

NFPA 101A

Guide on Alternative Approaches to Life Safety

2001 Edition



NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 101A
Guide on
Alternative Approaches to Life Safety
2001 Edition

This edition of NFPA 101A, *Guide on Alternative Approaches to Life Safety*, was prepared by the Technical Committee on Alternative Approaches to Life Safety, released by the Technical Correlating Committee on Safety to Life, and acted on by the National Fire Protection Association, Inc., at its November Meeting held November 12–15, 2000, in Orlando, FL. It was issued by the Standards Council on January 13, 2001, with an effective date of February 9, 2001, and supersedes all previous editions.

This edition of NFPA 101A was approved as an American National Standard on February 9, 2001.

Origin and Development of NFPA 101A

This 2001 edition of NFPA 101A is the fifth edition. Prior to the development of the 1988 edition of this document, it was published as several appendixes to NFPA 101®, *Code for Safety to Life in Buildings and Structures*.

Chapter 4 first appeared as Appendix C in the 1981 edition of the *Life Safety Code*®; Chapters 5, 6, and 7 first appeared in the 1985 edition of the *Life Safety Code* as Appendixes E, F, and G; and Chapter 8 was proposed as Appendix H for the 1988 edition but was published as a chapter of this document. These chapters were originally prepared by the Center for Fire Research of the National Institute of Standards and Technology (then the National Bureau of Standards). The Committees on Safety to Life have reviewed and modified the systems as appropriate for inclusion.

Chapter 9 is new to the 2001 edition. Its computer program and user manual were developed by Hughes Associates, Inc., under sponsorship of the General Services Administration and the Building Fire Research Laboratory of the National Institute of Standards and Technology.

The figures contained herein are copyrighted by NFPA, but users are hereby given permission to copy the worksheets for private use only.

To the User

This document provides alternative approaches to life safety based on the 2000 *Life Safety Code*. It is intended to be used *with* the *Life Safety Code*, not as a substitute. Section 1.5 of the *Life Safety Code* permits alternative compliance with the *Code* under equivalency concepts where such equivalency is approved by the authority having jurisdiction. The methodologies contained herein can be used to help determine equivalency where used as part of the technical documentation submitted to the authority having jurisdiction.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

A reference in parentheses () at the end of a section or paragraph indicates that the material has been extracted from another NFPA document. The bold number in parentheses indicates the document number and is followed by the section number where the extracted material can be found in that document. The complete title and current edition of an extracted document can be found in the chapter on referenced publications.

Information on referenced publications can be found in Chapter 2.

Chapter 1 Administration

1.1 This guide consists of a number of different alternative approaches to life safety. Each chapter is a different system independent of the others and is to be used in conjunction with the 2000 edition of NFPA 101®, *Life Safety Code*®.

1.2 This edition of NFPA 101A contains alternative approaches that are tied to NFPA 101, *Life Safety Code*. Each of these systems is recognized by the *Life Safety Code*, in its Annex A, as a method that can be used to assist the authority having jurisdiction in determining equivalent compliance with various chapters of the *Code*.

1.3 For further information on alternative approaches to fire safety, see "Systems Concepts for Building Firesafety," Section 1, Chapter 3 of the eighteenth edition of the NFPA *Fire Protection Handbook* and the *SFPE Handbook of Fire Protection Engineering*, second edition, Section 3, "Hazard Calculations," and Chapter 5-2, "Fire Risk Ranking."

Chapter 2 References

2.1 Referenced Publications. The following documents or portions thereof are referenced within this guide and should be considered as part of its recommendations. The edition indicated for each referenced document is the current edition as of the date of the NFPA issuance of this guide.

2.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1999 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 1999 edition.

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 1999 edition.

NFPA 72, *National Fire Alarm Code*®, 1999 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 1999 edition.

NFPA 92A, *Recommended Practice for Smoke-Control Systems*, 2000 edition.

NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, 2000 edition.

NFPA 101®, *Life Safety Code*®, 2000 edition.

NFPA 204, *Guide for Smoke and Heat Venting*, 1991 edition.

NFPA 220, *Standard on Types of Building Construction*, 1999 edition.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, 1999 edition.

NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, 1999 edition.

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, 2000 edition.

NFPA *Fire Protection Handbook*, 18th edition.

SFPE *Handbook of Fire Protection Engineering*, second edition.

2.2 Bibliography. The following documents provide detailed information on the development of the various fire safety evaluation systems contained in this guide. The documents are available as follows:

National Technical Information Service (NTIS), Sales and Order Desk

5285 Port Royal Road

Springfield, VA 22161

Technical reports sales and order desk

Telephone: 703-605-6000;

FAX 703-321-8547;

E-mail orders: orders@ntis.fedworld.gov;

Internet: <http://www.ntis.gov/ordering.htm>.

- (1) Nelson, H.E., *Fire Safety Evaluation System for NASA Office/Laboratory Buildings*, NBSIR 86-3404, National Bureau of Standards, Gaithersburg, MD, November 1986. Available from National Technical Information Service: PB87-134300.
- (2) Nelson, H.E., and A.J. Shibe, *System for Fire Safety Evaluation of Health Care Facilities*, NBSIR 78-1555-1, National Bureau of Standards, Gaithersburg, MD, May 1980. [U.S./Japan Government Cooperative Program on Natural Resources (UJNR), Fire Research and Safety, Fourth Joint Panel Meeting of UJNR Panel, February 5-9, 1979, Tokyo, Japan.] Available from National Technical Information Service: PB80-195795.
- (3) Nelson, H.E., and A.J. Shibe, *System for Fire Safety Evaluation for Multifamily Housing*, Interim Report, NBSIR 82-2562, National Bureau of Standards, Gaithersburg, MD, September 1982. Available from National Technical Information Service: PB83-119909.
- (4) Nelson, H.E., and A.J. Shibe, *Development of a Fire Safety Evaluation System for Detention and Correctional Occupancies*, NBSIR 84-2976, National Bureau of Standards, Gaithersburg, MD, January 1985. Available from National Technical Information Service: PB85-177913.
- (5) Nelson, H.E., B.M. Levin, A.J. Shibe, N.E. Groner, R.L., Paulsen, D.M. Alvord, S.D. Thorne, *Fire Safety Evaluation Systems for Board and Care Homes*, Final Report, NBSIR 83-2659, National Bureau of Standards, Gaithersburg, MD, March 1983. Available from National Technical Information Service: PB83-192674.
- (6) Nelson, H.E., A.J. Shibe, B.M. Levin, S.D. Thorne, L.Y. Cooper, *Fire Safety Evaluation System for National Park Service Overnight Accommodations*, NBSIR 84-2896, National Bureau of Standards, Gaithersburg, MD, September 1984. Available from National Technical Information Service: PB85-105518.

Chapter 3 Definitions

3.1 General. Quasi-definitions of terms used in the individual chapter can be found in the applicable chapter.

3.2 Official NFPA Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

3.2.3 Guide. A document that is advisory or informative in nature and that contains only nonmandatory provisions. A guide may contain mandatory statements such as when a guide can be used, but the document as a whole is not suitable for adoption into law.

3.2.4 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.5* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

Chapter 4 Fire Safety Evaluation System for Health Care Occupancies

4.1 General. This chapter is part of an NFPA guide and therefore is not mandatory. The term *shall* in this chapter is used to indicate that if the provisions of the chapter are applied, the procedures mandated are to be followed to ensure the effectiveness of the evaluation system.

The Fire Safety Evaluation System is a measuring system. It compares the level of safety provided by an arrangement of safeguards that differ from those specified in NFPA 101, *Life Safety Code*, to the level of safety provided in a building that conforms exactly with the details of the *Code*.

This chapter is provided to assist in completion of Figure 4.7, Worksheets for Evaluating Fire/Smoke Zones. The step-by-step instructions for completion appear on the worksheets. They are not repeated within the chapter. This chapter provides expanded discussion and definition of the various items in the worksheet to assist the user when questions of definitions or interpretation arise. The chapter is organized to follow the format of the worksheet progressively.

4.2 Procedure for Determining Equivalency.

4.2.1 Evaluate every fire zone using Figure 4.7 (Worksheets 4.7.1 through 4.7.11). Use the text portion (Sections 4.3 through 4.6.13.4.3) of this chapter as a guide.

4.2.2 The Facility Fire Safety Requirements Worksheet (Worksheet 4.7.10) is used to determine any nonconformance with the requirements on the worksheet.

4.2.3 Equivalency is achieved if the fire/smoke zone evaluations show equivalency or better in each and every fire zone and the requirements on the Facility Fire Safety Requirements Worksheet (Worksheet 4.7.10) are met.

4.3 Fire/Smoke Zone.

4.3.1 A fire/smoke zone is a space that is separated from all other spaces by floors, horizontal exits, or smoke barriers. Every zone on a floor that is subdivided into two or more zones shall have exit routes in accordance with 18.2.4.3 or 19.2.4.3 (NFPA 101). Compartments not meeting these requirements shall be evaluated as part of an adjacent zone. When a floor is not subdivided by horizontal exits or smoke barriers, the entire floor is considered to be the zone.

4.3.2 Selection of Zones to Be Evaluated. A floor that is not subdivided by horizontal exits or smoke barriers is considered a single zone. The entire facility shall be divided into zones. There shall be no areas that are not in a zone. For a complete evaluation, evaluate individually every zone in the health care facility. From a practical standpoint, most health care facilities have repetitive arrangements so that a complete picture can be developed by evaluating typical zones until all combinations are evaluated. The zones selected should include the following:

- (1) Each type of patient zone having a different type of mobility, density, or attendant ratio as specified in Worksheet 4.7.2
- (2) Each zone that represents a significantly different type of construction, finish, or protection system
- (3) Zones containing special medical treatment or support activities (operating suites, intensive care units, laboratories)
- (4) Zones not involving housing, treatment, or customary access for patients. Such zones should be evaluated as follows:
 - a. Any zone, whether or not used for patient egress, shall be permitted to be evaluated on the same basis as a patient use zone. In such case, the value of factor *F* in Worksheet 4.7.3 shall be assigned the value of factor *L* ("Zone Location") from Worksheet 4.7.2. In such cases, Safety Parameter 10, "Emergency Movement Routes," from Worksheet 4.7.6 shall be graded "deficient" if the exit capacity is less than that prescribed for the actual occupancy of the space and "<2 routes" if less than 75 percent of the prescribed exit capacity is present.
 - b. If the zone is separated by 2-hour fire-rated construction from all patient use zones (including any members that bear the load of a patient use zone) and if any communicating openings through the 2-hour fire-rated construction are protected by 1½-hour fire-protection-rated fire doors, the zone shall be permitted to be excluded from evaluation. In such case, that space shall conform with the portion of the *Life Safety Code* appropriate to its use. In addition, appropriate

charges under Safety Parameter 8, "Hazardous Areas," in Worksheet 4.7.6 shall be charged against other zones in the facility.

- c. Evaluation of an unoccupied floor(s) located above the highest floor used for health care occupancy is not required, provided the unoccupied floor(s) meets the construction requirements of 18.1.6 (NFPA 101) for new buildings or 19.1.6 (NFPA 101) for existing buildings, or if the unoccupied floor(s) is protected by automatic sprinklers.
- (5) Patient sleeping rooms or suites exceeding 1000 ft² (92.9 m²) or nonsleeping rooms or suites exceeding 2500 ft² (230 m²) of floor area, which should be evaluated as follows:
 - a. If the room or suite has a single exit access door, it should be evaluated as a single dead-end zone.
 - b. A patient sleeping room or suite of sleeping rooms exceeding 5000 ft² (460 m²) should be evaluated as a separate zone.
 - c. A room or suite of rooms other than a patient sleeping room, exceeding 10,000 ft² (930 m²), should be evaluated as a separate zone.

4.4 Maintenance. Any protection system, requirement, or arrangement that is not maintained in a dependable operating condition or is used in such a manner that the intended fire safety function or hazard constraint is impaired should be considered defective and receive no credit in the evaluation.

4.5 Occupancy Risk (Worksheet 4.7.2). In establishing a system for evaluating occupancy risk, the following facts are recognized:

- (1) There is a basic level of risk inherent in every health care facility.
- (2) The fuel characteristics of furniture, equipment, and supplies vary with time.
- (3) The arrangement of these items within the space available also can vary with time.

Consequently, these three factors are not included as parameters in a safety equivalency measurement. To account for these factors, the occupancy risk baseline is set at the inherent risk level, with the presumption that the furniture, equipment, and supplies are the most combustible and adversely located (from a fire safety standpoint) of those items normally found in health care facilities.

