

# National Fire Academy FESHE Model Curriculum Bachelor's (Non-Core)

Reviewed May 2019



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## **Fire Dynamics (C0257)**

### **Course Description**

This course examines the underlying principles involved in structural fire protection systems and building furnishings, as well as fire protection systems, including water-based fire suppressions systems, fire alarm and detection systems, special hazard suppression systems, and smoke management systems.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of this course, you will be able to:

1. Analyze building structural components for fire endurance and fire resistance.
2. Understand the flame spread and smoke production properties of building furnishings and materials.
3. Understand the importance of, and be able to calculate, heat release rate for combustibles.

### **Course Objectives**

#### **Module I: Definition, Units, Fire Tetrahedron, Heat Transfer, Heat of Combustion, Ideal Gas Law**

After completing this module, you will be able to:

1. Understand the definition and history of fire dynamics.
2. Review examples of fire incidents.
3. Become proficient in using S.I. units and converting between units.
4. Understand the fire tetrahedron.
5. Know the difference between diffusion flames and premixed flames.
6. Classify the three modes of heat transfer, and describe their relevance to fires.

7. Solve simple heat transfer problems.
8. Understand the principles of heats of combustion.
9. Solve elementary problems involving the Ideal Gas Law.

## **Module II: Ignition and Flame Spread of Materials**

After completing this module, you will be able to:

1. Given a specific fuel type and form, describe the ignition and fire growth process.
2. Explain the process of flame spread in liquid fuels, and calculate the burning rate for a liquid fuel fire.
3. Explain the process of flame spread over a solid fuel, and list variables that affect flame spread rate.
4. Be able to predict ignition times for various fuels.

## **Module III: Plumes**

After completing this module, you will be able to:

1. Calculate flame height.
2. Calculate the thermal radiation from a flame.
3. Define the structure of buoyant plumes and ceiling jets.
4. Calculate the temperature, velocity, and mass flow rate of a fire plume.
5. Predict a fire's heat release rate using the time squared method.
6. Explain the impact of walls and corners on flames and plumes.
7. Estimate operation time of sprinklers and heat detectors.
8. Estimate the heat release rate needed for flashover.

#### **Module IV: Smoke**

After completing this module, you will be able to:

1. Define smoke.
2. Understand the dangers of smoke.
3. Describe the effects of visibility in smoke, and calculate viewing distance in smoke.
4. Discuss the toxicity of smoke.
5. Explain how stack effect controls the movement of smoke.
6. Understand the various methods of controlling smoke.
7. Estimate the amount of smoke produced by a fire.
8. Calculate the filling rate of smoke in a space.

#### **Module V: Explosions**

After completing this module, you will be able to:

1. Discriminate between deflagrations and detonations.
2. Classify three types of explosions.
3. Relate blast effects and overpressure to property damage and life safety.
4. Differentiate between a BLEVE and an UVCE.
5. Explain the fire and explosion potential in concentrated dust environments.
6. Calculate the TNT equivalent of a given amount of material.
7. Relate TNT equivalence to overpressure.
8. Relate overpressure to damage.

## Available Texts

Cote, A. E. (Ed.). (2008). *Fire protection handbook, volumes I and II* (20th ed.). National Fire Protection Association. <https://www.constructionbook.com/store/product/fire-protection-handbook-20th-edition>

Drysdale, D. (2011). *An introduction to fire dynamics* (3rd ed.). Hoboken, NJ: Wiley. ISBN: 9780470319031, <http://www.wiley.com/WileyCDA/WileyTitle/productCd-EHEP002263.html>

Friedman, R. (1998). *Principles of fire protection chemistry and physics* (3rd ed.). Quincy, MA: National Fire Protection Association. ISBN: 0-87765-440-9. <http://www.nfpa.org/>

Gorbett, G. E., & Pharr, J. L. (2011). *Fire dynamics*. New York, NY: Pearson. <http://www.bradybooks.com/store/product.aspx?isbn=0135075882>

## Course Outline

### I. Introduction

- A. Basic Dynamics of Fire
  - 1. Heat Transfer
  - 2. Flame
  - 3. Flashover
- B. Mathematics Review

### II. Chemistry, Physics and Fluid Dynamics

- A. Working with Chemical and Physical/Kinetic Calculations
  - 1. Stoichiometry
  - 2. Heat Transfer
  - 3. Measurement Tools and Resources
  - 4. Fluid Dynamics

### III. Fire and Combustion

- A. Flame Dynamics
- B. Calorimetry

### IV. Explosions

- A. Definitions
- B. Deflagration and Detonation Calculations
- C. Enclosed Explosions

- V. Ignition and Flame Spread
  - A. Liquid and Solid Fuels Ignition
  - B. Liquid Flame Spread
  - C. Solid Flame Spread
  
- VI. Plumes
  - A. Flame height
  - B. Radiation
  - C. Velocity
  - D. Ceiling jets
  
- VII. Flashover and Compartment Fires
  - A. Combustion Phases
  - B. Smoke
  - C. Energy Release and Pressure Calculations
  - D. Backdraft
  
- VIII. Post-flashover Fires
  - A. Energy Release and Temperatures
  
- IX. Smoke Movement
  - A. Smoke Definition and Production
  - B. Toxicity
  - C. Stack Effect
  - D. Venting and Smoke Control
  
- X. Fire Suppression
  - A. Extinguishment Mechanisms
  
- XI. Fire Dynamics Applications to Building Codes and Large-Loss Fires
  - A. Hillhaven Nursing Home Fire
  - B. DuPont Plaza Hotel Fire
  - C. First Interstate Bank Fire
  - D. Fire Dynamics in Building Codes and Fire Safety Standards

XII. Fire Dynamics and Special Hazards

- A. Spontaneous Combustion
- B. Oxygen Enriched Environments
- C. Shipboard and Metal Wall Fires
- D. Wildland Fires
- E. Wind-driven Fires

XIII. Fire Modeling and Trends in Fire Dynamics

- A. Model Types
- B. Trends



## **Fire Related Human Behavior (C0263)**

### **Course Description**

This course presents a study of human behavior in fire and other emergency situations. Students will examine current and past research on human behavior, systems models, life safety education, and building design to determine the interactions of these areas in emergency situations. Students will develop an understanding of a best-practice building life safety system as one that combines knowledge in the areas of psychology and sociology, joined with engineering and education to produce the best possible outcomes in terms of human survivability in an emergency.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of the course, you will be able to:

1. Apply knowledge to create a system that integrates human behavior factors into life safety planning and practice.
2. Understand how psychology and sociology factors influence behavior.
3. Demonstrate how current computer systems modeling functions.
4. Locate and analyze current human-related fire research.

### **Course Objectives**

#### **Module 1: Fire and Human Behavior**

After completing this module, you will be able to:

1. Describe the history of fire-related human behavior as a field of study.
2. Explain common behavioral factors in response to fire and emergencies, and specify misconceptions about human behavior in a fire emergency.
3. Identify systems and the interrelationship of people and buildings as a system.
4. Explain the importance of studying fire-related human behavior as a method of reducing accidental death and injury.

