National Fire Academy

R0108 – Evaluating Performance-Based Designs
Version: 1st Edition, 7th Printing, April 2014
Quarter:
ACE Credit: In the upper division baccalaureate degree category, three semester hours in fire service administration.
IACET Continuing Education Units: 3.9

Length of Course: 6 Days (48 contact hours, Sunday – Friday)
Prerequisite: Yes
Curriculum: Fire Prevention: Technical
Training Specialist: Woody Stratton
Instructor:
Instructor email/phone:
Classroom: J-
Meeting Time: 8 AM – 5 PM

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Course Description (Catalog)

R0108 – "Evaluating Performance-Based Designs." This six-day course is designed to provide the student with the fundamental knowledge, skills and abilities to assess performance-based fire-safe building designs that employ sophisticated engineering and computer modeling techniques. Students will be introduced to concepts and technologies that transfer building design from traditional prescriptive-based building and fire regulations to strategies where engineers, architects and designers employ a variety of options to meet specific performance goals.

Topics addressed in this course include understanding the principal differences between the prescriptive-based and performance-based design options; why a building owner may wish to use the performance-based design option; essential elements of performance-based design, including the influence of fire behavior and the role of documentation, definition of project scope and fire

safety goals, and setting objectives; an introduction to the capabilities, limitations and assumptions of the engineering methods and fire modeling used in performance-based design; an introduction to the potential for change during the expected life cycle of the facility; and how changes should be addressed. This course does not teach students how to perform fire modeling.

Student Qualifications (Primary and Secondary Audience)

Anyone responsible for the review and/or approval of building and fire/life safety design in the regulatory process. This includes building officials, fire marshals, insurance representatives and designers/architects.

Course Scope (Goal)

Provide fire professionals and others responsible for reviewing and approving building projects the skills to interpret appropriate fire safety designs.

Course Objectives (Course Learning Outcomes – TLOs)

After successfully completing this course, you will be able to accomplish the following:

- Given examples of a performance-based design and a prescriptive-based design, describe the differences, based on criteria outlined in the Society of Fire Protection Engineers (SFPE) Guide and in Unit 1.
- Explain the progression of the fire, from start to extinguishment, given a fire scenario.
- Given a performance-based design, describe the capabilities and limitations of the models on which the design was based, including the characteristics of the building occupants and the assumptions of the risk analysis used.
- Given specific life-safety criteria and non-life-safety criteria requirements, determine whether a performance-based building design submitted for approval would meet the safety criteria.
- Given an example of a performance-based design report, determine whether the documentation submitted is adequate, according to Chapter 12 of the Society of Fire Protection Engineers (SFPE) Guide and this Unit.
- Given a change to a performance-based building design submitted for review and approval, and the fire protection Operations and Maintenance (O&M) manual sections for the original building design, review the revisions requested and determine what sections of the O&M manual provide direction for the change proposed.

Course Delivery Method

The National Fire Academy (NFA) offers specialized training courses and advanced management programs of national impact in an academic classroom environment on campus at the National Emergency Training Center (NETC) in Emmitsburg, Maryland. This classroom course is designed for the national level fire service officer from State and local fire service organizations. During this 6-day delivery, students will reside in dormitories provided on campus with classes conducted in classrooms designed for critical student/instructor interaction. All course materials are designed for interactive classroom environments, in either paper notebook or electronic formats.

Course Schedule

The purpose of the course schedule is to give you, at a glance, the required preparation, activities, and evaluation components of your course.