4.5.1 Patient Mobility.

4.5.1.1 The single most important factor controlling risk in a health care facility is the degree to which patients need assistance in taking the actions necessary for their safety. The level of capability in health care facilities varies from patients who, if informed or directed, are able to take positive, self-protecting actions to those patients who have no ability to move or even to take the simplest actions to safeguard themselves. In some cases, patients are directly connected to a fixed life-support system and are so dependent on it that, regardless of their physical condition or the availability of assistance, they cannot be moved without jeopardy of death or serious harm. In the measurement of occupancy risk factors, the least mobile category of patient expected in the zone determines the risk factor for that zone. The rationale for this approach is that, if a zone accepts any patient with a reduced mobility status, it might accept other such patients at any time. The impact of this

approach is that most health care facilities should be rated in the "not mobile" risk category.

4.5.1.2 Mobility Status Factor. Patient mobility status is based on the capability of each patient to take actions necessary for self-protection. The four classes are defined as follows.

(a) *Mobile.* Capable of readily rising from bed and taking self-protecting actions at approximately the same rate as a healthy adult. To be classified as mobile, the patient must not need assistance in getting out of bed and must be able to open a closed or locked door. Persons shall be considered to be mobile if they are not restrained or in any other way limited in response capabilities so that the type of arousal mechanism that normally would awaken an adult is not effective.

(b) *Limited Mobility.* Those patients who have all of the capabilities of a mobile person except that their rate of travel is significantly slower.

(c) *Not Mobile.* Patients incapable of removing themselves from danger exclusively by their own efforts. Examples include persons who are totally bedridden, who need assistance getting out of bed or moving, and who are restrained, locked in their rooms, or otherwise prevented from taking complete emergency self-protection evacuation actions without assistance. Mobility status should be based on the minimum level of mobility in an average 24-hour period.

(d) *Not Movable.* Patients not capable of being moved from the room in which they are housed during the course of a fire. Examples include patients attached to life-support systems or involved in medical or surgical procedures that prohibit their immediate relocation without extreme danger of death or serious harm.

4.5.2 Patient Density.

4.5.2.1 The occupancy risk evaluation for occupancy density (number of patients within the zone) measures both the inherent increase in the maximum fire death potential that occurs as the number of patients in a zone increases and the problems involved for a limited staff in handling larger numbers of patients during an emergency.

4.5.2.2 Patient Factor. The density of patients is the number of patients who could potentially be housed in the zone. The patient count should be based on the number of assignable beds in the zone, assuming that they might all be occupied at the time of the fire emergency.

4.5.3 Zone Location.

4.5.3.1 This risk factor relates to fire department accessibility to a fire. The rating system recognizes the inherent advantages for the first floor zone. It also recognizes the problems of evacuation from higher floors and the virtual impossibility of using external fire-fighting efforts above the sixth floor in any building.

4.5.3.2 Floor Factor. The measured zone's location shall be considered to be on floor one if the floor has direct access to the exterior at or within less than one-half floor height above or below grade. If a building is on a sloping grade, each floor that has such exterior access shall be considered as a first floor for the purpose of measuring fire zones on those floors. The measured zone shall be considered to be on the second to third floor range and the fourth to sixth floor range, based on the height of the zone above the nearest grade floor. The zone shall be considered to be above the sixth floor if it is more than six floors above the nearest grade floor. The risk factor value for zones in basements is the same as for zones at or above the

seventh floor. The problems involved in emergency internal access and in fire fighting and rescue and the inability to make external attack in basements are approximately equivalent to those in the upper stories of buildings.

4.5.4 Ratio of Patients to Attendants.

4.5.4.1 This risk factor recognizes the importance to patient safety of a staff that is immediately available to respond in an emergency. The emergency actions that might be undertaken by the staff include detection, alarm, fire extinguishment, confinement of the fire, establishment of barriers between the patients and the fire (closing patient room doors), rescue, emergency medical aid, and other related functions. A few of these functions, such as detection and alarming, might not be critically related to the ratio of nursing staff to patients, while those related to rescue and the closing of patient room doors have a strong relationship to the staffing ratio. The staff ratio considered is based on the minimum staffing level immediately available (normally the night shift).

4.5.4.2 Patient-Attendant Factor. The ratio of patients to attendants is based on those patients in the fire/smoke zone and the immediately available attendant staff. The ratio calculation shall be based on the minimum staffing level (usually occurring during the night shift). Where nursing stations or other positions of attendants are located at the junction of two or more zones and the location of the station is such that each of the zones has immediate access and is in view of the nursing station, the total staffing assigned to the nursing station can be credited to each of the zones. An exception occurs when staff members are bound by duty assignments (cardiac care units, infant nurseries, operating suites, etc.) that prevent them from responding to other than their assigned zone.

The evaluation system assesses this risk factor at 4.0 in any case involving periods when no attendants are immediately available to a zone that houses patients but where attendants are available within one floor of all patient floors. This evaluation system is not intended to be used in cases where no staff are present in the building housing patients.

4.5.5 Patient Average Age. This risk factor recognizes the increased susceptibility of the elderly and of infants up to one year old to physical harm by smoke particles, gaseous combustion products, and heated air. A larger risk factor is assigned to zones occupied by a population whose average age is above 65 years or below one year. Basically, imposition of this rating demands additional safety protection in nursing homes for the aged and in nurseries.

Age Factor. The mode value is used to arrive at the age factor for the patients in the zone. The calculation should be based on the past record of occupants assigned to the zone. Patients under one year old are classified at the same risk level as those over 65. This factor recognizes the susceptibility of infants to fire.

4.6 Safety Parameters (Worksheet 4.7.7). Safety parameters are a measure of those building factors that bear on or contribute to the safety of those persons (patients, staff, visitors, others) who might be in the particular zone at the time of a fire.

Each of the safety parameters was analyzed. Where the current *Code* requirements recognize several different approaches to the parameter, the most important alternatives were specified. Additionally specified were conditions likely to be encountered in situations failing to meet the explicit *Code* requirements and conditions exceeding those required by the *Code* but available for increased protection.

4.6.1 Construction. Construction types are classified in accordance with the definitions of NFPA 220, *Standard on Types of Building Construction*. Major revisions have been made in the categories and definitions in the recent editions of NFPA 220.

Note that prior editions of NFPA 220, *Standard on Types of Building Construction*, included requirements for “interior partitions enclosing stairs or other openings through floors.” Current editions do not. This change is fully accounted for in this system. (See 4.6.7.)

4.6.1.1 Where the facility includes additions or connected structures of different construction, the rating and classification of the structure shall be based on the following:

- (1) Separate buildings if a 2-hour or greater fire resistance-rated separation exists between the portions of the building
- (2) Separate buildings if the additions and connected structure conform to the provisions of applicable sections of Chapter 18 or 19 (NFPA 101), whether or not separation is provided
- (3) The lower safety parameter point score involved if neither (1) nor (2) applies

4.6.1.2 The floor level used to determine the parameter value is the floor of the fire zone being evaluated. The *floor of zone* is the story height above the floor of the primary level of exit discharge as defined by 18.1.6.1 and 19.1.6.1 (NFPA 101).

4.6.1.3 Where the zone is on a floor below the floor of lowest discharge, the construction value shall be based on the distance of that floor from the closest level of discharge (i.e., one floor below discharge equals “second”; two floors below discharge equals “third”; three or more floors below discharge equals “fourth and above”).

4.6.2 Interior Finish (Corridor and Exits). The classification of flame spread is in accordance with Section 10.2 (NFPA 101). The flame spread classification shall be based on the most combustible surface after deleting trim. No allowance is made in the safety parameter values for Class D or Class E interior finishes. It is not anticipated that such material will be used in health care facilities. In the rare case that such high flame spread interior finish material is involved, an individual appraisal outside the capability of this evaluation system will be required.

4.6.3 Interior Finish (Rooms). See 4.6.2.

4.6.4 Corridor Partitions/Walls. For the purpose of this evaluation, the fire-rated partitions considered are as defined in 18.3.6 (NFPA 101) for new buildings and 19.3.6 (NFPA 101) for existing buildings. All elements of the partition, except the door (considered as a separate element in this evaluation), must be included in the determination of its time-rated fire resistance classification according to NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. An exception to the general rule of evaluating doors separately from walls occurs where one or more rooms has no door (see 4.6.5). In this instance, it is considered that the worth of the fire resistance capabilities of the corridor partition wall is so reduced that the wall should be graded as having no fire resistance. (See Worksheet 4.7.6.)

4.6.4.1 Corridor partitions shall be graded as “none or incomplete” if they do not meet the requirements of 18.3.6 or 19.3.6 (NFPA 101), as appropriate, including applicable exceptions. In existing buildings, partitions shall be permitted to be graded as “ $<1/2$ hour,” provided the ceiling within the fire/smoke zone is of a design and construction sufficient to resist the passage of smoke and the partition either

extends through or terminates at the underside of the ceiling with a smoketight joint.

4.6.4.2 Corridor partitions shall be graded as “ $\geq 1/2$ hour but <1 hour” or “ ≥ 1 hour” only where the partitions extend to the underside of the floor or roof construction above in accordance with 18.3.6 or 19.3.6 (NFPA 101), as appropriate.

4.6.5 Doors to Corridor. The classification of doors to the corridor shall be based on the minimum quality of any door in the zone, and the classification shall be determined in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*. Doors for protection of vertical openings and hazardous areas that are covered separately in 4.6.7 and 4.6.8 are not included in this evaluation. Doors that do not latch and doors that have louvers shall not be considered in classifying doors to corridors if those doors open to toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces that do not contain flammable or combustible materials.

4.6.5.1 No Door. A room shall be considered as not having a door if there is no door in the opening or if there is some other mechanism that prevents closing of the door or otherwise leaves a significant opening between the patient room and the corridor. Doors with louvers or ordinary glass lights shall be classified as “no door.” (Ordinary glass lights shall not be considered as making a partition incomplete in locations where both sides of the glass light are fully protected by automatic sprinkler systems.) Doors that have been blocked open by door stops, chocks, tie backs, or other devices that necessitate manual unlatching or releasing action to close the door shall be classified as “no door.” Hold-open devices that release when the door is pushed or pulled (such as friction catches or magnetic catches) shall be permitted, and the door shall be classified under 4.6.5.2, 4.6.5.3, and 4.6.5.4. Also, doors that are not provided with a latch in accordance with 18.3.6.3.2 or 19.3.6.3.2 (NFPA 101) shall be classified as “no door.”

4.6.5.2 Doors of Less Than Twenty-Minute Fire Protection Rating (<20 min FPR). Doors that are not deficient as described in 4.6.5.1 but that do not meet the requirements of 4.6.5.3 shall be classified as less than 20-minute fire protection rating.

4.6.5.3 Doors of Twenty-Minute or More Fire Protection Rating (≥ 20 min FPR). Doors shall be considered as having a 20-minute or greater fire protection rating if they are of $1\frac{3}{4}$ -in. (4.4-cm) thick, solid, bonded wood core construction or any other arrangement of equal or greater stability and fire integrity. The thermal insulation capability of the door need not be considered. Hollow or sheet steel doors therefore meet the 20-minute requirement.

4.6.5.4 Twenty-Minute or More Fire Protection Rating and Automatic Closing (≥ 20 min FPR & Auto Clos.). Automatic closing devices shall be considered to be present if the door has an arrangement that holds it open in a manner such that it is released by a smoke-detector-operated device (e.g., a magnetic or pneumatic hold-open device) prior to the passage of significant smoke from a room of fire origin into the corridor or from the corridor into a room not involved in the fire. Smoke detectors for operation of such doors shall be permitted to be integral with the door closers, mounted at each opening, or operated from systems meeting the requirements for two or more points of credit under 4.6.12. The requirement for 20-minute fire protection rating is the same as in 4.6.5.3.

4.6.5.5 Self-Closing Patient Room Doors. Traditional self-closing doors on individual patient rooms shall be evaluated in the following manner:

- (1) If it can be established that the doors are constantly kept in the normally closed position except when persons are actually passing through the openings, the self-closing device shall be considered as equivalent to an automatic closing device and credited accordingly.
- (2) If the self-closing doors are blocked open, they shall be classified as “no door” and a parameter value of -10 invoked.

4.6.6 Zone Dimensions. Zone dimension shall be as calculated per 18.3.7.1 or 19.3.7.1 (NFPA 101).

4.6.6.1 The length of a corridor “dead end” shall be measured from the point at which a person egressing from the dead end would have an option of egressing in two separate directions.

4.6.6.2 In assessing the values for this parameter, a single value shall be chosen based on the worst safety level in the zone. For example, if one or more dead ends in excess of 50 ft (15 m) but not more than 100 ft (30 m) exist, the parameter value for dead ends (-4) shall be applied regardless of the actual corridor lengths.