## **Module 2: Factors Influencing Behavior**

After completing this module, you will be able to:

1. Analyze how specific occupant characteristics relate to behavior.
2. Explain how group dynamics affect decisionmaking.
3. Describe specific examples of how training (fire drills) and the built environment affect behaviors.
4. Explain how the built environment and human behavior are interdependent.
5. Explain factors that influence how a threat is perceived, as well as risk perception and decisionmaking factors that affect behavior, especially as they relate to alarms.
6. Explain how remote risks and action schemas influence risk perception and decisionmaking.
7. Assess how the occupancy category affects behaviors, and explain why people are more likely to die from a fire in their home than anywhere else.
8. Compare and contrast historical fires with more current fires to determine changes that have occurred.

## **Module 3: Research and Design**

After completing this module, you will be able to:

1. Describe various scientific methods for conducting fire-related social research, and explain how each is best applied to specific avenues of inquiry.
2. Demonstrate the ability to locate and use current research.
3. Distinguish good research from persuasive techniques and spurious research, online and on paper.
4. Give examples of two computer models that use information about building occupants to help predict overall systems (building) performance during fires.
5. Explain the logical basis for goal decomposition, and list three goal-based systems approaches that use this technique.
6. Describe the two ways in which hard and soft systems approaches differ, and how these differences make the various types of models more useful or less useful.

7. List two sources of assumptions used in the current method for calculating exit capacities in the model codes, and explain why a simple linear model of exit capacities is less valid than the effective width model; state how researchers discovered its inaccuracy.
8. Compare and contrast current modeling systems, and explain their positive and negative features.

#### **Module 4: Integrating Design and Behavior**

After completing this module, you will be able to:

1. Assess how the characteristics of the physical setting in which a fire occurs may influence how people respond to the emergency.
2. Identify the three features of building exits that are important from a human behavior standpoint.
3. Explain three examples of how human behavior can negate the effects of warning and fire suppression systems.
4. Describe two methods of reducing crowding situations during emergency egress.
5. Correctly rank the effectiveness of floor plans, signs, and verbal instructions in helping people find their way around buildings, and explain why these approaches fall into this order of effectiveness.
6. Describe the false alarm effect, and identify five steps to lessen the effect.
7. Explain how task persistence can jeopardize life safety.
8. Differentiate between active errors and latent errors.
9. Explain the interaction and interdependence of environment and behavior.
10. Describe potential problems associated with protecting people with disabilities during fire emergencies.
11. Describe at least two human behavioral issues associated with the use of elevators to evacuate people from large, multistory buildings.

## Module 5: Toward Integrated Systems

After completing this module, you will be able to:

1. Differentiate between performance and prescriptive codes and explain the benefits and drawbacks of each.
2. Discuss industry goals for the future that are informed by behavioral science.
3. Develop a model system that integrates human behavior factors into life-safety planning and practice.
4. Demonstrate synthesis of learning over this course by drawing conclusions based on material studied and applying knowledge to practical and realistic tasks.

### Available Text

Cote, A. E. (Ed.). (2008). *Fire protection handbook, volumes I and II* (20th ed.). National Fire Protection Association. <https://www.constructionbook.com/store/product/fire-protection-handbook-20th-edition>

### Additional Resources

Badger, S. G. (2005). *Catastrophic multiple-death fires in the United States*. Quincy, MA: National Fire Protection Association.

Benichou, N., & Hadjisophocleous, G. V. (2001, Winter). Development of performance-based codes, performance criteria and fire safety engineering methods. *International Journal on Engineering Performance-Based Fire Codes*, 2(4): 127–142.

Bryan, J. L. (2002, Fall). A selected historical review of human behavior in fire. *Fire Protection Engineering*, 16, 4–10.

Bukowski, R. W. (2005, December). Applying the lessons of September 11, 2001 to the built environment. *Australian Building Regulation Bulletin*.

Consulting-Specifying Engineer staff. (2003, March). Disasters offer lessons for future. *Consulting-Specifying Engineer*, 33(3). Retrieved from <https://www.csemag.com/articles/disasters-offer-lessons-for-future/>

Drabek, T. E. (2007). Sociology, disasters and emergency management: History, contributions, and future agenda. In D. A. McEntire (Ed.), *Disciplines, disasters and emergency management: The convergence and divergence of concepts, issues and trends in the research literature*. Springfield, IL: Charles C Thomas Publisher.

- Duval, R. F. (2006). *NFPA case study: Nightclub fires*. Quincy, MA: National Fire Protection Association.
- Evarts, B. (2011). *Human factors contributing to fatal injury* [Executive Summary]. Retrieved from <https://www.nfpa.org/News-and-Research/Data-research-and-tools/ARCHIVED/Fire-statistics/Demographics-and-victim-patterns/Human-factors-contributing-to-fatal-injury>
- Evarts, B. (2011). *Structure fires in dormitories, fraternities, sororities, and barracks*. Quincy: MA: National Fire Protection Association.
- Fahy, R. F., & Proulx, G. (1997). *Human behavior in the World Trade Center evacuation* [Publication]. Gaithersburg, MD: National Institute of Standards and Technology.
- Fahy, R. F., & Proulx, G. (2002). *A comparison of the 1993 and 2001 evacuations at the World Trade Center*. National Research Council Canada.
- Fischer, H. W., Stine, G. F., Stoker, B. L., & Trowbridge, M. L. (1995). Evacuation behavior: Why do some evacuate, while others do not? A case study of the Ephrata, Pennsylvania (USA) evacuation. *Disaster Prevention and Management* 4(4): 30–36. doi: 10.1108/09653569510093414
- Groner, N. E. (1985, September). Life safety strategies: How a building's designers and users can work together to reduce the risk of death and injury during a fire. *Fire Journal*, 79(5): 27–30.
- Groner, N. E. (2002, October). A compelling case for emergency elevator systems. *Fire Engineering*, 155(10).
- Groner, N.E. (2004). User centered design can produce safer and more cost effective buildings by supporting the adaptive responses of emergency teams and occupants. *Proceedings of the 3rd International Symposium on Human Behavior in Fire*. London: Interscience Communications
- Hoover, A. (2015, November 28). The worst nightclub fire in history happened 73 years ago in Boston. *The Boston Globe*. Retrieved from <https://www.boston.com/news/history/2015/11/28/the-worst-nightclub-fire-in-history-happened-73-years-ago-in-boston>
- Jones, B. K., & Pauls, J. L. (1980). Research in human behavior. *Fire Journal*, 74(3): 35–41.
- Kuligowski, E. D. (2005). *Review of 28 egress models* (Report no. 1032). Gaithersburg, MD: National Institute of Standards and Technology.
- Kuligowski, E. D. (2008). *Modeling human behavior during building fires* (Report no. 1619). Gaithersburg, MD: National Institute of Standards and Technology.