COURSE SCHEDULE

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
AM	NFA and Course Introductions Unit 1: Introduction	Unit 2: Introduction to Fire Dynamics	Unit 3 (cont'd) Module 2: Human Behavior Module 3: Risk/Probabilty Analysis	Unit 4: The process Method	Unit 5: Documentation	Final Project Examination
PM	Unit 1 (cont'd) Readings: Units 1, 2, and 3 in Student Manual Student Manual: Babrauksas article: Heat Release Rate Fleming, et al., article O'Hara and Bierwerth article Begin reading final project information: *Performance-Based Design Analysis for a Shopping Mall*	Unit 3: Introduction to Fire Effects and Egress Models Module 1: Fire Effects Models LRC--Scheduled Orientation Readings: Review Unit 3 in Student Manual Babrauksas article: Fire Modeling Bryan article Bukowski article McGrattan, et al., article Mower article Paulsen article	Unit 3 (cont'd) Module 3 (cont'd) Test: Units 1, 2, and 3 (closed book) Readings: Chapter 3 in SFPE *Engineering Guide* Unit 4 in Student Manual Final project information: *Performance-Based Design Analysis for a Shopping Mall*	Unit 4 (cont'd) Test: Unit 4/ Debrief (closed book) Readings: Units 5 and 6 in the Student Manual Chapter 12 in SFPE *Engineering Guide* Final project information: *Performance-Based Design Analysis for a Shopping Mall*	Unit 6: Testing, Inspection, and Maintenance Reading: Final project information: *Performance-Based Design Analysis for a Shopping Mall*	Final Project Debrief Graduation

Course Resources (Instructional Materials)

In order to be fully prepared, obtain a copy of the required textbooks and other instructional materials prior to the first day of class.

Required Readings

The student must complete required readings during the course to be able to thoughtfully participate in discussions and activities.

The following articles are reprinted by permission from the relevant issues of *Fire Protection Engineering,* copyright Society of Fire Protection Engineers. This permission is limited to use in course materials for the NFA course, *Evaluating Performance-Based Designs.*

Bryan, John L. "Psychological Variables That May Affect Fire Alarm Design." *Fire Protection Engineering*, Summer 2001: 42-44, 47-48.

Janssens, Marc. L. Evaluating Computer Fire Models. *Fire Protection Engineering*, Winter 2000: 19-21.

McGrattan, Kevin, et al. "The Future of Fire Simulation." *Fire Protection Engineering*, Winter 2000: 24-36.

Mowrer, Frederick W. "The Right Tool for the Job." *Fire Protection Engineering*, Winter 2002: 39-44.

O'Hara, Michael A., with Ryan Bierwerth. "Performance-Based Design of a Professional Hockey Arena." *Fire Protection Engineering*, Winter 2000: 33-34, 37-40.

The following articles are reprinted with permission of the author:

Babrauskas, Vytemis. "Fire Modeling: An Introduction for Attorneys." *Fire Science and Technology, Inc.*, 1996.

_____. "Heat Release Rate: A Brief Primer." *Fire Science and Technology, Inc.*, 1996.

The following article is reprinted with permission of Kluwer Academic Publisher:

Paulsen, R. L. "Human Behavior and Fires: An Introduction." *Fire Technology*. 20. 2 (1984).

The following paper is reprinted with permission of the author:

Fleming, Joseph, Paul Donga, and Michael J.Wojcik. *Code Officials and Performance Based Fire Safety*. Boston: Boston Fire Department. (Paper presented at the 2nd Conference on Fire Safety Design in the 21st Century, Worchester Polytechnic Institute, June 1999.)

The following paper is not subject to copyright:

Bukowski, Richard W., E. K. Bidnick, and C. F. Schemel. "Estimates of the Operational Reliability of Fire Protection Systems." Proceedings of International Conference on Fire Research and Engineering. Chicago: October 4-8, 1999.

Suggested Reading/Resources

Suggested readings and resources are not evaluated, but may enhance the student's understanding, serve as additional sources for citation and promote discussion of course material.

None.

Required Resources (Course Textbook)

Student Manual.

Supplemental Resources (Supplemental Course Textbook)

None.

Grading Methodology (Evaluation Procedures)

A minimum final grade of at least 70 percent is required to pass this course.