4.6.6.3 Since dead-end corridors and single emergency movement routes (see 4.6.10) each confine the occupants of a fire zone to a single means of egress, the effect of these two factors on the parameter value is not cumulative. As indicated by footnote (b) to Worksheet 4.7.6, the parameter value for dead-end corridors is to be 0 instead of either -2, -4, or -6 in the special case where a value of -8 is assessed under 4.6.10 for single emergency movement routes.

4.6.7 Vertical Openings. These values apply to vertical openings and penetrations including exit stairways, ramps, and other vertical exits of the type recognized by NFPA 101, *Life Safety Code*, plus pipe shafts, ventilation shafts, duct penetrations, and laundry and incinerator chutes. Enclosures shall be of construction having a fire resistance rating not less than that prescribed for vertical openings (see *Safety Parameter 7 of Worksheet 4.7.6*). In addition, they shall be equipped with fire doors or acceptable protection of openings into the shafts, all designed and installed to provide a complete barrier to the vertical spread of fire or smoke.

4.6.7.1 A vertical opening or penetration shall be considered open if it has any of the following characteristics:

- (1) It is unenclosed.
- (2) It is enclosed but does not have doors.
- (3) It is enclosed but has openings other than doorways.
- (4) It is enclosed with cloth, paper, or similar materials without any sustained flame-stopping capabilities.

4.6.7.2 Where vertical openings are located outside the fire/smoke zone and the separation between the zone and the vertical opening is of 1-hour or greater fire resistance rating and is of higher fire resistance rating than the protection of the vertical opening itself (for example, an open shaft separated from the zone by a 2-hour fire resistance-rated partition with $1\frac{1}{2}$ -hour fire protection-rated self-closing fire doors), the rating of this factor for the zone being measured shall be based on the higher of the two fire resistance categories. In this example, a safety parameter value of 3 would be given for the 2-hour fire resistance rating. Where this occurs, however, the space with the vertical opening cannot be considered an

exit route or refuge area for that zone when evaluating the emergency movement route parameter addressed in 4.6.10.

4.6.7.3 A vertical opening shall be considered open for more than three floors if there is unprotected penetration of four or more floors on the same shaft without an intervening slab or other cutoff (*also see same area as an unprotected penetration in 4.6.13*). If a shaft is enclosed at all floors except one and this results in an unprotected opening between the shaft and one, and only one, fire/smoke zone, the parameter value assigned for that shaft opening in the fire/smoke zone where the unprotected opening occurs shall be 0.

4.6.8 Hazardous Areas. Hazardous area protection is determined in accordance with Section 8.4 (NFPA 101). The term *adjacent zone* as used in the evaluation form means any zone, either on the same floor or on the floor immediately below, that physically abuts the zone being evaluated and not separated by 2-hour fire resistance-rated construction.

The term *outside zone* as used in the evaluation form means any place within the building other than the fire/smoke zone being measured and not separated by 2-hour fire resistance-rated construction.

4.6.8.1 In assessing the parameter value for hazardous areas, only one value shall be chosen. It shall be the most severe value corresponding to the deficiencies present. A double deficiency can exist only where the hazard is severe and the space is not sprinkler protected. Double protection consists of both a fire-rated enclosure and automatic sprinkler protection of the hazardous area. If both of these protections are lacking in a severe hazardous location, the double deficiency value shall be chosen. If double deficiencies exist both within the zone and outside the zone, the higher value (–11) for the condition inside the zone shall be chosen. The values are not cumulative, regardless of how many hazardous areas are present. Table 4.6.8.1 provides a matrix to be used to determine degree of deficiency to be assessed.

Table 4.6.8.1 Hazardous Areas Deficiencies

Protection	Hazard	
	Severe	Not Severe
None	Double	Single
Fire resistance-rated enclosures	Single	None
Automatic sprinklers	Single	None
Both	None	None

4.6.8.2 Where the hazard is not severe, the maximum deficiency that can occur is a single deficiency, which shall be permitted to be countered by either a fire-rated enclosure or automatic extinguishing equipment.

4.6.8.3 A single deficiency situation also is considered to exist where a severe hazard is protected either by automatic extinguishing systems or by a fire resistance-rated enclosure, but not by both.

4.6.9 Smoke Control. Smoke control definitions are provided in 4.6.9.1 through 4.6.9.3.

4.6.9.1 No Control. There are no smoke barriers (or horizontal exits) on the floor, and there is no mechanical smoke control system.

4.6.9.2 Smoke Barrier Serves Zone. A smoke barrier consists of a partition extending across the entire width of the zone equipped with doors that either are self-closing or are closed upon detection by smoke detectors located at the door arches or other release mechanisms as described in 7.2.18 (NFPA 101). To be credited as a smoke barrier, an existing partition also shall conform with the requirements of 19.3.7.2 through 19.3.7.7 (NFPA 101). New smoke barriers in either new or existing buildings shall meet the more stringent requirements of 18.3.7.2 through 18.3.7.8 (NFPA 101). A horizontal exit will act as a smoke partition and is credited as both a smoke barrier (*see 4.6.9*) and an emergency movement route (*see 4.6.10*).

4.6.9.3 Mechanically Assisted Systems — by Zone. Mechanically assisted smoke control on a zone basis shall include a smoke barrier, as in 4.6.9.2, supported by a tested and accepted smoke control system that obstructs the leakage of smoke between zones. One method of judging the acceptability of smoke control systems is contained in NFPA 92A, *Recommended Practice for Smoke-Control Systems*.

4.6.10 Emergency Movement Routes. A movement route is any means of egress meeting the requirements for such means specified in 7.2.2 through 7.2.6 (NFPA 101). Horizontal exits also shall meet the requirements specified in 4.6.10.4. Doors exiting directly to the exterior also shall constitute a movement route from the room containing such a door.

4.6.10.1 Fewer Than Two Routes. The means of emergency movement from a zone is classified as fewer than two routes if there are not at least two remote movement routes serving the zone. Movement routes shall be permitted to be outside the physical limits of the zone.

4.6.10.2 Multiple Routes. The emergency movement route is multiple if the zone occupants have the choice of two or more distinctly separated movement routes from the zone.

4.6.10.3 Deficient. The choice of parameter value for deficient emergency movement routes is independent of any values determined in 4.6.7.

4.6.10.3.1 An emergency movement route of a type described by 18.2.2 or 19.2.2 (NFPA 101) is deficient if the door to a patient room or passage through a smoke barrier is less than 32 in. (81 cm) [41.5 in. (105 cm) in new buildings] in clear width or if the corridor in the zone between patient rooms and smoke barriers and exits is less than 48 in. (122 cm) [8 ft (244 cm) in new buildings] in clear width. These figures are based on the minimum width for a wheelchair to egress a room and the minimum width for the passage of a wheelchair in one direction and an ambulatory person in the opposite direction.

4.6.10.3.2 Exit routes also shall be considered deficient if they fail to meet the requirements of 18.2.1 through 18.2.7 or 19.2.1 through 19.2.7 (NFPA 101), for the egress route involved. However, any route where the doors from rooms or through partitions or walls are less than 32 in. (81 cm) in the clear, where the corridor(s) involved is less than 34 in. (86 cm) wide, or where stair access is less than 28 in. (71 cm) in the clear shall not be credited as an egress route.

4.6.10.3.3 Exit routes shall be considered deficient if the route does not otherwise conform to the requirements of Section 7.1 through 7.2.8 (NFPA 101), even if the routes have been or are acceptable to the authority having jurisdiction.

4.6.10.3.4 Exit routes shall be considered deficient if the capacity of the exits serving the floor containing the zone being evaluated is insufficient for the calculated occupant load of the floor.

4.6.10.4 Horizontal Exits. The presence of a single horizontal exit from the zone being evaluated shall be assigned a parameter value of 1, provided the space on the opposite side of the horizontal exit is capable of handling all of the patients from affected zones.

4.6.10.4.1 To be credited as a horizontal exit, the existing arrangement also shall conform with the requirements of 19.2.2.5 (NFPA 101). New horizontal exits in new or existing buildings shall meet the more stringent requirements of 18.2.2.5 (NFPA 101).

4.6.10.4.2 To receive credit for horizontal exits, the zone credited shall conform to the requirements of 7.5.1.2 (NFPA 101) with the zone served considered a separate portion of the building.

4.6.10.4.3 In addition, to receive credit for horizontal exits, each patient sleeping room in the zone shall be within 150 ft (45 m) of travel of a horizontal exit door or exit to grade.

4.6.10.5 Direct Exits. To be credited for direct exits, each patient-use space (except bathrooms, restrooms, and corridors) in the zone shall have a door that is operable by the room occupant(s) and opens directly to the exterior at grade or onto an exterior balcony with direct access to an exterior exit or a smokeproof enclosure. The direct exit shall be ramped or otherwise without steps or changes in elevation that could prevent or obstruct the movement of wheelchairs or wheel-littered patients through the direct exits to a place of safety and refuge.

4.6.11 Manual Fire Alarm. The manual alarm systems for new construction shall be in accordance with the requirements of 18.3.4.1, 18.3.4.2, 18.3.4.3.1, and 18.3.4.4 (NFPA 101). Existing construction shall be in accordance with 19.3.4.1, 19.3.4.2, 19.3.4.3.1, and 19.3.4.4 (NFPA 101). Connection to the fire department shall be considered as being met if the fire alarm system is connected directly to the fire department, through an approved central station, or through other means acceptable to the authority having jurisdiction.

4.6.12 Smoke Detection and Alarm. A detection system as used herein is one based on the use of automatic smoke detectors installed in accordance with Section 9.6 (NFPA 101). Notification shall be in accordance with 18.3.4.3.1 or 19.3.4.3.1 (NFPA 101). No recognition is given for thermal detectors; however, credit is given for the use of quick-response sprinklers per note (g) of Worksheet 4.7.6. The detection system categories are described in 4.6.12.1 through 4.6.12.5.

4.6.12.1 None. There are no smoke detectors in the zone, or, if present, they are not included in any of the categories of 4.6.12.2 through 4.6.12.5.

4.6.12.2 Corridor Only. Smoke detectors are installed throughout the corridors of the zone involved in accordance with Section 9.6 (NFPA 101).

4.6.12.3 Rooms Only. Smoke detectors are installed throughout the rooms of the zone involved. These smoke detectors shall be considered as meeting this requirement where there is at least one smoke detector in each room occupied or used by patients. Detectors are not required in restrooms or closets.

4.6.12.4 Corridor and Habitable Spaces. Detection systems installed throughout the corridors of the zone involved and in the habitable spaces (patient rooms, nurses stations, and other areas basically used for human occupancy) shall be considered as meeting the requirements for a corridor and habitable spaces detection system. Closets, toilet rooms, and other auxiliary spaces as well as ceiling voids, interstitials, and other building spaces not used by humans as a normal part of their regular occupancy are not required to have detectors.

4.6.12.5 Total Spaces in Zone. Total space provision of detectors includes detector coverage of all spaces except noncombustible building voids that contain no combustible materials. The total space credit is to be given if the zone measured meets this criterion, regardless of the presence or lack of detectors in other portions of the building.

4.6.13 Automatic Sprinklers.

4.6.13.1 Wherever sprinkler protection is involved in an area having an unprotected vertical opening, the sprinkler protection around that vertical opening shall conform to Chapter 8 (NFPA 101). This protection is required to allow the credit for sprinkler protection but shall in no way reduce any assessed value under Safety Parameter 7 in Worksheet 4.7.6 resulting from an unprotected vertical opening.

4.6.13.2 In Worksheet 4.7.7, the value for sprinkler protection credited to the people movement safety (S_3) category is divided by 2. This produces a safety parameter value of only one-half the value credited in other categories.

4.6.13.3 Each sprinkler system shall be provided with supervision. Each sprinkler system shall be interconnected electrically with the fire alarm system, and the main sprinkler control valve shall be supervised electrically so that at least a local alarm shall sound in a constantly attended location when the valve is closed.

4.6.13.4 In evaluating sprinkler protection within the zone, the protection or lack of protection of hazardous areas is considered separately and covered under 4.6.8. For all other areas in the zone, sprinklers shall be graded based on the categories specified in 4.6.13.4.1 through 4.6.13.4.3.

4.6.13.4.1 None. No credit is applied if there are no sprinklers or if sprinklers, though present, are not sufficient to qualify for one of the other categories specified.

4.6.13.4.2 Corridor and Habitable Space. Habitable space includes patient rooms, nurses stations, and other areas used basically for human occupancy. Habitable space does not include closets, bathrooms, toilets, elevators, and similar spaces. This safety parameter value is based on standard sprinkler spacings in the areas covered and is conditional, based on the classification of construction type as covered in 4.6.1, as follows.