- Kuligowski, E. D. (2009). *The process of human behavior in fires* (Report no. 1632). Gaithersburg, MD: National Institute of Standards and Technology.
- Lee, A., Midgett, J., & White, S. (2004). *A review of the sound effectiveness of residential smoke alarms* (Report no. CPSC-ES-0502). Washington, D.C.: U.S. Consumer Product Safety Commission.
- Libby, R. J., & Evenson, J. M. (2012, May). Designing an effective emergency communication system. *Consulting-Specifying Engineer*. Retrieved from <https://www.csemag.com/articles/designing-an-effective-emergency-communication-system/>
- Marsar, S. (2010, July). Survivability profiling: How long can victims survive in a fire? *Fire Engineering*, 163(7): 77–82.
- Murphy, S. (2002, September-October). The human factor. *NFPA Journal*, 96(5): 54–60.
- National Research Council. (2003). *Making the nation safe from fire: A path forward in research*. Washington, D.C.: National Academies Press.
- NFPA. (1996). *Fire investigation summary: Chapel Hill, NC Fraternity House Fire, May 12, 1996* [Report]. Quincy, MA: National Fire Protection Association.
- O'Connor, D. J. (2005, Fall). Integrating human behavior factors into design. *Fire Protection Engineering*, 28, 8–20.
- Peacock, R. D., & Kuligowski, E. D. (2010). *Building occupant egress data*. Gaithersburg, MD: National Institute of Standards and Technology.
- Pires, T. T. (2005, March). An approach for modeling human cognitive behavior in evacuation models. *Fire Safety Journal*, 40(2): 177–189.
- Proulx, G. (2000). *Strategies for ensuring appropriate occupant response to fire alarm signals*. Ottawa, Ontario, Canada: Institute for Research in Construction.
- Proulx, G. (2000). *Why building occupants ignore fire alarms*. Ottawa, Ontario, Canada: Institute for Research in Construction.
- Public/Private Fire Safety Council. (2006). *Home smoke alarms and other fire detection and alarm equipment* [White paper]. Retrieved from <http://www.staugustafd.org/pdf/SmokeAlarmsWhitePaper0406.pdf>
- SFPE. (2003). *Human behavior in fire*. Bethesda, MD: Society of Fire Protection Engineers.
- USFA, National Fire Data Center. (2003, July). Establishing a relationship between alcohol and casualties of fire. *Topical Fire Research Series*, 3(3).

- Winerman, L. (2004, September). Fighting fire with psychology. *Monitor on Psychology*, 35(8): 28–30.
- Yamada, T., & Akizuki, Y. (2016). Visibility and human behavior in fire smoke. In Hurley, M. J. et al. (Eds.), *SFPE Handbook of Fire Protection Engineering*. New York, NY: Springer.
- Yung, D. T., Proulx, G., Benichou, N. (2001). *Comparison of model predictions and actual experience of occupant response and evacuation in two highrise apartment building fires*. National Research Council Canada.

## Course Outline

- I. History and Scope of the Problem
- II. Research
  - A. Methods
- III. Systems Models
  - A. Computer Modeling
  - B. Goal-Based Approaches
  - C. Sociological Approach vs. Engineering Approach
- IV. Case-Based Learning
  - A. Scenario: Single Family Residential Dwelling
    - 1. Socioeconomic Factors Influencing Fire Related Human Behavior
    - 2. Gender Differences
    - 3. Consequences and Risk Perception
  - B. Scenario: Wildland/Rural Fire
    - 1. Challenges Presented in Wildland Fire
    - 2. Threat Recognition
  - C. Decisionmaking
  - D. Taking Action
  - E. Psychological Effects on Firefighters
  - F. Physical Reaction to Stress
  - G. Scenario: Board-and-Care Home Fire
    - 1. Socioeconomic Factors that Influence Fire Risk Decisions
    - 2. Role Conflicts
    - 3. Familiarity with Routes of Escape
    - 4. The Building System
  - H. Scenario: Commercial/Industrial Fire
    - 1. Motives of Arson
    - 2. Characteristics of Group Response to Fire

- 3. Characteristics of the Physical Setting
  - 4. Interpreting Alarm Signals
- I. The Content of Codes
  - 1. Assumptions About Human Behavior that Effect Code Provisions
- J. Code Enforcement
- K. Scenario: Multi-Use Occupancy (High-rise) Fire
  - 1. Errors: Active vs. Latent
  - 2. The “Myth” of Panic
  - 3. Hollywood and Flashover
  - 4. Role Behaviors During a Fire
  - 5. Evacuation Delays and Difficulties
  - 6. Problems
    - a. False and Nuisance Alarms
    - b. Fire Alarm Fatigue
    - c. Occupants not Awakened by the Smell of Smoke
    - d. Ambiguity of Information
    - e. Crowding: Egress Design Issues
    - f. Convergence Clusters
    - g. Disabled Persons
    - h. Disabled Persons
  
- V. Egress Behavior
  - A. Hazard Perception
  - B. Misrecognized Clues
  - C. Task Persistence
  - D. Positive Behaviors
  
- VI. Alcohol
  - A. Perception of Safety
  - B. Overconfidence
  
- VII. Survivability — Why Do Some Survive
  
- VIII. Incorporating Human Behavior into Life Safety Systems — The 3 E’s Fire Safety through Environmental Design
  
- IX. 911 Was a Success?!?
  
- X. Security vs. Fire Safety — Managing Large Crowds
  
- XI. Computerized Evacuation Modeling — Improving Evacuation Modeling



XII. Prescriptive Codes vs. Performance Based Codes

- A. Behavioral Economics

XIII. Sociology of Disasters

- A. Crowd Behavior
- B. “Sensemaking”
- C. Community Resilience and Learned Helplessness

## **Analytical Approaches to Public Fire Protection (C0265)**

### **Course Description**

This course examines the tools and techniques of rational decision-making in fire and emergency services agencies, including data collection, statistics, probability, decision analysis, utility modeling, resource allocation, and cost-benefit analysis.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of this course, you will be able to:

1. Discuss the uses of analytical approaches to rational decision-making.
2. Differentiate techniques of analysis.
3. Select appropriate analytic tools to support critical thinking.
4. Discuss how the use of databases, histograms, inferential statistics and probabilities and GIS are used in fire station location planning.
5. Apply the 5-step cost-benefit analysis process to justify essential budgetary needs.
6. Use linear programming to solve fire department equipment, revenue, facility, and personnel issues.

### **Course Objectives**

#### **Module I: Analytical Thinking, Data, and Analysis**

After completing this module, you will be able to:

1. Articulate the importance of rational decision-making and the analytical thinking that underlies it.
2. Given a scenario, determine which research methodology is most effective.
3. Apply critical thinking techniques to evaluate the research of others.

4. Determine the difference between data and information.
5. Identify the advantages and disadvantages of using a database.
6. Analyze the structure and use of databases.
7. Interpret graphs, frequency charts, and histograms.
8. Measure the usefulness of means and standard deviations -- the measures of centrality and spread.
9. Analyze database design, and develop descriptive statistics to address a range of fire and emergency services issues.