Numerical Score	Letter Grade
100-90	A
89-80	B
79-70	C
69 or below	F

Required Reading Assignments

Student completion of reading assignments will be done via evaluation of their class participation and will not be a separately graded activity.

Suggested Readings

Suggested readings are not evaluated, but may enhance the student's understanding and promote discussion of course material.

Course Outline

Unit 1: Introduction (Day 1)

Objectives

Terminal Objective

Given examples of a performance-based design and a prescriptive-based design, the students will be able to describe the differences, based on criteria outlined in the Society of Fire Protection Engineers (SFPE) Guide and in Unit 1.

Enabling Objectives

Given examples of performance-based and prescriptive-based designs, the students will:

1. Identify the defining characteristics of each design type.

2. Identify differences between prescriptive group/division occupancy classifications and "performance groups."

3. Identify legal issues in transitioning from prescriptive to performance-based designs and how they are resolved.

Unit 2: Introduction to Fire Dynamics (Day 2)

Objectives

Terminal Objective

The students will be able to explain the progression of the fire, from start to extinguishment, given a fire scenario.

Enabling Objective

The students will define the terms heat flux/transfer, heat of combustion, heat release rate (HRR), T2 fire, fire plumes, and ceiling jets.

Unit 3: Introduction to Fire Effects and Egress Models (Day 2)

Objectives

Terminal Objective

Given a performance-based design, the students will be able to describe the capabilities and limitations of the models on which the design was based, including the characteristics of the building occupants and the assumptions of the risk analysis used.

Enabling Objectives

The students will:

1. Given a fire simulation provided by the National Institute of Standards and Technology (NIST), and working in groups, identify the variables the simulation incorporates in terms of materials and structure and occupants.

2. Given an egress model, explain how the model takes into account the occupants of a building.

3. Given a performance-based design, complete a risk analysis matrix.

Unit 4: The Process Method (Day 4)

Objectives

Terminal Objective

Given specific life-safety criteria and non-life-safety criteria requirements, the students will be able to determine whether a performance-based building design submitted for approval would meet the safety criteria.

Enabling Objective

Given the Society of Fire Protection Engineers (SFPE) flowchart, the students will identify the blocks that outline the responsibilities of those who review and approve building and facility designs.

Unit 5: Documentation (Day 5)

Objectives

Terminal Objective

Given an example of a performance-based design report, the students will be able to determine whether the documentation submitted is adequate, according to Chapter 12 of the Society of Fire Protection Engineers (SFPE) Guide and this Unit.

Enabling Objectives

The students will:

1. Identify the documentation that is required as part of an acceptable performance-based design submission.

2. In small groups, critique a set of documents for a performance-based building design to determine whether the documents include all items that are required.

Unit 6: Testing, Inspection, and Maintenance (Day 5)

Objectives

Terminal Objective

Given a change to a performance-based building design submitted for review and approval, and the fire protection Operations and Maintenance (O&M) manual sections for the original building design, the students will be able to review the revisions requested and determine what sections of the O&M manual provide direction for the change proposed.

Enabling Objectives

The students will:

1. Given the O&M manual for a building design, determine whether a proposed change is within the combustible load defined in the manual.

2. Review pictures that illustrate types of changes to the content or use of different types of buildings and describe the O&M manual sections that would apply to the changes.

Policies

Class Attendance and Cancellation Policy

Attendance

- You are required to attend all sessions of the course. If you do not, you may not receive a certificate, and your stipend may be denied.

- If you need to depart campus early and miss any portion of the course and/or graduation, you must make the request in writing to the NFA training specialist. The training specialist, in collaboration with the superintendent, may waive the attendance requirement in order to accommodate you with extraordinary circumstances as long as you complete all course requirements. If you receive approval for departing early, you must forward the approval to the Admissions Office so your stipend reimbursement is not limited.

Student Substitutions

Substitutions for NFA courses are made from waiting lists; your fire department can't send someone in your place.