(a) Safety Parameter 1, "Construction" (*see 4.6.1*), in Worksheet 4.7.6 is based on a "protected" or "fire-resistive" type of construction. Protected or fire-resistive types of construction include Types I, II(222), II(111), III(211), and V(111). This credit is based on a system that effectively provides coverage for all corridor and habitable space in the zone, plus the establishment of water distribution patterns or other protection in a manner to prevent the advance of fire from nonsprinklered spaces into the sprinklered spaces. In buildings of protected or fire-resistive construction, the credit is to be applied to any

zone where these conditions are met, whether or not areas outside the zone are protected similarly.

(b) Safety Parameter 1, “Construction” (*see 4.6.1*), is based on an “unprotected” type of construction. Unprotected types of construction include Types II(000), III(200), and V(000). In any unprotected type of construction, the credit for corridor and habitable space protection is to be given only if, in addition to the conditions described in 4.6.13.4.2(a), sprinkler protection also is provided in all spaces in the building (including attic or loft spaces) with construction elements that are not sheathed, enclosed, or otherwise protected with fire-resistive materials such as gypsum board, plaster, or masonry block.

4.6.13.4.3 Entire Building. Total space automatic sprinkler protection is to be credited only if the entire structure is protected by automatic sprinklers in accordance with 18.3.5 or 19.3.5 (NFPA 101). This credit also is given where a smoke zone is renovated to install quick-response or residential sprinklers in accordance with 18.1.1.4.5 (NFPA 101). Wherever quick-response automatic sprinklers are provided for zones as part of the entire building sprinkler system, additional credit shall be permitted to be taken under Safety Parameter 12, “Smoke Detection and Alarm.” (*See 4.6.12 and Worksheet 4.7.6.*)

4.7 Worksheets for Evaluating Fire/Smoke Zones. Complete the cover sheet (Worksheet 4.7.1) found in Figure 4.7.

Step 1: Determine occupancy risk parameter factors — use Worksheet 4.7.2. For each risk parameter in Worksheet 4.7.2, select and circle the appropriate risk factor value. Choose only one for each of the five risk parameters.

Step 2: Compute occupancy risk factor F — use Worksheet 4.7.3.

A. Transfer the circled risk factor values from Worksheet 4.7.2 to the corresponding blocks in Worksheet 4.7.3.

B. Compute occupancy risk factor F by multiplying the risk factor values as indicated in Worksheet 4.7.3.

Step 3: Compute adjusted building status R — use Worksheet 4.7.4 or Worksheet 4.7.5.

A. If building is classified as “new,” use Worksheet 4.7.4. If building is classified as “existing,” use Worksheet 4.7.5.

B. Transfer the value of F from Worksheet 4.7.3 to Worksheet 4.7.4 or Worksheet 4.7.5, as appropriate. Calculate R .

C. Transfer R to the block labeled R in Worksheet 4.7.9.

Step 4: Determine safety parameter values — use Worksheet 4.7.6. Select and circle the safety value for each safety parameter in Worksheet 4.7.6 that best describes the conditions in the zone. Choose only one value for each of the

13 parameters. If two or more values appear to apply, choose the one with the lowest point value.

Step 5: Compute individual safety evaluations — use Worksheet 4.7.7.

A. Transfer each of the 13 circled safety parameter values from Worksheet 4.7.6 to every unshaded block in the line with the corresponding safety parameter in Worksheet 4.7.7. For Safety Parameter 13, the value entered in the “People Movement Safety” column is recorded in Worksheet 4.7.7 as one-half the corresponding value circled in Worksheet 4.7.6.

B. Add the four columns, keeping in mind that any negative numbers need to be deducted.

C. Transfer the resulting total values for S_1 , S_2 , S_3 , and S_4 to the corresponding blocks in Worksheet 4.7.9.

Step 6: Determine mandatory safety requirements values — use Worksheet 4.7.8.

A. Using the classification of the building (i.e., new or existing) and the floor where the zone is located, circle the appropriate value in each of the three columns in Worksheet 4.7.8.

B. Transfer the three circled values from Worksheet 4.7.8 to the blocks marked S_m , S_b , and S_e in Worksheet 4.7.9.

C. The mandatory safety requirements values for basements are based on the distance of the basement level from the closest level of discharge. (*Also see 4.6.1.2 and 4.6.1.3.*)

Step 7: Determine zone fire safety equivalency — use Worksheet 4.7.9.

A. Perform the subtractions indicated in Worksheet 4.7.9. Enter the differences in the appropriate answer blocks.

B. For each row, check “yes” if the value in the answer block is zero (0) or greater. Check “no” if the value in the answer block is a negative number.

Step 8: Evaluate considerations not previously addressed — use Worksheet 4.7.10. The equivalency covered by Worksheets 4.7.2 through 4.7.9 includes the majority of the considerations covered by the *Life Safety Code*. Some considerations, not evaluated by this method, must be considered separately. These additional considerations are covered in Worksheet 4.7.10, the “Facility Fire Safety Requirements Worksheet.” Complete one copy of this separate worksheet for each facility.

Step 9: Conclude whether the level of life safety is at least equivalent to that prescribed by the *Life Safety Code* — use Worksheet 4.7.11. Worksheet 4.7.11, Conclusions, combines the zone fire safety equivalency evaluation of Worksheet 4.7.9 and the additional considerations of Worksheet 4.7.10.

FIGURE 4.7 Worksheets for evaluating fire/smoke zones.

WORKSHEET 4.7.1 COVER SHEET						
Fire/Smoke Zone* Evaluation Worksheet for Health Care Facilities						
Facility _____			Building _____			
Zone(s) evaluated _____						
Evaluator _____			Date _____			
Complete this worksheet for each zone. Where conditions are the same in several zones, one worksheet can be used for those zones.						
*Fire/smoke zone is a space separated from all other spaces by floors, horizontal exits, or smoke barriers.						
WORKSHEET 4.7.2 OCCUPANCY RISK PARAMETER FACTORS						
Risk Parameters	Risk Factor Values					
1. Patient Mobility (<i>M</i>)	Mobility Status	Mobile	Limited Mobility	Not Mobile	Not Movable	
	Risk Factor	1.0	1.6	3.2	4.5	
2. Patient Density (<i>D</i>)	No. of Patients	1–5	6–10	11–30	>30	
	Risk Factor	1.0	1.2	1.5	2.0	
3. Zone Location (<i>L</i>)	Floor	1st	2nd or 3rd	4th to 6th	7th and Above	Basements
	Risk Factor	1.1	1.2	1.4	1.6	1.6
4. Ratio of Patients to Attendants (<i>T</i>)	$\frac{\text{Patients}}{\text{Attendant}}$	$\frac{1-2}{1}$	$\frac{3-5}{1}$	$\frac{6-10}{1}$	$\frac{>10}{1}$	One or More [†] None
	Risk Factor	1.0	1.1	1.2	1.5	4.0
5. Patient Average Age (<i>A</i>)	Age	Under 65 Years and Over 1 Year			65 Years and Over 1 Year and Younger	
	Risk Factor	1.0			1.2	
† A risk factor of 4.0 is charged to any zone that houses patients without any staff in immediate attendance.						
WORKSHEET 4.7.3 OCCUPANCY RISK FACTOR CALCULATION						
Occupancy Risk	M	D	L	T	A	F
	□ ×	□ ×	□ ×	□ ×	□ =	□
WORKSHEET 4.7.4 (NEW BUILDINGS)						
1.0 ×	F	R				
	□ =	□				
WORKSHEET 4.7.5 (EXISTING BUILDINGS)						
0.6 ×	F	R				
	□ =	□				
(For use with NFPA 101A-2001/NFPA 101-2000)						
(Page 1 of 4)						

FIGURE 4.7 Continued

WORKSHEET 4.7.6 SAFETY PARAMETER VALUES								
Safety Parameters		Parameter Values						
1. Construction		Combustible Types III, IV, and V				Noncombustible Types I and II		
	Floor or Zone	000	111	200	211 + 2HH	000	111	222, 322, 433
	First	-2	0	-2	0	0	2	2
	Second	-7	-2	-4	-2	-2	2	4
	Third	-9	-7	-9	-7	-7	2	4
4th and Above	-13	-7	-13	-7	-9	-7	4	
2. Interior Finish (Corridors and Exits)	Class C	Class B		Class A				
	-5(0) ^f	0(3) ^f		3				
3. Interior Finish (Rooms)	Class C	Class B		Class A				
	-3(1) ^f	1(3) ^f		3				
4. Corridor Partitions/Walls	None or Incomplete	<½ hr		≥½ to <1 hr	≥1 hr			
	-10(0) ^a	0		1(0) ^a	2(0) ^a			
5. Doors to Corridor	No Door	<20 min FPR		≥20 min FPR	≥20 min FPR and Auto Clos.			
	-10	0		1(0) ^d	2(0) ^d			
6. Zone Dimensions	Dead End				No Dead Ends >30 ft and Zone Length Is			
	>100 ft	>50 ft to 100 ft	30 ft to 50 ft	>150 ft	100 ft to 150 ft	<100 ft		
	-6(0) ^b	-4(0) ^b	-2(0) ^b	-2(0) ^c	0	1		
7. Vertical Openings	Open 4 or More Floors	Open 2 or 3 Floors	Enclosed with Indicated Fire Resist.					
			<1 hr	≥1 hr to <2 hr		≥2 hr		
	-14	-10	0	2(0) ^e		3(0) ^e		
8. Hazardous Areas	Double Deficiency		Single Deficiency			No Deficiencies		
	In Zone	Outside Zone	In Zone	In Adjacent Zone				
	-11	-5	-6	-2		0		
9. Smoke Control	No Control	Smoke Barrier Serves Zone	Mech. Assisted Systems by Zone					
	-5(0) ^c	0	3					
10. Emergency Movement Routes	<2 Routes	Multiple Routes						
		Deficient	W/O Horizontal Exit(s)	Horizontal Exit(s)		Direct Exit(s)		
	-8	-2	0	1		5		
11. Manual Fire Alarm	No Manual Fire Alarm		Manual Fire Alarm					
			W/O F.D. Conn.	W/F.D. Conn.				
	-4		1	2				
12. Smoke Detection and Alarm	None	Corridor Only	Rooms Only	Corridor and Habit. Spaces		Total Spaces in Zone		
	0(3) ^g	2(3) ^g	3(3) ^g	4		5		
13. Automatic Sprinklers	None	Corridor and Habit. Space	Entire Building					
	0	8	10					

NOTES: ^a Use (0) where Parameter 5 is -10.
^b Use (0) where Parameter 10 is -8.
^c Use (0) on floor with fewer than 31 patients (existing buildings only).
^d Use (0) where Parameter 4 is -10.

^e Use (0) where Parameter 1 is based on first floor zone or on an unprotected type of construction (columns marked “000” or “200”)
^f Use () if the area of Class B or C interior finish in the corridor and exit or room is protected by automatic sprinklers and Parameter 13 is 0; use () if the room with existing Class C interior finish is protected by automatic sprinklers, Parameter 4 is greater than or equal to 1, and Parameter 13 is 0.
^g Use this value in addition to Parameter 13 if the entire zone is protected with quick-response automatic sprinklers.

For SI units: 1 ft = 0.3048 m

(For use with NFPA 101A-2001/NFPA 101-2000)

(Page 2 of 4)

FIGURE 4.7 Continued

WORKSHEET 4.7.7 INDIVIDUAL SAFETY EVALUATIONS					
Safety Parameters	Containment Safety (S ₁)	Extinguishment Safety (S ₂)	People Movement Safety (S ₃)	General Safety (S ₄)	
1. Construction					
2. Interior Finish (Corr. and Exit)					
3. Interior Finish(Rooms)					
4. Corridor Partitions/Walls					
5. Doors to Corridor					
6. Zone Dimensions					
7. Vertical Openings					
8. Hazardous Areas					
9. Smoke Control					
10. Emergency Movement Routes					
11. Manual Fire Alarm					
12. Smoke Detection and Alarm					
13. Automatic Sprinklers			÷ 2 =		
Total Value	S₁ =	S₂ =	S₃ =	S₄ =	

WORKSHEET 4.7.8 MANDATORY SAFETY REQUIREMENTS (FOR USE IN HOSPITALS OR NURSING HOMES)						
Zone Location	Containment (S _a)		Extinguishment (S _b)		People Movement (S _c)	
	New	Exist.	New	Exist.	New	Exist.
1st story	11	5	15(12) ^a	4	8(5) ^a	1
2nd or 3rd story ^b	15	9	17(14) ^a	6	10(7) ^a	3
4th story or higher	18	9	19(16) ^a	6	11(8) ^a	3

^a Use () in zones that do not contain patient sleeping rooms.