### **Module II: Decision Analysis**

After completing this module, you will be able to:

1. Apply system analysis techniques to decision-making.
2. Compare and contrast event and decision trees and how they aid in decision analysis.
3. Apply strategic planning concepts to decision-making.

### **Module III: Mathematical Modeling and GIS**

After completing this module, you will be able to:

1. Evaluate the functions of mathematical modeling.
2. Illustrate the benefits and limitations of using a mathematical function to model the relationship between multiple factors.
3. Demonstrate how the ISO Fire Suppression Rating Schedule is an example of utility modeling that can be used in the fire services.
4. Analyze the benefits and limitations of using a mathematical function to model the relationships between multiple factors.
5. Correlate input conditions and constraints.
6. Apply mathematical techniques to a model system in order to make reasonable predictions.

7. Evaluate how to implement GIS in an emergency service agency.
8. Apply GIS to identify and evaluate a community's risk and hazard level.

#### **Module IV: Probability**

After completing this module, you will be able to:

1. Compute probabilities of simple and compound events.
2. Apply Bayes' Theorem to decision-making situations in the fire and emergency services.
3. Determine the number of possible permutations and combinations.
4. Solve simple probability problems.

#### **Module V: Resource Allocation and Cost-Benefit Analysis**

After completing this module, you will be able to:

1. Calculate run distances, travel times, and company workload using graphing techniques, hand calculations, and statistical analysis.
2. Explore various automated tools available to do statistical analysis of resource allocation.
3. Assess and interpret fire station location issues and recommendations supported by analysis.
4. Evaluate the basic assumptions of cost-benefit analyses.
5. Examine the five steps of cost-benefit analysis: risk assessment, identification, data collection, calculation, and analysis.

#### **Available Texts**

Cote, A. E. (Ed.). (2008). *Fire protection handbook, volumes I and II* (20th ed.). National Fire Protection Association. <https://www.constructionbook.com/store/product/fire-protection-handbook-20th-edition>

USFA. (2004). *Fire data analysis handbook* (2nd ed.). Retrieved from <https://www.usfa.fema.gov/downloads/pdf/publications/fa-266.pdf>

## Course Outline

- I. Definitions
- II. Rational Decision-Making and Research Analysis
- III. Databases
  - A. Definition and Purpose
- IV. Descriptive Statistics
  - A. Graphs and Functions
  - B. Histograms
  - C. Standard Deviation
  - D. Standardized Scores
- V. Inferential Statistics
  - A. Sampling
  - B. Process Control
- VI. Probability
  - A. Approaches to Probability
  - B. Basic Rules of Probability
- VII. Decision Analysis
  - A. Event Trees
  - B. Systems Analysis
- VIII. Mathematical Modeling
  - A. Mathematical Modeling Processes
- IX. Resource Allocation
  - A. Station Location Analysis Principles
- X. Geographical Information Systems
  - A. Definition
  - B. Data Resources
  - C. Application

XI. Cost-Benefit Analysis

- A. Definition
- B. The Five Steps of Cost-Benefit Analysis

XII. Linear Programming

- A. The Mathematics Behind Linear Programming
- B. Graphing Processes

## **Managerial Issues in Hazardous Materials (C0274)**

### **Course Description**

This course presents current issues in management of a department-wide hazardous materials program. It includes issues that are pertinent to officers and managers in public safety departments, including regulations and requirements for hazardous materials (hazmat) preparedness, response, storage, transportation, handling and use, and the emergency response to terrorism threat/incident. Subjects covered include State, local and Federal emergency response planning, personnel and training, and operational considerations, such as determining strategic goals and tactical objectives.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of this course, you should be able to:

1. Explain and apply local, State, and Federal regulations concerning hazmat.
2. Participate meaningfully in the process of planning, organizing, and training for response to hazmat/terrorist incidents.
3. Interpret and act on departmental responsibility for hazmat response preparedness, incident prevention, and incident response.
4. Identify and work with representatives of multiple services, levels of government, and organizations in an organized incident-management structure.
5. Discuss issues pertaining to terrorism and tactical violence, including terrorism preparedness, response, and planning issues.
6. Develop an incident command organizational structure for a hazmat response using the guidelines set forth in the National Incident Management System (NIMS).

## **Course Objectives**

### **Module 1 Introduction to Hazardous Materials**

After completing this module, you will be able to:

1. Explain the correlation between trends in chemical use and emergency-release incidents.
2. Recognize and define common terms used in hazmat response and regulation.
3. Summarize the intent of major pieces of legislation and standards that affect hazmat planning and emergency response.
4. Explain the purpose of the State and local emergency-response commissions and their role in managing hazmat situations in the community.
5. Identify the Federal agencies that are responsible for enacting and enforcing hazmat regulations, and explain each agency's specific area of concern.

### **Module 2: Community-Centered Managerial Issues**

After completing this module, you will be able to:

1. List and explain the basic components of emergency planning for hazmat response and management.
2. Explain the purpose of the State Emergency Response Commission (SERC) and Local Emergency Planning Committee (LEPC) and their roles in managing hazmat.
3. Recognize the difference between protection-in-place and evacuation strategies.
4. Explain the legal basis for the requirement of using Incident Command.
5. Differentiate between public information and public education.
6. Explain the legal requirements governing public access to information.
7. Discuss current concerns about information access versus homeland security.
8. Describe the benefits of community education programs.
9. Identify at least one automated community information program currently in use.



### **Module 3: Department-Centered Managerial Issues**

After completing this module, you will be able to:

1. Compare the similarities and critical differences between a “normal” fire emergency and a hazmat emergency.
2. Describe the capabilities and limitations of first responders with regard to equipment, protective clothing, training, and experience.
3. Explain the training and emergency response requirements mandated in regulation 29 CFR 1910.120(q), and compare them to standard NFPA 472.
4. Explain the certification-of-competency requirement and recordkeeping requirements specified in the regulations.
5. Describe regulated occupancies and activities related to hazardous materials.
6. Demonstrate methods of ascertaining code compliance for storage, handling, and use of hazmat.
7. Locate applicable codes and regulations pertaining to storage, handling, and use of hazmat.

### **Module 4: Incident-Response Managerial Issues**

After completing this module, you will be able to:

1. Assess the strategic goals and tactical options for managing a hazmat incident.
2. List and describe the steps involved in the management process at a hazmat incident.
3. Explain additional risk and response considerations for a hazmat incident that is also a terrorist incident.
4. State the differences between a Command Post and an Emergency Operations Center.
5. Name the different interest groups in the Command Post, and explain their goals and concerns.
6. Define the terms *recovery* and *termination*.
7. Discuss the necessary documentation to be produced in conjunction with incident management.

8. Explain debriefing, post-incident analysis, and after-action reports.
9. Explain the Federal precedents for cost-recovery legislation.
10. Describe the four phases of termination.
11. Make response decisions based on risk analysis.

