 8 |
| 500-7 | Building Systems | 4 |
| 500-8 | Electricity and Fire | 8 |
| 500-9 | Building Fuel Gas Systems | 4 |
| 500-10 | Fire-Related Human Behavior | 2 |
| | Total Recommended Hours | 36 |
| | PHASE II | |
| 500-11 | Legal Considerations | 8 |
| 500-12 | Safety | 2 |
| 500-13 | Sources of Information | 8 |
| 500-14 | Planning the Investigation | 2 |
| 500-15 | Documentation of the Investigation | 8 |
| 500-16 | Physical Evidence | 4 |
| 500-17 | Origin Determination | 8 |
| | Total Recommended Hours | 40 |
| | PHASE III | |
| 500-18 | Fire Cause Determination | 4 |
| 500-19 | Analyzing the Incident for Cause and Responsibility | 8 |
| 500-20 | Failure Analysis and Analytical Tools | 8 |
| 500-21 | Explosions | 4 |
| 500-22 | Incendiary Fires | 8 |
| 500-23 | Fire and Explosion Deaths and Injuries | 4 |
| | Total Recommended Hours | 36 |
| | PHASE IV | |
| 500-24 | Appliances | 2 |
| 500-25 | Motor Vehicle Fires | 8 |
| 500-26 | Wildfire Investigations | 3 |
| 500-27 | Management of Complex Investigations | 2 |
| 500-28 | Marine Fire Investigations | 3 |
| | Practical Exercises* | 20 |
| | Total Recommended Hours | 38 |
| | 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.

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

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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).***

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SECTION 4

BASIC METHODOLOGY

4.1 General

NFPA 1033 4.1.2 The fire investigator shall employ all elements of the scientific method as the operating analytical process throughout the investigation and for the drawing of conclusions.

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.***

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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 ignitability 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 ignitability; distinguish impact of different types of fuel loads; evaluate fuel trails; and analyze and synthesize information.

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

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

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

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 transitions 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 ignitability; 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

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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

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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

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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

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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

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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

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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.***

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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

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SECTION 19

ANALYSING 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

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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

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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

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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

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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 identify 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.***

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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.***

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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.

REFERENCE LIST FOR THE HAZARDOUS MATERIALS AWARENESS 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

Texts

- Code of Federal Regulations, Title 29 Part 1910.120, Appendix A.* United States. U.S. Department of Labor, Occupational Safety & Health Administration.
http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/29cfr1910.120.pdf
- Certification Curriculum Manual.* Texas Commission on Fire Protection. (Most current edition). Austin, TX: Texas Commission on Fire Protection.
- Emergency Response Guidebook.* United States. (Most current edition). Washington, DC: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.
- Essentials of Fire Fighting **and Fire Department Operations**, 5th edition.* International Fire Service Training Association. (2008). Stillwater, OK: Fire Protection Publications, Oklahoma State University.
- Firefighter's Handbook: Essentials of Firefighting and Emergency Response, 3rd edition.* Delmar Publishers. (2008). Clifton Park, NY: Delmar, Cengage Learning.
- Fundamentals of Fire Fighter Skills, 2nd edition.* International Association of Fire Chiefs, & National Fire Protection Association. (2008). Sudbury, MA: Jones and Bartlett.
- Hazardous Materials Awareness and Operations.* DeBobes, L. J. (2009). Sudbury, MA: Jones & Bartlett.
- Hazardous Materials for First Responders, 3rd edition.* Adams, B., & Miller, L. A. (2004). Stillwater, OK: Fire Protection Publications, Oklahoma State University.
- Hazardous Materials Handbook: Awareness and Operations Levels.* Hawley, C., & Walter, A. (2008). Clifton Park, NY: Delmar, Cengage Learning.
- Hazardous Materials/Weapons of Mass Destruction Response Handbook, 5th edition.* Trebisacci, D. G. (2008). Quincy, MA: National Fire Protection Association.
- NFPA 472: Standard for Professional Competence of Responders to Hazardous Materials Incidents.* (2008 ed.). Quincy, MA: NFPA Publications. National Fire Protection Association
- Standards Manual for Fire Protection Personnel.* Texas Commission on Fire Protection. (Current edition). Austin, TX: Texas Commission on Fire Protection.