^b For a 2nd story zone location in a *sprinklered* EXISTING facility, as an alternative to the mandatory safety requirement values set specified in the table, the following mandatory values *set* shall be permitted to be used:
S_a = 7, S_b = 10, and S_c = 7.

(For use with NFPA 101A-2001/NFPA 101-2000) (Page 3 of 4)

FIGURE 4.7 Continued

WORKSHEET 4.7.9 ZONE FIRE SAFETY EQUIVALENCY EVALUATION

				Yes		No
Containment Safety (S_1)	minus	Mandatory Containment (S_a)	≥ 0	$\begin{array}{c} S_1 \\ \square \end{array} - \begin{array}{c} S_a \\ \square \end{array} = \begin{array}{c} C \\ \square \end{array}$		
Extinguishment Safety (S_2)	minus	Mandatory Extinguishment (S_b)	≥ 0	$\begin{array}{c} S_2 \\ \square \end{array} - \begin{array}{c} S_b \\ \square \end{array} = \begin{array}{c} E \\ \square \end{array}$		
People Movement Safety (S_3)	minus	Mandatory People Movement (S_c)	≥ 0	$\begin{array}{c} S_3 \\ \square \end{array} - \begin{array}{c} S_c \\ \square \end{array} = \begin{array}{c} P \\ \square \end{array}$		
General Safety (S_4)	minus	Occupancy Risk (R)	≥ 0	$\begin{array}{c} S_4 \\ \square \end{array} - \begin{array}{c} R \\ \square \end{array} = \begin{array}{c} G \\ \square \end{array}$		

WORKSHEET 4.7.10 FACILITY FIRE SAFETY REQUIREMENTS WORKSHEET

Complete one copy of this worksheet for each facility.
For each consideration, select and mark the appropriate column.

		Met	Not Met	Not Applic.
A.	Building utilities conform to the requirements of Section 9.1.			☒
B.	In new facilities only, life-support systems, alarms, emergency communication systems, and illumination of generator set locations are powered as prescribed by 18.5.1.2 and 18.5.1.3.			
C.	Heating and air conditioning systems conform with the air conditioning, heating, and ventilating systems requirements within Section 9.2, except for enclosure of vertical openings, which have been considered in Safety Parameter 7 of Worksheet 4.7.6.			☒
D.	Fuel-burning space heaters and portable electrical space heaters are not used.			☒
E.	There are no flue-fed incinerators.			
F.	An evacuation plan is provided and fire drills conducted in accordance with 18.7.1/18.7.2 and 19.7.1/19.7.2.			☒
G.	Smoking regulations have been adopted and implemented in accordance with 18.7.4 and 19.7.4.			☒
H.	Draperies, upholstered furniture, mattresses, furnishings, and decorations combustibility is limited in accordance with 18.7.5 and 19.7.5.			
I.	Fire extinguishers are provided in accordance with the requirements of 18.3.5.4 and 19.3.5.6.			☒
J.	Exit signs are provided in accordance with the requirements of 18.2.10.1 and 19.2.10.			
K.	Emergency lighting is provided in accordance with 18.2.9.1 or 19.2.9.			
L.	Standpipes are provided in all new high rise buildings as required by 18.4.2.			

All references are to NFPA 101-2000, *Life Safety Code*.

WORKSHEET 4.7.11 CONCLUSIONS

- ☐ All of the checks in Worksheet 4.7.9 are in the "Yes" column. The level of fire safety is at least equivalent to that prescribed by the *Life Safety Code*.*
- ☐ One or more of the checks in Worksheet 4.7.9 are in the "No" column. The level of fire safety is not shown by this system to be equivalent to that prescribed by the *Life Safety Code*.*

* The equivalency covered by this worksheet includes the majority of considerations covered by the *Life Safety Code*. There are some considerations that are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 4.7.10, the "Facility Fire Safety Requirements Worksheet." One copy of this separate worksheet is to be completed for each facility.

Chapter 5 Fire Safety Evaluation System for Detention and Correctional Occupancies

5.1 General. This chapter is part of an NFPA guide and therefore is not mandatory. The term *shall* in this chapter is used to indicate that if the provisions of the chapter are applied, the procedures mandated are to be followed to ensure the effectiveness of the evaluation system.

The Fire Safety Evaluation System is a measuring system. It compares the level of safety provided by an arrangement of safeguards that differ from those specified in NFPA 101, *Life Safety Code*, to the level of safety provided in a building that conforms exactly with the details of the *Code*.

5.2 Procedure for Determining Equivalency. Evaluate the entire facility using Figure 5.5, Worksheets for Evaluating Fire Safety in Detention and Correctional Occupancies (Worksheets 5.5.1 through 5.5.8), as defined in Sections 22.1 and 23.1 (NFPA 101), on a single worksheet. Where different use conditions or fire protection features are involved, portions of the facility separated from each other by 2-hour or greater fire resistance-rated construction (including any members that bear the load of detention use, egress, or refuge space and

with 1½-hour fire protection-rated doors in any communication opening) shall be permitted to be evaluated separately.

5.3 Maintenance. Any protection system, requirement, arrangement, or procedure that is not maintained in a dependable operating condition, is used in such a manner that the intended fire safety function or hazard constraint is impaired, or is not in a sufficient state of readiness should be considered defective and should receive no credit in the evaluation.

5.4 Safety Parameters (Worksheet 5.5.3). The safety parameters are a measure of those building factors that bear upon or contribute to the safety of those persons who might be in the building at the time of a fire. (See Worksheet 5.5.3.)

Each of the safety parameters is to be analyzed, and the safety value for each parameter that best describes the condition in the building is to be identified. Only one value for each of the parameters is to be chosen. If two or more values appear to apply, the one with the lowest point value governs.

5.4.1 Construction. Construction types are defined by the fire resistance and combustibility of load-bearing framing members, floor construction, and roof construction in accordance with NFPA 220, *Standard on Types of Building Construction*. Table 5.4.1 is extracted from NFPA 220.

Table 5.4.1 Fire Resistance Ratings (in Hours) for Type I Through Type V Construction

	Type I		Type II			Type III		Type IV	Type V	
	443	332	222	111	000	211	200	2HH	111	000
Exterior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0 ¹	2	2	2	1 ^a	0 ^{a,b}
Supporting one floor only	4	3	2	1	0 ¹	2	2	2	1 ^a	0 ^{a,b}
Supporting a roof only	4	3	1	1	0 ¹	2	2	2	1 ^a	0 ^{a,b}
Interior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1 ^a	0 ^a	2	1 ^a	0 ^a
Supporting one floor only	3	2	2	1	0	1 ^a	0 ^a	1	1 ^a	0 ^a
Supporting a roof only	3	2	1	1	0	1 ^a	0 ^a	1	1 ^a	0 ^a
Columns										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Supporting one floor only	3	2	2	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Supporting a roof only	3	2	1	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Beams, Girders, Trusses, and Arches										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Supporting one floor only	3	2	2	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Supporting a roof only	3	2	1	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Floor Construction	3	2	2	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Roof Construction	2	1½	1	1	0	1 ^a	0 ^a	H ^{a,c}	1 ^a	0 ^a
Exterior Nonbearing Walls	0 ¹	0 ¹	0 ¹	0 ¹	0 ¹	0 ^{a,b}	0 ^{a,b}	0 ^{a,b}	0 ^{a,b}	0 ^{a,b}

^a Those members that shall be permitted to be of approved combustible material.

^b Requirements for fire resistance of exterior walls, the provision of spandrel wall sections, and the limitation or protection of wall openings are not related to construction type. They need to be specified in other standards and codes, where appropriate, and may be required in addition to the requirements of this standard for the construction type.

^c "H" indicates heavy timber members; see NFPA 220 for requirements.

Source: This table is an extract from NFPA 220, *Standard on Types of Building Construction*, 1999.

5.4.1.1 Where the facility includes additions or connected structures of different construction, the rating and classification of the structure shall be based on one of the following:

- (1) Separate buildings where a 2-hour or greater fire resistance-rated separation exists between the portions of the building
- (2) The lower safety parameter point score involved, where such a separation does not exist

5.4.1.2 The story used to determine the parameter value is the highest story used for confinement purposes. Story height is based on stories starting with the primary level of exit discharge. Where there are stories below the primary level of exit discharge, the maximum value assigned to the construction parameter shall be based on a two-story building or the actual story height, whichever is the lower value.

5.4.1.3 A multitiered open cell block in an existing building shall be permitted to be considered a single story, provided that one or more of the following conditions exist:

- (1) A smoke control system is provided (*see recommended design criteria in A.23.3.1.3 of NFPA 101*) to maintain the level of smoke filling from potential cell fires at least 5 ft (152 cm) above the floor level of any occupied tier.
- (2) A smoke control system as described in 5.4.1.3(1) is provided to maintain the level of smoke filling at least 5 ft (152 cm) above the exit level where either of the following situations exist:
 - a. The cell block is Use Condition II.
 - b. The cell block is Use Condition III, and all persons housed in the cell block can pass through a free access smoke barrier or freely pass below the calculated smoke level with not more than 50 ft (15 m) of travel from their cell.
- (3) Complete automatic sprinkler protection is provided.

5.4.2 Hazardous Areas.

5.4.2.1 The assignment of charges for hazardous areas is a four-step process.

5.4.2.1.1 Step 1 — Identify Hazardous Areas. Hazardous areas are defined in 22.3.2 and 23.3.2 (NFPA 101).

5.4.2.1.2 Step 2 — Determine the Level of Hazard. A hazardous area is classed as severe if it is an area requiring both automatic sprinkler protection and enclosure per 22.3.2.1 or 23.3.2.1 (NFPA 101).

5.4.2.1.3 Step 3 — Determine the Fire Protection Provided. The parameter value for hazardous areas is based on the presence or absence of the fire protection necessary to control or confine the hazard. Two levels of fire protection are considered. The first consists of automatic sprinklers or other appropriate extinguishing system covering the entire hazard. The second is

based on fire resistance-rated enclosures, including any bearing members in the space, partitions separating the hazardous area from all other spaces, and doors to the space sufficient to exceed the potential of the fire load involved. Any hazardous space that has either protection system is classified as having single protection. Any hazardous space that is both fully enclosed in a capable fire resistance-rated enclosure and is sprinklered is classified as having both (i.e., double-level protection). On this basis, any fuel load that has the potential to overwhelm the available structural capability of both its own enclosure and the basic structure could, as a maximum, have single protection.

5.4.2.1.4 Step 4 — Determine the Degree of Deficiency and Assign Parameter Values. The parameter value ultimately is determined by the degree of the deficiencies of the hazardous area based on the level of protection needed.

5.4.2.2 Table 5.4.2.2 provides a matrix to be used to determine the degree of deficiency for this parameter.

In some situations, more than one hazardous area with the same or differing levels of deficiency can exist. In this case, the choice is based on the single most serious deficiency for the hazardous area.

5.4.3 Fire Alarm. Fire alarms are defined in 5.4.3.1 through 5.4.3.3.

5.4.3.1 No Alarm. There is no fire alarm system, or the system is incomplete and does not meet the requirements for a higher-scored category.

5.4.3.2 Without Fire Department Notification (W/O F.D. Notification). There is a manual fire alarm system or smoke detection system conforming with the appropriate requirements of 22.3.4 or 23.3.4, except that the requirements of 22.3.4.3.2 or 23.3.4.3.2 (NFPA 101) covering automatic transmission of the alarm to the fire department are not met.

5.4.3.3 With Fire Department Notification (W/F.D. Notification). There is a manual fire alarm or smoke detection system conforming with the appropriate requirements of 22.3.4 or 23.3.4 (NFPA 101).

(a) *Without Manual Alarm.* There is no manual alarm system, but a smoke detection alarm system or sprinkler system recognized under Safety Parameter 4 or Safety Parameter 5 of this system is provided and is arranged to transmit an alarm automatically to the fire department under either of the following conditions:

- (1) Fire resistance and structural strength exceed maximum potential of hazard.
- (2) Fire resistance or structural strength is not sufficient to withstand potential of hazard.

(b) *With Manual Alarm.* There is a manual alarm system, and it is arranged to transmit an alarm automatically to the fire department.

Table 5.4.2.2 Hazardous Areas — Degree of Deficiency

	No protection	Sprinkler protection	Fire resistance-rated enclosure	Sprinklered and rated enclosure
Hazardous area	Single deficiency	No deficiency		
Severely hazardous area	Double deficiency	Single deficiency	Single deficiency ¹ Double deficiency ²	No deficiency ¹ Single deficiency ²

¹If fire resistance and structural strength exceed maximum potential of hazard.