## **Module 5: Program Management**

### **Available Texts**

- Cote, A. E. (Ed.). (2008). *Fire protection handbook, volumes I and II* (20th ed.). National Fire Protection Association. <https://www.constructionbook.com/store/product/fire-protection-handbook-20th-edition>
- Noll, G. G., & Hildebrand, M. S. (2014). *Hazardous materials: Managing the incident* (4th ed.). Burlington, MA: Jones & Bartlett Learning.

### **Additional Resources**

**U.S. Fire Administration (USFA) Publications:** <http://www.usfa.fema.gov/applications/publications> (see Arson, Fire Data, Fire Protection, Fire Service Operations, Hazardous Materials, Health and Safety, Wildfire).

**Applied Research:** Agency Research: <http://www.usfa.fema.gov>

**Research Reports:** <http://www.usfa.fema.gov>

**Technical Reports:** <http://www.usfa.fema.gov/applications/publications>

**Topical Fire Research Series:** <http://www.usfa.fema.gov/research>

**Learning Resource Center:** <http://www.lrc.fema.gov>

**National Institute for Standards and Technology (NIST):** <http://www.fire.nist.gov> (see Publications, FIREDOC (under Publications)).

### **Lessons Learned Information Sharing:**

- <http://www.llis.dhs.gov/member/secure/index.cfm>
- <http://www.usfa.fema.gov/applications/publications/techreps.cfm>
- <http://www.homefiresprinkler.org>

Bryan, J. L. (March 1993). *Fire suppression and detection systems* (3rd ed.). London: MacMillan Publishing.

Gagnon, R. (1997). *Design of water-based fire protection systems*. Clifton Park, NY: Delmar, Cengage Learning.

Smith, C. A., Wieder, M., Brakhage, C. (2001). *Private fire protection and detection* (2nd ed.). International Fire Service Training Association.

Society of Fire Protection Engineers: <http://www.sfpe.org/>

## **Assessment**

Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor.

## **Course Outline**

- I. Preparing for the Incident
  - A. The Hazardous Materials Incident Management System
  - B. Health and Safety
  - C. Incident Command
  
- II. Responding to the Incident
  - A. Site Management
  - B. Identifying the Problem
  - C. Hazard Assessment and Risk Evaluation
  - D. PPE and Equipment Selection
  - E. Information Management and Resource Coordination
  - F. Implementing Response Objective
  - G. Decontamination
  
- III. Terminating the Incident
  - A. Post Incident Review
  - B. Liability Issues

## **Fire Investigation and Analysis (C0285)**

### **Course Description**

This course examines the technical, investigative, legal, and social aspects of arson, including principles of incendiary fire analysis and detection, environmental and psychological factors of arson, legal considerations, intervention, and mitigation strategies. This course prepares the student to recognize and apply best practices in the investigation of fires, conduct the origin and cause determination procedures and practices necessary to ascertain if the fire was accidental or incendiary, prepare the investigative reports necessary to document such analysis, and apply the findings and knowledge acquired through such efforts to reduce the consequence of both accidental and intentional fires.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of this course, you will be able to:

1. Demonstrate a technical understanding of the characteristics and impacts of fire loss and the crime of arson, which is necessary to conduct competent fire investigation and analysis.
2. Document the fire scene in accordance with best practice and legal requirements.
3. Analyze the fire scenario utilizing the scientific method, fire science, and relevant technology.
4. Analyze the legal foundation for conducting a systematic incendiary fire investigation and case preparation.
5. Design and integrate a variety of arson-related intervention and mitigation strategies.

### **Course Objectives**

#### **Module I: Introduction to Fire Investigation and Analysis**

After completing this module, you will be able to:

1. Compare and contrast local, State, or national fire data trends related to cause, property type, deaths, injuries, and dollar loss as a result of both accidental fires and arson.

2. Define and properly apply the classification factors utilized to describe the four fire cause determinations.
3. Assess and compare the major (USFA-NFPA) fire data collection systems, methods, and analytical techniques used to quantify and qualify the nations' fire loss experience.
4. Identify and examine the major organizations with resources available to assist communities as they develop fire analysis procedures.
5. Describe the six motives for incendiary fire.
6. Explain other factors to consider when conducting a fire investigation, such as sociology and culture.

## **Module II: Origin and Cause Determination**

After completing this module, you will be able to:

1. Explain the significance of using the scientific method in fire investigations and the importance of fire investigation as a science.
2. Describe how the basic steps in fire investigation relate to the sequence of events in proper scene documentation.
3. Describe the significance of preserving the fire scene and how initial observations made by first responders (fire, police, EMS) may lead to origin and cause determination.
4. Explain the functional organization and significance of the fire investigative team, including the canine detection unit, special teams, interrogation team, and forensics unit.
5. Recognize and interpret fire patterns.
6. Determine the effects of fire on materials, such as glass, wood, concrete, and metals.
7. Describe the major steps in a comprehensive fire investigation.
8. Compare and contrast the concepts of motive versus intent.
9. Explain the legal requirements of the investigative process.
10. Given a scenario, identify the persons who should be interviewed during an incendiary investigation.

### **Module III: Fire Analysis**

After completing this module, you will be able to:

1. Explain the components of the fire tetrahedron and their relevance to fire investigation.
2. Differentiate between temperature and energy.
3. Describe the three methods of heat transfer.
4. Explain the physical, thermal, and chemical properties of solid, liquid, and gaseous fuels, and how they are relevant to ignition and heat release rate of the fuels.
5. Identify the difference between a pre-mixed and diffusion flame.
6. Explain the process of ignition and burning of different fuel types.
7. Describe fire growth.
8. Explain the impact of fuel geometry on heat release rate.
9. Compare and contrast fire plumes and ceiling jets.
10. Describe the impact of ceilings, walls, and ventilation on compartment fires.
11. Explain the interrelationship of fuel, compartmentation, ventilation, and heat release rate.
12. Describe flashover and backdraft.
13. Understand the different methods of fire modeling, both physical and computational methods, and how they may be used to test your hypothesis as part of the scientific method.
14. Describe the types of standardized fire tests that are available and what material properties/characteristics can be measured.
15. Examine the pros and cons of bench-scale fire testing vs. full-scale fire testing.
16. Describe the types of computational fire modeling available and the capabilities and limitations of each.
17. Differentiate between probabilistic and deterministic fire models, and zone and field compartment fire models.
18. Understand how to apply simplified fire growth calculations to the fire investigation process appropriately.

## **Module IV: Incendiary Fire Investigation**

After completing this module, you will be able to:

1. Compare and contrast the burden of proof for civil and criminal acts.
2. Analyze the legal considerations to access the fire scene.
3. Define the crime of arson.
4. Explain how the provisions of the Fourth Amendment condition a fire investigator's access to the scene.
5. Define the constitutional limits involving the privilege against self-incrimination and the right to counsel in the contexts of an arrest, interrogation, and confession (Miranda).
6. Compare and contrast different types of evidence.
7. Describe the impact of case law relative to arson investigations.
8. Apply investigative techniques, including: assignment receipt; scene response; application of scientific methodology; scene documentation/examination; evidence identification, collection, preservation (chain of custody); witnesses/suspect interrogation; and investigative case file/report development.