Recommended References

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

Texts

Hazardous Materials Field Guide, 2nd edition. Bevelacqua, A. S., & Stilp, R. H. (2007). Albany, NY: Delmar Publications.

Symbol Seeker: Hazard Identification Manual. Burns, P. P. (2002). Preston, England: Symbol Seeker.

Media

DOT Chart 13: Hazardous Materials Marking, Labeling and Placarding Guide. United States. (2007). Washington, DC: U.S. Dept. of Transportation, Pipeline and Hazardous Materials Safety Administration.

Emergency Response Guidebook 2008. [DVD]. United States. (2008). Washington, DC: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.

Hazmat Awareness. Action Training Systems, Inc. (2008). [2 Disc DVD Set - Recognition & Identification]. Poulsbo, WA: Action Training Systems.

Hazardous Materials Awareness and Operations [DVD]. International Association of Fire Chiefs, & National Fire Protection Association. (2006). Sudbury, MA: Jones and Bartlett.

REFERENCE LIST FOR THE HAZARDOUS MATERIALS OPERATIONS - MISSION SPECIFIC COMPETENCIES 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

Texts

Certification Curriculum Manual. Texas Commission on Fire Protection. (Most current edition). Austin, TX: Texas Commission on Fire Protection.

Code of Federal Regulations, Title 29 Part 1910.120, Appendix A. United States. U.S. Department of Labor, Occupational Safety & Health Administration.
http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/29cfr1910.120.pdf

Emergency Response Guidebook. United States. (Most current edition). Washington, DC: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.

Essentials of Fire Fighting and Fire Department Operations, 5th edition. International Fire Service Training Association. (2008). Stillwater, OK: Fire Protection Publications, Oklahoma State University.

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Hazardous Materials/Weapons of Mass Destruction Response Handbook, 5th edition. Trebisacci, D. G. (2008). Quincy, MA: National Fire Protection Association.

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

NIOSH Pocket Guide to Chemical Hazards. National Institute for Occupational Safety and Health. (Most current edition). Cincinnati, OH: US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. <http://www.cdc.gov/niosh/npg/>

Standards Manual for Fire Protection Personnel. Texas Commission on Fire Protection. (Most current edition). Austin, TX: Texas Commission on Fire Protection.

Recommended References

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

Texts

Bretherick's Handbook of Reactive Chemical Hazards. Urben, P. G., Pitt, M. J., & Bretherick, L. (2007). Amsterdam: Elsevier.

Chlorine Emergencies: An Overview for First Responders. Chlorine Institute. (2007). Arlington, VA: The Chlorine Institute.

CHRIS: Chemical Hazards Response Information System. United States. (1992). COMDTINST, M16465.11B. Washington, DC: U.S. Dept. of Transportation, U.S. Coast Guard.

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Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads. (2009). Washington, DC: Association of American Railroads.

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Fire Protection Guide to Hazardous Materials. National Fire Protection Association. (2001). Quincy, MA: National Fire Protection Association.

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Hazardous Materials Field Guide, 2nd edition. Bevelacqua, A. S., & Stilp, R. H. (2007). Albany, NY: Delmar Publications.

Hazardous Materials: Managing the Incident Field Operations Guide. Chester Bevelacqua, A. S., Hildebrand, M. S., & Noll, G. G. (2005). MD: Red Hat Publishing, Inc.

How to Use the Chlorine Institute Emergency Kit "A" for 100 lb. and 150 lb. Chlorine Cylinders. Chlorine Institute. (1996). New York, NY: The Chlorine Institute.

How to Use the Chlorine Institute Emergency Kit "B" for Chlorine Ton Containers. Chlorine Institute. (1988). New York, NY: The Chlorine Institute.

How to Use the Chlorine Institute Emergency Kit "C" for Chlorine Tank Cars and Tank Trucks. Chlorine Institute. (1993). New York, NY: The Chlorine Institute.

Symbol Seeker: Hazard Identification Manual. Burns, P. P. (2002). Preston, England: Symbol Seeker.

Media

Hazardous Materials Containment Series. Action Training Systems. [4 Disc DVD Set] Hazardous materials containment - series of 4 titles. Seattle, WA: Action Training Systems.

Hazardous Materials: Managing the Incident DVD Series. Massingham, G., Noll, G. G., Hildebrand, M. S., & Noll, G. G. (2005). [8 Disc DVD Set] Edgartown, MA: Emergency Film Group.