²If fire resistance and structural strength are not sufficient to withstand potential of hazard.

5.4.4 Smoke Detection.

5.4.4.1 General. A detection system as used herein is one based on use of smoke detectors meeting the installation requirements of 22.3.4.4 and 23.3.4.4 (NFPA 101) and NFPA 72, *National Fire Alarm Code*[®], with the extent of coverage as defined in 5.4.4.2. No credit is given for thermal detectors in habitable spaces.

5.4.4.2 The detection system categories are described in 5.4.4.2.1 through 5.4.4.2.5.

5.4.4.2.1 None. There are no smoke detectors, or, if present, they do not meet the requirements for a higher-scored category.

5.4.4.2.2 Corridors, Common Spaces, and Sleeping Rooms for More Than Four Persons. Smoke detection requirements of such spaces located within the residential housing area are covered by smoke detector installations in accordance with NFPA 72, *National Fire Alarm Code*. In Use Condition II dormitory rooms in sprinklered buildings where staff is present whenever the dormitory room is occupied, detectors may be omitted from the dormitory room but not from the corridors and common spaces.

5.4.4.2.3 All Sleeping Rooms. Smoke detectors shall be considered as meeting the requirement when there is at least one smoke detector in each sleeping room occupied or used by prisoners. In rooms having a dimension in excess of 30 ft (9.1 m), additional detectors are provided so that detector spacing does not exceed approximately 30 ft (9.1 m). Detectors are not required in restrooms or closets.

5.4.4.2.4 Full Coverage. The requirements of 5.4.4.2.2 and 5.4.4.2.3 are met.

5.4.4.2.5 Total Building. Total building detector credit requires conformance with the requirements of NFPA 72, *National Fire Alarm Code*, for total coverage.

5.4.5 Automatic Sprinklers.

5.4.5.1 General. In evaluating sprinkler protection, the protection or lack of protection of hazardous areas is considered separately and covered under 5.4.2, except that total building protection shall include hazardous areas. In addition, the existence or lack of fire department notification is considered separately under 5.4.3. In all other situations, any sprinkler installations shall conform to 22.3.5 and 23.3.5 (NFPA 101) and be graded based on the categories specified in 5.4.5.1.1 through 5.4.5.1.3.

5.4.5.1.1 None. No credit is given if there are no sprinklers or if sprinklers, though present, are not sufficient to qualify for one of the other categories specified.

5.4.5.1.2 Residential Housing Areas. The credit for sprinkler protection of residential housing areas is given for arrangements whereby sprinklers are located throughout the areas such that all space within such areas (including cells or sleeping rooms) is covered by the protection spray pattern of sprinkler heads.

5.4.5.1.3 Entire Building. The building is totally sprinkler protected in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, for light hazard occupancy (or higher hazard occupancy for any spaces classified as higher hazard by NFPA 13).

5.4.6 Interior Finish.

5.4.6.1 Classification of interior finish is in accordance with Section 10.2 (NFPA 101).

5.4.6.2 No consideration is included in the safety parameter value for any finish with a flame-spread rating greater than 200 or for any material not rationally measured by NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Materials not rationally measured include foamed plastics and asphalt-impregnated paper or other materials capable of inducing extreme rates of fire growth and rapid flashover. In any case involving these materials, the resultant risk is considered to classify any such finish area as a hazardous area to be evaluated under 5.4.2.

Note that plywood of $\frac{1}{4}$ in. (0.6 cm) or greater thickness should be considered as having a flame-spread rating of 200 or less.

5.4.7 Reserved.

5.4.8 Cell/Sleeping Room Enclosure.

5.4.8.1 The parameter value categories for cell or sleeping room enclosures are divided between those for cells or sleeping rooms that face directly onto a corridor and those for which there is an intervening common space (i.e., day room, group activity space, or other space between the sleeping room and the corridor access).

5.4.8.2 Open. The cell or sleeping room enclosure includes an opening in excess of 120 in.² (0.08 m²). In Use Condition V, the closure shall be considered "open" if there are any openings exceeding the minimum necessary for door swing and latch unless either of the following conditions exists:

- (1) The affected cells meet the requirements for mechanically assisted smoke control in 5.4.13.3.
- (2) There is a closure for such openings operable from inside the cell.

5.4.8.3 Smoke Resistant <1 Hour. An enclosure qualifies in this category if the walls are complete from slab to slab or to a continuous smoke-resistant ceiling and doors are complete, but some wall aspect (wall, ceiling, etc.) is less than 1-hour fire resistance-rated, or the door is not capable of resisting fire for at least 20 minutes.

5.4.8.4 One-Hour Fire Resistance-Rated or Greater (≥1-Hour Fire Resistance). An enclosure qualifies in this category if it meets all of the requirements of 5.4.8.3, all wall aspects have at least a 1-hour fire resistance rating, and the door is capable of resisting fire for at least 20 minutes.

5.4.9 Separation of Residential Housing Areas from Other Areas. A residential housing area includes sleeping areas and any contiguous day room, group activity space, or other common space.

5.4.9.1 The parameter value categories for separation of residential housing areas are based on the quality of the common walls, separating partitions, and doors between residential housing areas and the rest of the building. The parameter value is based on the residential housing area that has the lowest quality separation. Where a building contains more than one residential housing area, the separation of residential housing areas from each other also is to be considered equivalent to the separation of a residential housing area from some other type of space. In buildings entirely composed of a single residential housing area, the separation is considered to

be fire resistant if there is at least a 30-ft (9.1-m) separation from other structures and smoke resistant if there is a separation of less than 30 ft (9.1 m).

5.4.9.2 Classification of internal separations is based on the following:

(a) *Incomplete*. Any separation that does not meet the criteria for 5.4.9.2(b) or (c) is incomplete.

(b) *Smoke-Resistant Less Than 1 Hour*. An enclosure qualifies in this category if the walls are complete from slab to slab or to a continuous smoke-resistant ceiling and doors are complete, but some wall aspect (wall, ceiling, etc.) is less than 1-hour fire resistance rated or the door is not capable of resisting fire for at least 20 minutes.

(c) *One-Hour Fire Resistance or Greater (≥ 1 -Hour Fire Resistance)*. An enclosure qualifies in this category if it meets all of the requirements of 5.4.9.2(b), all wall aspects have at least a 1-hour fire resistance rating, and the door is capable of resisting fire for at least 20 minutes.

5.4.10 Exit System.

5.4.10.1 General. Exit routes are the paths of travel from the residential housing area to outside of any of the types and arrangements described in Chapter 7 (NFPA 101). The exit route starts at the corridor interface with the cell or common space as indicated by 5.4.8.

5.4.10.2 Multiple Routes. Multiple routes exist where the occupants of any residential housing area have, either from the residential housing area or through access in a corridor adjacent to the residential housing area, a choice of two separate exit routes in accordance with 22.2.4 or 23.2.4 (NFPA 101) to the outside of the types specified in 22.2.2 and 23.2.2 (NFPA 101).

5.4.10.3 Deficient. An exit route is deficient if it is usable with reasonable safety but fails to meet any of the applicable criteria in Chapter 7 (NFPA 101).

5.4.10.4 Direct Room Exits. To be credited with direct room exits, each cell or other sleeping room must have a door that opens to the exterior at grade or to an unenclosed exterior balcony with direct access to an exterior exit or smokeproof enclosure. The locking of such a door must be no more restrictive than that required for the least restrictive exit or smoke barrier door for the use condition involved. In large rooms, the maximum travel distance from any occupiable location to a direct room exit must not exceed 50 ft (15 m). Where the separation of the individual sleeping rooms from other spaces and from each other is smoke resistant, the credit for direct room exits is applicable even if there are no other exit routes from the involved sleeping rooms.

5.4.10.5 No exit shall be considered in this parameter unless the locking arrangement conforms with the criteria for the use condition being applied to the facility.

5.4.11 Exit Access.

5.4.11.1 Exit access is the travel distance from any point in a room to an exit (or to a smoke barrier in an existing building). In addition, any exit arrangement that does not conform with 22.2.6.1 (NFPA 101) for new buildings or with 23.2.6.1 (NFPA 101) for existing buildings shall receive a parameter value no higher than the score for egress travel [i.e., >150 ft (>45 m) and ≤ 200 ft (≤ 61 m)].

5.4.11.2 The penalty for dead-end access shall be assessed where any corridor affords access in only one direction to a required exit from that corridor. The calculation of the distance to determine the parameter value is the measurement from the centerline of the doorway exiting to the corridor to the doorway of the exit from the corridor or building, whichever is shorter. Exit travel is the distance from the door to the corridor to the point where the building is exited or a stairwell is entered, whichever is shorter. Where the distance to the stairwell is the shorter distance, that distance shall be based on the distance to the door enclosing the stairwell if the stairwell is enclosed, or to the top tread if the stairwell is open.

5.4.12 Vertical Openings.

5.4.12.1 General. These values apply to vertical openings and penetrations including exit stairways, ramps, and any other vertical exits, pipe shafts, ventilation shafts, duct penetrations, and laundry and incinerator chutes. The charge for vertical openings shall be based on the presence or lack of enclosure and the fire resistance rating of the enclosure, if provided.

5.4.12.2 Open or Incomplete. A vertical opening or penetration shall be classified as an *open or incomplete* enclosure, provided it has any of the following characteristics:

- (1) It is unenclosed.
- (2) It is enclosed but does not have doors.
- (3) It is enclosed but has openings other than doorways.
- (4) It is enclosed with cloth, paper, or similar materials without any sustained firestopping capabilities.

5.4.12.2.1 If a shaft other than a credited exit route (i.e., credited as one of the multiple routes required in 5.4.10 or in determining travel distance in 5.4.11) is enclosed on all floors but one and this results in an unprotected opening between that shaft and one, and only one, floor, the parameter value assigned to that shaft shall be 0. If a required egress route is contained in that shaft, the parameter value shall be -2.

5.4.12.2.2 If vertical firestopping is incomplete, the vertical opening shall be evaluated using the criteria of 5.4.12.2 and 5.4.12.2.1.

5.4.12.3 Communicating Floors. Communicating floor levels shall be permitted without enclosure protection between levels, provided they meet the requirements of 22.3.1 or 23.3.1 (NFPA 101), as appropriate.

5.4.12.4 Open Tiered Cells. The *open or incomplete enclosures* category does not apply to open, multitiered cell blocks in existing buildings classified as single-story buildings in accordance with 5.4.1.

5.4.12.5 Smoke Resistant. A complete enclosure is provided and is capable of resisting the passage of smoke but does not meet the fire resistance requirements of 8.2.5.4 (NFPA 101). Unprotected vertical openings in accordance with 22.3.1.1 Exception No. 2 and 23.3.1.1 Exception No. 2 (NFPA 101) shall be considered to be smoke resistant.

5.4.12.6 Fire Resistant. A smoke-resistant enclosure that also meets the fire resistance requirements of 8.2.5.4 (NFPA 101). Atriums in accordance with 8.2.5.6 (NFPA 101) shall be considered to be fire resistant.

5.4.13 Smoke Control. Smoke control definitions are provided in 5.4.13.1 through 5.4.13.4.

5.4.13.1 No Control. Smoke barriers (or horizontal exits) are nonexistent on the floor or are not accessible to those confined.

5.4.13.2 Smoke Compartment — Passive. Credit for smoke barriers is given to any facility meeting the requirements of 22.3.7 or 23.3.7 (NFPA 101), as appropriate.

5.4.13.3 Smoke Compartment — Mechanically Assisted. Mechanically assisted smoke control on a compartment basis must include a smoke barrier (or a horizontal exit) supported by a mechanism of automatic control fans, smoke vent shafts, or a combination thereof to provide a pressure differential that assists in confining smoke to the compartment of origin. Fans involved shall be permitted to be special smoke control fans or special adjustments of the normal building air movement fans.

5.4.13.4 Heat and Smoke Vent System. A heat and smoke vent system is a tested and accepted system that handles smoke in order to maintain the level of smoke above head height in the residential housing area. Methods of judging the acceptability of the system are contained in NFPA 92A, *Recommended Practice for Smoke-Control Systems*; NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*; and NFPA 101, *Life Safety Code*, A.23.3.1.3. Additional credit for this system shall be given if the operation of the exhaust system is initiated automatically by smoke detection available in the zone.

5.5 Worksheets for Evaluating Fire Safety.

Step 1: In Figure 5.5, complete Worksheet 5.5.1.