## **Module V: Strategies for Combating Arson**

After completing this module, you will be able to:

1. Discuss the role of the community in arson reduction efforts.
2. Discuss the role of local public safety organizations in developing incendiary mitigation programs.
3. Discuss the role of the private sector in arson mitigation.
4. Define the use of pattern recognition and other profiling techniques in identifying arson-prone targets.
5. List sources of data available at the local, State, and Federal levels in planning anti-arson strategies.
6. Define the main elements of an effective incendiary fire prevention program.

## Available Texts

IAAI, IAFC, & NFPA. (2019). *Fire investigator: Principles and practice to NFPA 921 and 1033* (5th ed.). Burlington, MA: Jones & Bartlett Learning. ISBN: 9781284140743.  
<https://www.psglearning.com/catalog/productdetails/9781284140743>

Icove, D. J., DeHaan, J. D., & Haynes, G. A. (2013). *Forensic fire scene reconstruction* (3rd ed.). New York, NY: Pearson. ISBN-10: 0-13-260577-5; ISBN-13: 978-0-13-260577-9.  
<http://www.bradybooks.com/store/product.aspx?isbn=0132605775>

Due to the dynamic nature of fire investigation, it is also recommended that instructors build content around contemporary readings.

## Additional Texts

**U.S. Fire Administration (USFA) Publications:** <http://www.usfa.fema.gov/applications/publications> (see Arson, Fire Data, Fire Protection, Fire Service Operations, Hazardous Materials, Health and Safety, Wildfire).

**Applied Research:** Agency Research: <http://www.usfa.fema.gov>

**Research Reports:** <http://www.usfa.fema.gov>

**Technical Reports:** <http://www.usfa.fema.gov/applications/publications>

**Topical Fire Research Series:** <http://www.usfa.fema.gov/research>

**Learning Resource Center:** <http://www.lrc.fema.gov>

**National Institute for Standards and Technology (NIST):** <http://www.fire.nist.gov> (see Publications, FIREDOC (under Publications)).

## Lessons Learned Information Sharing:

- <http://www.llis.dhs.gov/member/secure/index.cfm>
- <http://www.usfa.fema.gov/applications/publications/techreps.cfm>
- <http://www.homefiresprinkler.org>

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Gagnon, R. (1997). *Design of water-based fire protection systems*. Clifton Park, NY: Delmar, Cengage Learning.



Smith, C. A., Wieder, M., Brakhage, C. (2001). *Private fire protection and detection* (2nd ed.). International Fire Service Training Association.

Society of Fire Protection Engineers: <http://www.sfpe.org/>

## **Assessment**

Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor.

## **Course Outline**

- I. History and Development of Fire Analysis and Investigation
- II. Chemistry of Fire
  - A. The Oxidation/Reaction/Reduction process
  - B. Fuels
- III. Fire Dynamics
  - A. Heat Transfer
  - B. Ignition
  - C. Flux
  - D. Heat Release Rates
  - E. Ventilation
  - F. Flashover
- IV. Fire Scene Investigation
  - A. First Responder Responsibilities
  - B. Scene Preservation and Tactical Decision Making
  - C. Scene Investigation
  - D. Special Scene Investigations
  - E. Legal Considerations
- V. Incendiary Crime Investigation
  - A. The Investigative Planning Process
  - B. The Investigation Report
- VI. Environmental Factors Influencing Arson
  - A. Why People Set Fires

- VII. The Sociology of Arson
  - A. Changing Value Systems
- VIII. The Psychology of Arson
  - A. The Juvenile Firesetter
  - B. Characteristics of a Pyromaniac
  - C. Fire Setters
    - 1. Vanity
    - 2. Revenge
    - 3. Serial Arsonists
    - 4. Other Criminals
- IX. Legal Considerations and Preparing for Trial
  - A. Common-Law Definitions
  - B. Statutory Definitions
  - C. Federal Law in Arson Prosecution
  - D. Search and Seizure
  - E. Search
    - 1. Administrative Search Warrants
    - 2. Criminal Search Warrants
    - 3. Warrantless Searches
    - 4. Arrest and Detention
    - 5. Process of Administering Justice
    - 6. Evidence
- X. Managing the Fire Investigation Unit
  - A. Quality Management and TQM
  - B. Case Management
  - C. Training, Standards and Accreditation
- XI. Intervention and Mitigation Strategies for Combating Arson
  - A. The National Juvenile Firesetter/Arson Control and Prevention Program
  - B. Community Partnerships
  - C. Private Sector Partnerships
  - D. Technology
  - E. Data Resources

## XII. The Future of Arson Investigation

- A. Fire Modeling
  - 1. Computer Fire Models
  - 2. Deterministic Fire Models
  - 3. Probabilistic Fire Models
  - 4. Expert Systems

## **Fire Protection Structures and Systems Design (C0295)**

### **Course Description**

This course examines the underlying principles involved in structural fire protection systems and building furnishings, as well as fire protection systems including water-based fire suppression systems, fire alarm and detection systems, special hazard suppression systems, and smoke management systems.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of this course, you will be able to:

1. Analyze building structural components for fire endurance and fire resistance.
2. Understand the flame spread and smoke production properties of building furnishings and materials.
3. Analyze, evaluate, and determine appropriate use for fire detection and alarm systems; water-based fire suppression systems; special hazard fire suppression systems; and smoke management systems, with a sophisticated understanding of how they integrate to function as a complete life-safety system.
4. Understand the fundamental principles related to structural fire protection, building furnishings, and fire protection systems.

### **Course Objective**

After completing this module, you will be able to:

1. Explain the objective of fire-resistant building components and assemblies.
2. Summarize the ASTM E-119 test procedure and the parameters that influence its validity.
3. Analyze how elevated temperatures affect steel, concrete, masonry and wood assemblies.
4. Outline potential problems for fire service personnel relative to the fire resistance requirements of steel, concrete, wood, and masonry structures.

5. Compare three means of providing fire protection for steel members.
6. Explain the fire hazards associated with unenclosed vertical openings, atriums, and concealed spaces.
7. Differentiate among three different methods used to limit horizontal fire and smoke spread in a building.

## **Module 2: Building Furnishings and Materials**

After completing this module, you will be able to:

1. Summarize the application of the Steiner Tunnel Test (ASTM E-84) and its three flame-spread classifications.
2. Differentiate between flame-spread index and smoke density.
3. Explain the role of floor materials in corridor fire spread.
4. Articulate the four categories of dangerous effects of smoke.
5. Explain one smoke toxicity testing method.
6. List two organizations that have promulgated standards for furniture flammability.
7. Summarize four characteristics that contribute to the fire hazard of furniture.
8. Generalize the role of furnishings (materials and placement) in fire growth development.