Cancellations or No-Shows

NFA's mission for delivery of courses is impaired significantly by cancellations and no-shows. It is very difficult and costly to recruit students at the last minute. Currently there is a two-year ban on student attendance for students who are no-shows or cancel within 30 days of the course start date without a valid reason. If you receive such a restriction, your supervisor needs to send a letter to our Admissions Office explaining the cancellation/no-show.

Course Failure

If you fail an on-campus course, you will not be issued a stipend for that course. You can reapply for the failed course or any other NFA course and go through the random selection process. You don't have to successfully complete the failed course before attending another NFA course.

Student Code of Conduct Policy

Students, instructors and staff are expected to treat each other with respect at all times. Inappropriate behavior will not be tolerated and may result in removal from campus and denial of stipends.

Writing Expectations

Student writing will conform to the generally accepted academic standards for college papers. Papers will reflect the original work of the student and give appropriate credit through citations for ideas belonging to other authors, publications or organizations. Student written work should

be free of grammatical and syntax errors, free of profanity or obscene language or ideas, and reflect critical thinking related to the course subject matter.

Citation and Reference Style

Attention Please: Students will follow the APA, Sixth Edition as the sole citation and reference style used in written work submitted as part of coursework to NFA. Assignments completed in a narrative essay, composition format, abstract, and discussion posts must follow the citation style cited in the APA, Sixth Edition.

Late Assignments

Students are expected to submit classroom assignments by the posted due date (11:59 p.m. EDT/EST) and to complete the course according to the published class schedule. As adults, students, and working professionals, you must manage competing demands on your time. Discussion board postings submitted within 3 days after the submission deadline will receive up to a 20% deduction. Those that do not submit their discussion board postings within this timeline will receive a "0" grade for the week. Final assignment papers will not be accepted after the deadline. Any paper submitted after the deadline will receive a "0" grade for that assignment.

Netiquette

Online learning promotes the advancement of knowledge through positive and constructive debate – both inside and outside the classroom. Forums on the Internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a professional learning setting – basic academic rules of good behavior and proper "Netiquette" must persist. Remember that you are in a place for the rewards and excitement of learning which does not include descent to personal attacks or student attempts to stifle the forum of others.

- Technology Limitations. While you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The NFA Online classroom may not fully support MIME or HTML encoded messages, which means that bold face, italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.

- Humor Note. Despite the best of intentions, jokes and especially satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add "emoticons" to help alert your readers: ;-), :), ☺ .

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

Grading

Please review the following rubrics that explain how grades will be awarded.

Students who do not complete the entire course will be awarded an Incomplete (I) grade. In accordance with National Fire Academy academic policies, an Incomplete (I) grade must be removed by the end of the next semester following the course, or it automatically becomes a Failing (F) grade.

If you fail an on-campus course, you will not be issued a stipend for that course. You can reapply for the failed course or any other NFA course and go through the random selection process. You don't have to successfully complete the failed course before attending another NFA course.

http://www.usfa.fema.gov/training/nfa/admissions/student_policies_campus_information.html

Academic Honesty

Students are expected to exhibit exemplary ethical behavior and conduct as part of the NFA community and society as a whole. Acts of academic dishonesty including cheating, plagiarism, deliberate falsification, and other unethical behaviors will not be tolerated.

Students are expected to report academic misconduct when they witness a violation. All cases of academic misconduct shall be reported by the instructor to the Training Specialist.

If a student is found to have engaged in misconduct and the allegations are upheld, the penalties may include, but are not limited to one or a combination of the following:

- expulsion,
- withholding of stipend or forfeiture of stipend paid,
- exclusion from future classes for a specified period; depending on the severity it could range from 1-10 years, and/or
- forfeiture of certificate for course(s) enrolled in at NETC.

Refer to NFA-specific Standard Operating Procedure 700.1 – *Academic Code of Conduct and Ethics* for more information.