Step 2: Using Worksheet 5.5.2, determine the most restrictive use condition in the facility.

Step 3: Determine safety parameter values, using Worksheet 5.5.3. Select and circle the safety value for each safety parameter that best describes the conditions in the zone. Choose only one value for each of the 13 safety parameters. If two or more values appear to apply, choose the one with the lowest point value.

Step 4: Compute individual safety evaluations, using Worksheet 5.5.4.

A. Transfer each of the 13 circled safety parameter values from Worksheet 5.5.3 to every unshaded block in the line with the corresponding parameter title in Worksheet 5.5.4. Where the block is marked “÷ 2 =,” enter one-half the value from Worksheet 5.5.3.

B. Add the four columns, keeping in mind that any negative numbers need to be deducted.

C. Transfer the resulting values for S_1 , S_2 , S_3 , and S_4 to the corresponding blocks in Worksheet 5.5.6.

Step 5: Determine mandatory safety requirements, using Worksheet 5.5.5A, 5.5.5B, or 5.5.5C, as appropriate.

A. Select the proper row in Worksheet 5.5.5A, Worksheet 5.5.5B, or Worksheet 5.5.5C. For high-rise buildings, use Worksheet 5.5.5B. Circle the appropriate values.

B. Transfer the circled values from Worksheet 5.5.5A, Worksheet 5.5.5B, or Worksheet 5.5.5B to the blocks marked S_w , S_p , S_e , and S_d in Worksheet 5.5.6.

Step 6: Compute the fire safety equivalency evaluation.

A. Perform the subtractions indicated in Worksheet 5.5.6. Enter the differences in the appropriate answer blocks.

B. For each row, check “yes” if the value in the answer block is zero (0) or greater. Check “no” if the value in the answer block is a negative number.

Step 7: Evaluate considerations not previously addressed, using Worksheet 5.5.7. The equivalency covered by Worksheets 5.5.3 through 5.5.6 includes the majority of the considerations covered by the *Life Safety Code*. There are some considerations that are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 5.5.7, the Facility Fire Safety Requirements Worksheet. Complete one copy of this separate worksheet for each facility.

Step 8: Using Worksheet 5.5.8, conclude whether the level of life safety is at least equivalent to that prescribed by the *Life Safety Code*. Worksheet 5.5.8, Conclusions, combines the zone fire safety equivalency evaluation of Worksheet 5.5.6 and the additional considerations of Worksheet 5.5.7.

FIGURE 5.5 Worksheets for evaluating fire safety in detention and correctional occupancies.**WORKSHEET 5.5.1 COVER SHEET**

Fire Safety Evaluation Worksheet: Detention and Correctional Occupancies

Building Identification _____

Evaluator _____ Date _____

Complete one worksheet for each building evaluated.

WORKSHEET 5.5.2 USE CONDITION

_____ Use Condition II — Zoned Egress _____ Use Condition IV — Impeded Egress

_____ Use Condition III — Zoned Impeded Egress _____ Use Condition V — Contained

NOTE: If Use Condition III or Use Condition IV is involved, staff location, remote release locks, or fire detection, or any combination of these, must be sufficient to ensure the prompt release required by the use condition checked.

WORKSHEET 5.5.3 SAFETY PARAMETER VALUES

Safety Parameters	Parameter Values							
1. Construction	V (000)	V (111)	IV (2HH)	III (200)	III(211)	II (000)	II (111)	II (222) or I (ANY)
1st flr.	−2	0	0	−2	0	0	2	2
2nd flr.	−2	0	0	−2	0	−2	2	2
3rd flr.	−8(−2) ^a	−2(0) ^a	−2(0) ^a	−8(−2) ^a	0	−5(−2) ^a	2	2
≥4th flr.	−10(−2) ^a	−4(0) ^a	−4(0) ^a	−10(−2) ^a	−2(0) ^a	−8(−2) ^a	0	2
2. Hazardous Areas	Within Res. Housing Area				Outside Res. Housing			None or No Deficiencies
	Double Deficiency		Single Deficiency		Double Deficiency		Single Deficiency	
	−7		−4		−4(−7) ^b		0	
3. Fire Alarm	No Alarm		W/O F.D. Notification			W/ F.D. Notification		
						W/O Man. Alarm		W/ Man. Alarm
	−1		0			1		2
4. Smoke Detection	None	Residential Housing Area						Total Bldg.
		Partial Coverage					Full Coverage	
		Corr. + Comm. Spa. + Lrg. Sleeping Rms.			All Sleeping Rms.			
	−4(−1) ^a	0			2		4	5
5. Automatic Sprinklers	None			Residential Housing Areas		Entire Building		
	0			8		10		
6. Interior Finish (Corrs. and Egress)	Class C			Class B		Class A		
	−3			−1		0		
7. Interior Finish (Other Areas)	Class C			Class B		Class A		
	−2			−1		0		
8. Cell/Sleeping Room Enclosure	Cells (Rooms) Face on Corridor (Each Cell is a Separate Residential Housing Area)				Intervening Common Space Within Resid. Housing Area			
					Open	Smoke Resistant <1 Hour	≥1-Hour Fire Resistance-Rated	
	0				−3(−5) ^c (0) ^d	0(−2) ^c		2(0) ^c

Worksheet 5.5.3 continues.

FIGURE 5.5 Continued

Worksheet 5.5.3 Continued					
9. Separation of Resid. Housing Areas from Other Areas	Incomplete		Smoke Resistant <1 Hour	≥1-Hour Fire Resistance-Rated	
	Parameter 5 Value <10	Parameter 5 Value = 10			
	-6	2	2(4) ^h	4(2) ^b	
10. Exit System	<2 Routes		Multiple Routes		
	-6		Deficient	No Deficiencies	Direct Room Exits
			-2	0	3
11. Exit Access	Dead Ends		No Dead Ends >50 ft and Travel Is ⁱ		
	>100	>50 ft ⁱ	>200	≤200 ft	>150 ft
	-2(0) ^g	-1(0) ^g	-2(0) ^g	-1(0) ^g	
12. Vertical Openings	Open or Incomplete Enclosures			Enclosed ^(e)	
	Thru ≥4 Floors	2-3 Floors	1 Floor	Smoke Resistant	Fire Resistant
	-10(0) ^f	-7(0) ^f	-2(0) ^f	0	2
13. Smoke Control	No Control	Smoke Compartments		Heat + Smoke Vent System	
		Passive	Mechanically Assisted		
	-2	2	3		8

^a Use () if Parameter 5 is 10.

^b Use () if Parameter 1 is based on II(000), III(200), or V(000) construction and Parameter 5 is 0.

^c Use () for Use Condition V, new construction, where Parameter 5 is 0.

^d Use ():

- For Use Condition II.

^e Use 0 in 1-story buildings.

^f Use () if Parameter 13 is 8.

^g Use () if Parameter 10 is -6.

^h Use () for Use Conditions II, III, and IV, new construction, if cells are facing access corridor.

ⁱ Use 20 ft (6.1 m) for Use Condition V.

For SI units: 1 ft = 0.3048 m

WORKSHEET 5.5.4 INDIVIDUAL SAFETY EVALUATIONS				
Safety Parameters	Fire Control Provided (S ₁)	Egress Provided (S ₂)	Refuge Provided (S ₃)	General Fire Safety Provided (S ₄)
1. Construction				
2. Hazardous Areas		÷ 2 =		
3. Fire Alarm	÷ 2 =			
4. Smoke Detection	÷ 2 =			
5. Automatic Sprinklers		÷ 2 =	÷ 2 =	
6. Interior Finish (Corrs. and Egress)				
7. Interior Finish (Other Areas)	÷ 2 =			
8. Cell/Sleeping Room Enclosure				
9. Separation of Residential Housing Areas from Other Areas		÷ 2 =		
10. Exit System			÷ 2 =	
11. Exit Access				
12. Vertical Openings	÷ 2 =			
13. Smoke Control				
Total	S₁ =	S₂ =	S₃ =	S₄ =

(For use with NFPA 101A-2001/NFPA 101-2000) (Page 2 of 4)

FIGURE 5.5 Continued

**WORKSHEET 5.5.5A MANDATORY SAFETY REQUIREMENTS PARTIALLY
SPRINKLERED OR NONSPRINKLERED EXISTING BUILDINGS OTHER THAN HIGH RISE**

Use Condition	Height	Fire Control (S_a)	Egress (S_b)	Refuge (S_c)	General (S_d)
II + III	1 Story	0	4	2	1
	2 Stories	3	6	6	5
	≥3 Stories	5	6	8	7
IV	1 Story	2	8	2	5
	2 Stories	5	10	6	9
	≥3 Stories	7	10	8	11
V	1 Story	6	9	6	9
	2 Stories	9	11	10	13
	≥3 Stories	9	11	10	13

**WORKSHEET TABLE 5.5.5B MANDATORY SAFETY REQUIREMENTS
NEW BUILDINGS, TOTALLY SPRINKLERED BUILDINGS, and HIGH-RISE BUILDINGS**

Use Condition	Height	Fire Control (S_a)		Egress (S_b)		Refuge (S_c)		General (S_d)	
		New	Exist.	New	Exist.	New	Exist.	New	Exist.
II, III, IV	1 and 2 Stories	2	2	4	2	-1	-1	2	0
	≥3 Stories	7	2	6	2	5	-1	8	0
V	1 and 2 Stories	10	10	7	6	7	7	9	8
	≥3 Stories	15	10	9	6	13	7	15	8

**WORKSHEET 5.5.5C MANDATORY SAFETY REQUIREMENTS — MODERNIZATIONS
OR RENOVATIONS IN NONSPRINKLERED EXISTING BUILDINGS OTHER THAN HIGH RISE**

Use Condition	Height	Fire Control (S_a)	Egress (S_b)	Refuge (S_c)	General (S_d)
II + III	1 Story	4	6	6	6
	2 Stories	5	8	8	8
	≥3 Stories	7	8	10	10
IV	1 Story	6	10	6	10
	2 Stories	7	12	8	12
	≥3 Stories	9	12	10	14
V	1 Story	8	10	8	12
	2 Stories	9	12	10	14
	≥3 Stories	9	12	10	14

(For use with NFPA 101A-2001/NFPA 101-2000)

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FIGURE 5.5 Continued

WORKSHEET 5.5.6 FIRE SAFETY EQUIVALENCY EVALUATION						Yes	No
Control Provided (S_2)	minus	Required Control (S_a)	$\geq$	0	$\frac{S_1}{\boxed{}} - \frac{S_a}{\boxed{}} = \frac{C}{\boxed{}}$		
Egress Provided (S_2)	minus	Required Egress (S_b)	$\geq$	0	$\frac{S_2}{\boxed{}} - \frac{S_b}{\boxed{}} = \frac{E}{\boxed{}}$		
Refuge Provided (S_3)	minus	Required Refuge (S_c)	$\geq$	0	$\frac{S_3}{\boxed{}} - \frac{S_c}{\boxed{}} = \frac{R}{\boxed{}}$		
General Fire Safety (S_4)	minus	Required Gen. Fire Safety (S_d)	$\geq$	0	$\frac{S_4}{\boxed{}} - \frac{S_d}{\boxed{}} = \frac{G}{\boxed{}}$		

WORKSHEET 5.5.7 FACILITY FIRE SAFETY REQUIREMENTS WORKSHEET		Yes	No
1.	Utilities and building services conform to the requirements of Section 22.5 and Section 23.5, except for enclosure of vertical openings, which have been considered in Safety Parameter 12 of Worksheet 5.5.3.		
2.	24-hour staffing is provided as required by 22.7.1 and 23.7.1.		
3.	Furnishing, upholstered furniture, mattresses, and decorations combustibility is limited in accordance with Sections 22.7 and 23.7.		
4.	Portable fire extinguishers are provided at least at staff locations.		
5.	Standpipes are provided in all buildings over 2 stories in height as required by 22.3.5.5, 22.4.3, or 23.3.5.5.		
6.	If Use Condition III or Use Condition IV is involved, is the combination of staff location, remote release locks, and fire detection sufficient to ensure the prompt release required by those use conditions?		

All references are to NFPA 101, *Life Safety Code*.

WORKSHEET 5.5.8 CONCLUSIONS	
1.	☐ All of the checks in Worksheet 5.5.6 are in the "Yes" column. The level of fire safety is at least equivalent to that prescribed by NFPA 101, <i>Life Safety Code</i> .*
2.	☐ One or more of the checks in Worksheet 5.5.6 is in the "No" column. The level of fire safety is not shown by this system to be equivalent to that prescribed by NFPA 101, <i>Life Safety Code</i> .*
* The equivalency covered by this worksheet includes the majority of considerations covered by NFPA 101, <i>Life Safety Code</i> . There are some considerations that are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 5.5.7.	