## **Module 3: Fire Detection and Alarm Systems**

After completing this module, you will be able to:

1. Explain the basic operating principles of smoke, heat, and flame detectors and provide applications for each.
2. Differentiate between an ionization and photoelectric smoke detector.
3. Differentiate between rate-of-rise, rate-compensated, and fixed-temperature heat detectors.
4. Besides detection devices, list and describe three devices that can initiate a fire alarm system.

5. Classify four types of fire alarm system indicating devices.
6. Demonstrate the temporal code 3 fire alarm signal.
7. Summarize the operational characteristics of a voice fire alarm system.
8. Explain the three operational characteristics of a fire alarm control panel (alarm, trouble, supervisory).
9. Determine two advantages and disadvantages of remote fire alarm system monitoring.

#### **Module 4: Fire Suppression Systems**

After completing this module, you will be able to:

1. Compare the basic suppression principle for sprinkler, foam, dry-chemical, carbon dioxide, and Halon replacement systems, and provide applications for each.
2. Explain the difference between wet, dry, deluge, and preaction sprinkler systems.
3. Assess the benefits of residential fire sprinkler systems and residential sprinkler legislation.
4. Select three appropriate water storage and supply sources for a water-based fire suppression system.
5. Classify sprinklers based on position, temperature rating, and pattern.
6. Apply an appropriate sprinkler system density for four occupancy classifications.
7. Explain two appropriate applications for a water-mist system.
8. Identify the required flow and pressure for the three types of standpipe system classifications.
9. Illustrate a standard fire pump curve, and identify the three important performance points.
10. Compare and contrast vertical and horizontal fire pumps, and apply applications for each.
11. Outline the procedure for performing a fire pump service test.
12. Classify three types of foam extinguishing agents.
13. Determine the correct type of system for the protection of a kitchen hood, and describe its method of operation.

14. Explain the operating principle of a carbon dioxide suppression system.
15. Explain why the installation of new Halon suppression systems is prohibited in the United States.
16. Explain the development of two types of Halon replacement systems.

### **Module 5: Smoke Management Systems**

After completing this module, you will be able to:

1. Explain four factors influencing smoke movement in a building.
2. Explain stack effect.
3. Distinguish between passive and active smoke management.
4. Compare and contrast three types of active smoke management systems.
5. Outline the methodology used to test a smoke management system.
6. Summarize the use of the firefighters' smoke control station.

### **Available Texts**

Cote, A. E. (Ed.). (2008). *Fire protection handbook, volumes I and II* (20th ed.). National Fire Protection Association. <https://www.constructionbook.com/store/product/fire-protection-handbook-20th-edition>

IFSTA. (2011). *Fire detection and suppression systems* (4th ed.). Stillwater, OK: Fire Protection Publications. [https://shop.ifsta.org/product\\_info.php/cPath/73/products\\_id/70288](https://shop.ifsta.org/product_info.php/cPath/73/products_id/70288)

### **Supporting References/Research for Faculty and Students**

**U.S. Fire Administration (USFA) Publications:** <http://www.usfa.fema.gov/applications/publications> (see Arson, Fire Data, Fire Protection, Fire Service Operations, Hazardous Materials, Health and Safety, Wildfire).

**Applied Research:** Agency Research: <http://www.usfa.fema.gov>

**Research Reports:** <http://www.usfa.fema.gov>

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**Learning Resource Center:** <http://www.lrc.fema.gov>

**National Institute for Standards and Technology (NIST):** <http://www.fire.nist.gov> (see Publications, FIREDOC (under Publications)).

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- <http://www.homefiresprinkler.org>

Bryan, J. L. (March 1993). *Fire suppression and detection systems* (3rd ed.). London: MacMillan Publishing.

Gagnon, R. (1997). *Design of water-based fire protection systems*. Clifton Park, NY: Delmar, Cengage Learning.

Smith, C. A., Wieder, M., Brakhage, C. (2001). *Private fire protection and detection* (2nd ed.). International Fire Service Training Association.

Society of Fire Protection Engineers: <http://www.sfpe.org/>

**Assessment**

Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor.

**Course Outline**

- I. Historical Background
  - A. Conflagrations, Large-loss Fires
  - B. Fire Protection Systems
- II. Fire Resistance and Endurance
  - A. Test Types and Resources
  - B. Application of Test Results
- III. Fire Resistance Computations and Evaluation Procedures
  - A. Structural Member Properties



- IV. Flame Spread Evaluation
  - A. Steiner Tunnel Testing
  - B. Radiant Panel Testing
  - C. Floor Cover Material Evaluation
  
- V. Smoke Production
  - A. Nature and Hazards of Smoke
  - B. Smoke Testing Methods
  
- VI. Furnishings and the Building
  - A. Regulation
  - B. Furniture Fire Testing
  - C. Heat Release Rate
  
- VII. Detection Systems and the Building
  - A. Fire Signature
  - B. Detector Types and Operations
  - C. Detector Inspection and Maintenance
  
- VIII. Smoke Control Systems
  - A. Smoke Dynamics
  - B. Smoke Management
  - C. System Testing and Inspection
  - D. Stairwell Pressurization
  
- IX. Alarm and Communication Systems
  - A. Circuit types
  - B. Alarm signals
  - C. Communication systems
  
- X. Water Supply Systems
  - A. Historical Development
  - B. Water System Considerations
  - C. Fire Flow Calculations
  - D. High-rise Water Supply

XI. Stationary Fire Pumps

- A. Classification
- B. Installation
- C. Performance
- D. Testing

XII. Sprinkler Systems

- A. Residential
- B. Early Suppression Fast Response (ESFR)
- C. Hydraulic Calculations and Design Criteria
- D. Water Supply and Demand Curves

XIII. Evaluating Sprinkler System Design

- A. Building and fire code requirements
- B. Role of the Authority Having Jurisdiction (AHJ)
- C. Plan review

XIV. Specialized Suppression Systems

- A. Gaseous Agent Systems
- B. Dry Chemical Systems
- C. Foam Systems

## **Disaster Planning and Control (C0296)**

### **Course Description**

This course examines concepts and principles of community risk assessment, planning, and response to fires and natural and human-caused disasters, including the National Incident Management System--Incident Command Systems (NIMS ICS), mutual aid and automatic response, training and preparedness, communications, civil disturbances, terrorist threats/incidents, hazardous materials planning, mass casualty incidents, earthquake preparedness, and disaster mitigation and recovery.

### **Prerequisites**

None

### **Course Outcomes**

Upon completion of this course, you will be able to:

1. Discuss the importance of disaster planning, preparation, and mitigation.
2. Evaluate the hazard assessment processes and the role of the firefighter in community disaster planning and recovery.
3. Assess hazard response and planning procedures.
4. Define the impact of hazard occurrence on community response.
5. Define the parameters and effectiveness of an Emergency Operations Plan (EOP) and its components.
6. Differentiate the multilevel agency responsibilities in disaster mitigation.
7. Define the relationships between disaster planning, mitigation, and recovery.

### **Course Objectives**

#### **Module I: Disaster Anticipation and Preparation**

After completing this module, you will be able to:

1. Explain the generic and technical meanings of disaster and emergency.

2. Identify the types of disasters and their similarities and differences.
3. Explain the importance of disaster planning.
4. Differentiate between human-caused and technological hazards, natural hazards, and domestic security threats.
5. Identify the distinguishing characteristics of hazards, emergencies, and disasters.
6. Analyze the provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act as they relate to the National Response Plan/National Response Framework (NRP/NRF) for local and State emergencies.
7. Describe why a team approach to disaster planning is recommended.

## **Module II: Managing Disasters**

After completing this module, you will be able to:

1. Describe the hazard assessment process.
2. Explain the purpose of capability assessment.
3. Define the concepts of mutual-aid and automatic aid.
4. Identify the personnel and agencies that play a role in formulating an EOP.
5. Analyze the fire and emergency services department's leadership role in integrated community disaster planning.
6. Differentiate the availability of outside resources: local, State, Federal, and private.
7. Identify communication issues regarding the various levels of people in local, State, and Federal agencies that will respond in times of disaster.
8. Define the modes of communication that can be used during major emergencies and the individuals who need to share information.
9. Analyze the communications needs of each organizational level.
10. List the communication modes available to emergency response agencies during major emergencies.
11. Determine the different uses of computers during major emergencies.

12. Describe the most common types of communication problems that develop during major emergencies.
13. Illustrate alternative/redundant communications systems in the event of system failure.

### **Module III: Frequent Threats — Fire, Transportation, and Hazmat**

After completing this module, you will be able to:

1. Describe the background and development of the NIMS-ICS.
2. Identify the principles and features of the NIMS-ICS.
3. Describe how a NIMS-ICS incident organization expands or contracts to meet operational needs of the incident or event.
4. Identify the difference in required responses for different types of hazards.
5. Describe examples of each hazard type.
6. Assess the unique planning issues for each hazard type.
7. Analyze the impact on the community of each hazard type.

### **Module IV: Growing Threats, Global Concerns**

After completing this module, you will be able to:

1. Identify the personnel and agencies that play a role in formulating an EOP.
2. Outline the four problems that confront fire chiefs and emergency services managers in the development of EOPs.
3. Identify the steps in preparing a written EOP.
4. Assess the purpose and components of the EOP basic plan.
5. Evaluate how an EOP resource inventory supports the plan.
6. Review the planning issues that are common to the development of most EOPs.
7. Describe the multiagency responsibilities of disaster response.

8. Identify how functional annexes and hazard-specific appendices support the overall emergency management plan.
9. Compare and contrast the differences in required responses for different types of hazards.
10. Analyze the use of Branches, Divisions, and Groups within the Operations Section, and correlate the supervisory titles associated with each level.
11. Identify the advantages of Unified Command and the kinds of situations that may call for a Unified Command organization.
12. Describe the primary features of a Unified Command organization.
13. Classify the kinds of incident management problems that the lack of multiagency coordination can create.
14. Compare the levels at which multiagency coordination is commonly accomplished.
15. Identify the primary components of a multiagency coordination system.

### **Module V: Natural Disasters and Recovery**

After completing this module, you will be able to:

1. Identify the four phases of a disaster and describe the partnerships among the Federal, State, and local governments in each of the four phases.
2. Compare several forms of Federal assistance, and explain the terms and conditions under which Federal disaster relief may be made available.
3. Outline the sequence of events through which a disaster may be declared by the president.
4. Identify the stages of the damage assessment process and the reporting requirements following a disaster.
5. Describe the roles and responsibilities of key State and Federal personnel in responding to a declared major disaster.
6. Assess the various Federal, State, and local assistance programs available to disaster victims during the recovery phase.
7. Determine some typical responses that may be anticipated from disaster survivors and workers.

8. Calculate the capabilities of and methods for accessing the crisis counseling and stress management programs during disaster response and recovery operations.
9. Describe the Federal assistance programs available to supplement State and local governments recovering from a major disaster.
10. Correlate the concepts of mitigation and recovery with natural and technological hazard events.
11. Analyze the interrelationships between mitigation and recovery phases.

### **Available Text**

It is also recommended that the instructor builds content around contemporary readings and current events.

Kramer, W. M. (2009). *Disaster planning and control*. Tulsa, OK: PennWell Books. ISBN: 9781593701895. <http://www.pennwellbooks.com/diplandco.html>

### **Supporting References/Research for Faculty and Students**

**U.S. Fire Administration (USFA) Publications:** <http://www.usfa.fema.gov/applications/publications> (see Arson, Fire Data, Fire Protection, Fire Service Operations, Hazardous Materials, Health and Safety, Wildfire).

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**Topical Fire Research Series:** <http://www.usfa.fema.gov/research>

**Learning Resource Center:** <http://www.lrc.fema.gov>

**National Institute for Standards and Technology (NIST):** <http://www.fire.nist.gov> (see Publications, FIREDOC (under Publications)).

### **Lessons Learned Information Sharing:**

- <http://www.llis.dhs.gov/member/secure/index.cfm>
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Smith, C. A., Wieder, M., Brakhage, C. (2001). *Private fire protection and detection* (2nd ed.). International Fire Service Training Association.

Society of Fire Protection Engineers: <http://www.sfpe.org/>

## **Course Outline**

- I. History, Definition and Disaster Profile
  - A. History of FEMA
- II. The Integrated Emergency Management System
- III. Preparedness
  - A. Hazard Assessment
  - B. Hazard Identification
  - C. Vulnerability
  - D. Rating the Risk
  - E. Resources
    1. Ordering Systems
    2. Emergency Response Directories
    3. Resource Agreements
- IV. Developing an Emergency Response Plan
  - A. The Planning Process
  - B. Basic Plan Content
- V. Functional Annexes and Hazard-Specific Appendices
  - A. Functional Annexes
    1. Direction and Control
    2. Communications
    3. Warning
    4. Emergency Public Information
    5. Evacuation
    6. Mass Care
    7. Health and Medical
    8. Resource Management
  - B. Development of Hazard-Specific Appendices



VI. Managing the Disaster

- A. History of ICS Development
- B. ICS Features and Functions
- C. ICS Organization
- D. Unified Command
- E. Area Command
- F. Emergency Operation Centers/Multiagency Coordination System

VII. Communications

- A. Interpersonal Communications
- B. Data Technologies
- C. Communications in Emergency Response Operations
- D. Communications Center Operations and Personnel
- E. Planning for Communications

VIII. Evaluating the Plan

- A. Exercises
  - 1. Tabletop Exercises
  - 2. Functional Exercises
  - 3. Full-Scale Exercises

IX. Aftermath and Recovery

- A. Acronyms
- B. History and Philosophy of Disaster Assistance
- C. Federal Disaster Declaration
- D. Damage Assessment
- E. Disaster Recovery Operations
- F. FEMA's Role in Disaster Response
- G. State and Federal Roles and Responsibilities
- H. Coordinating Resources
- I. The Application Process
- J. Hazard Mitigation and Disaster Recovery
- K. Media Relations
- L. Community Relations
- M. Human Response to Disaster