(For use with NFPA 101A-2001/NFPA 101-2000)

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Chapter 6 Evacuation Capability Determination for Board and Care Occupancies

6.1 General.

6.1.1 This chapter is part of an NFPA guide and therefore is not mandatory. The term *shall* in this chapter is used to indicate that if the provisions of the chapter are applied, the procedures mandated are to be followed to ensure the effectiveness of the system. For ease of reading, only the masculine pronoun is used; however, the contents of this chapter apply equally to females and males.

6.1.2 Chapters 32 and 33 (NFPA 101) specify three sets of requirements for a facility based on its evacuation capability. The three levels of evacuation capability defined are *prompt*, *slow*, and *impractical*.

6.1.3 The evacuation capability shall be determined for the residents of a given facility who are living as a group and are provided with staff assistance prior to application of the fire protection requirements. This chapter describes one method for determining evacuation capability.

6.1.4 The evacuation capability for specific facilities, with residents living as a group with staff assistance, is determined by a mathematical method that includes the following:

- (1) Determining the evacuation assistance scores of the individual residents
- (2) Computing a relative level of evacuation difficulty faced by the resident of a specific facility based on the response capabilities of the staff
- (3) Adjusting for vertical egress travel
- (4) Calculating an evacuation capability score

6.1.5 Chapters 32 and 33 (NFPA 101) define the three evacuation capability levels in terms of residents' performance in a timely response to an emergency evacuation with assistance from staff members or other residents. Utilization of this chapter provides a numerical score that can be translated into one of the three levels of evacuation capability.

6.1.6 The evacuation capability shall be permitted to be used with either Chapter 7 of this guide or Chapters 32 and 33 (NFPA 101).

6.2 Procedure for Determining Evacuation Capability.

6.2.1 Methodology. Evacuation capability shall be determined via the worksheets included in Figure 6.8.

6.2.2 Evacuation Capability by Zones.

6.2.2.1 Small facilities (those with no more than 16 residents) shall have their evacuation capability scores based on all the residents and the available staff measured in accordance with the criteria for evaluating residents and staff in this chapter.

6.2.2.2 Large facilities (those with more than 16 residents) shall be permitted to have the evacuation capability score calculated on the basis of the entire building, as with small facilities, or on the basis of separate fire or smoke zones. The procedure providing the superior (i.e., lower) evacuation capability score shall be permitted to be used. A fire or smoke zone is a portion of the building separated from all other portions of the building by construction having at least 1-hour fire resistance or by a smoke barrier conforming to the requirements of Section 8.3 (NFPA 101), with the smoke barriers constructed with at least a half-hour fire resistance rating.

Exception: In buildings protected throughout with an automatic sprinkler system, zoning of the facility shall be permitted to be by construction that is sound and smoke resistant.

6.2.3 If a building is zoned, each zone shall be evaluated separately. The evacuation capability score is based on the residents of that zone and the staff available to that zone in accordance with the staff rating criteria in this chapter.

6.2.4 Where using zones, a separate evacuation capability score shall be determined for zones that include common use spaces where the residents of more than one zone congregate for meals, recreation, or other purposes. In such cases, adjust the resident evacuation assistance scores as appropriate to reflect the different needs that residents might have under such conditions.

6.3 Rating Residents.

6.3.1 Worksheets 6.8.1 through 6.8.4 of Figure 6.8 are used for rating the individual resident and also for recordkeeping purposes.

6.3.2 This method of determining evacuation capability has been designed to minimize speculation about how a resident might perform in an actual fire emergency by using ratings based on observed performance. Instead of speculating, raters who are not familiar enough with a resident to provide ratings confidently should consult with an individual who has observed the resident on a daily basis.

6.3.3 Due to the stress of an actual fire emergency, some residents are not likely to perform at full capacity. Therefore, ratings based on commonly observed examples of poor performance provide the best readily available indication of behavior that could be reduced by the unusually stressful conditions of an actual fire. All persons are less capable on some occasions, and the ratings should be based on examples of resident performance on a typical "bad" day. Ratings should not be based on rare instances of poor performance.

6.4 Rating Residents Using Worksheets 6.8.1 through 6.8.4.

6.4.1 Risk of Resistance (Line I of Worksheet 6.8.2).

6.4.1.1 Line I rates the risk that the resident might resist leaving the facility during an emergency evacuation. Unless there is specific evidence that resistance might occur, the resident should be rated as "minimal risk." If more than one rating applies, use the rating with the highest numerical score.

6.4.1.2 Specific evidence of resistance means that staff have had to use some physical force in the past. However, an episode of resistance should not be counted if it was the result of a situation that was different enough from an actual fire emergency that it probably does not predict behavior in such an emergency. For example, an incident in which a resident refuses to visit with parents probably does not predict behavior in an actual fire emergency and should not be counted as specific evidence. Resistance can be active (the resident might have struck a staff member or attempted to run away) or passive (the resident might have "gone limp" or hidden from staff members). Mere complaining or arguing is not considered resistance.

6.4.1.3 Minimal Risk. This rating indicates that there is no specific evidence to suggest that the resident might resist an evacuation.

6.4.1.4 Risk of Mild Resistance. This rating indicates that there is specific evidence that the resident might resist leaving the facility. Examples of specific evidence are as follows.

(a) The resident has mildly resisted instructions from staff. Further, the resistance was brief or easily overcome by one staff member and occurred in a situation similar enough to a fire emergency to predict that the behavior could recur during an actual fire emergency.

(b) The resident has hidden from the staff in a situation similar enough to a fire emergency to predict that the behavior could recur during an actual fire emergency. However, once found, the resident offered no further resistance.

6.4.1.5 Risk of Strong Resistance. The resident might offer resistance that necessitates the full attention of one or more staff members. Examples of such specific evidence include the following:

- (1) The resident has struggled vigorously in a situation similar enough to a fire emergency to predict that the behavior could recur during an actual fire emergency.
- (2) The resident has totally refused to cooperate in a situation that is similar enough to a fire emergency to predict that the behavior could recur during an actual fire emergency.
- (3) The resident has hidden in a situation that is similar enough to a fire emergency to predict that the behavior could recur during an actual fire emergency. Moreover, once found, the resident continued to offer resistance.

6.4.2 Impaired Mobility (Line II of Worksheet 6.8.2).

6.4.2.1 Line II rates the physical ability of the resident to leave the facility. This rating should reflect the current physical environment in the building where the resident lives and should be based on the resident's lying awake on his bed. The resident is rated according to how easily he can leave, given the presence of factors such as physical barriers that hinder movement (e.g., stairs), the resident's ability to get out of bed, or the chairs normally used. The resident should be given credit for being able to use devices that aid movement (e.g., wheelchairs, walkers, crutches, and leg braces). However, the rater shall be permitted to give credit for such devices only if the devices are always available for an emergency evacuation.

6.4.2.1.1 The resident should be rated on his ability to use the most accessible route out of the facility. For example, a resident who is "self-starting" when using the back door but who "needs limited assistance" to get out the front door would be rated as "self-starting."

6.4.2.1.2 The resident should be rated for performance while under the influence of any routine medication that slows movement.

6.4.2.1.3 Where the resident needs physical assistance to make a timely evacuation, the rating of assistance needed is based on the degree of strength used by the staff member to assist the resident. Guiding or directing the resident by giving gentle pushes or leading by the hand is not considered physical assistance. If more than one rating applies, use the rating with the highest numerical score.

6.4.2.1.4 Self-Starting. The resident is physically able to start and complete an evacuation without physical assistance.

6.4.2.1.5 Slow. The resident prepares to leave and travels to the exit (or an area of refuge) at a speed significantly slower

than normal. Specifically, the resident is rated "slow" if not able to prepare to leave and then travel from his sleeping room to the exit (or area of refuge) within 90 seconds.

6.4.2.1.6 Needs Limited Assistance. The resident might need some initial or brief intermittent assistance but can accomplish most of the evacuation without assistance. An example of specific evidence is that the resident is physically able to start and complete an evacuation, except under the following conditions:

- (1) The resident needs help to get into a wheelchair.
- (2) The resident needs help to descend stairs.
- (3) The resident needs help to get out of bed.
- (4) The resident needs help to open a door.

6.4.2.1.7 Needs Full Assistance or Very Slow. The resident needs "full assistance" or is "very slow" as defined in 6.4.2.1.7.1 and 6.4.2.1.7.2.

6.4.2.1.7.1 Needs Full Assistance. The resident either needs physical assistance from a staff member during most of the evacuation or must be assisted by staff in one of the following ways:

- (1) Carried from the facility
- (2) Helped into a wheelchair and wheeled out of the facility
- (3) Helped into leg braces and to descend the stairs

6.4.2.1.7.2 Very Slow. The resident is very slow if the time necessary to prepare to leave and then travel from his sleeping room to the exit is so long that the staff usually assists the resident to evacuate. Specifically, the resident is rated very slow if unable to prepare to leave and then travel to the exit (or area of refuge) within 150 seconds.

6.4.3 Impaired Consciousness (Line III of Worksheet 6.8.2).

6.4.3.1 Line III rates the risk that a resident could experience a partial or total loss of consciousness in a fire emergency. Unless there is specific evidence that loss of consciousness might occur during a fire emergency, the resident should be rated as "no significant risk."

6.4.3.2 Specific evidence is an indication that the resident has experienced some temporary impairment of consciousness of short duration (seconds or minutes) six or more times during the three months preceding the rating of the resident. Regardless of frequency, if there is specific evidence that loss of consciousness might be caused by the stress of a fire emergency, the resident should be rated as having impaired consciousness. An episode of partial loss of consciousness should be counted only if the impairment was severe enough to significantly interfere with the resident's ability to leave the facility. Do not count episodes where the loss of consciousness was the result of a temporary medical problem (e.g., a severe infection). If more than one rating applies, use the rating with the highest numerical score.

6.4.3.3 No Significant Risk. The resident is not subject to loss of consciousness, or the resident has had fewer than six episodes of losing consciousness (partial and total) during the three months preceding the rating.

6.4.3.4 Partially Impaired. The resident has had at least six episodes of losing consciousness in the preceding three months, and the most severe of these episodes was only a partial loss of consciousness; that is, the resident still is able to participate in an evacuation to some degree. Specific evidence that a resident should be rated in this category includes loss of consciousness resulting from mild (partial or petit mal) seizures, dizzy spells,

intoxication, or any other partially incapacitating impairment of consciousness.

6.4.3.5 Totally Impaired. The resident has had at least six episodes of losing consciousness in the preceding three months, and the most severe of these episodes was total or severely incapacitating loss of consciousness; that is, the resident needs the full assistance of at least one staff member to get out of the building. Specific evidence that a resident should be rated in this category includes losses of consciousness resulting from severe (generalized or grand mal) seizures, fainting spells, intoxication, or other total or severely incapacitating loss of consciousness.

6.4.4 Need for Extra Help (Line IV of Worksheet 6.8.2).

6.4.4.1 Line IV rates the possibility that more than one staff member might be needed to evacuate the resident. Specific evidence is a previous need for two or more persons to assist the resident and an indication that the resident could need assistance from two persons in a fire emergency.

6.4.4.2 Where determining the need for additional assistance, the evaluator should disregard the physical strength or weakness of staff members. (For example, a large staff member who is exceptionally strong might be able to assist a resident alone, while a smaller staff member might be unable to assist the resident fully. However, there is no assurance that a staff member who is able to assist alone always will be able to respond to a resident requiring extra assistance.)

6.4.4.3 Needs at Most One Staff Member. There is no specific evidence that the resident might need help from two or more persons in a fire emergency.

6.4.4.4 Needs Limited Assistance from Two Staff Members. The resident might need some initial or brief intermittent assistance from two staff members, but otherwise needs help from no more than one. Specific evidence is that a resident needs assistance from no more than one person except in the following cases:

- (1) The resident needs assistance from two persons to get into a wheelchair.
- (2) The resident needs assistance from two persons to descend stairs.

6.4.4.5 Needs Full Assistance from Two Staff Members. The resident might need assistance from two staff members during most of an evacuation. Specific evidence of the need for assistance from two staff members follows:

- (1) Two persons are needed to carry the resident from the facility.
- (2) Two persons are needed to get the resident into a wheelchair and to get the wheelchair down a flight of stairs.
- (3) The resident might resist an evacuation vigorously, and two persons are needed to get the resident out of the facility.

6.4.5 Response to Instructions (Line V of Worksheet 6.8.2).

6.4.5.1 Line V rates the resident's ability to receive, comprehend, and follow through with simple instructions during a staff-directed evacuation. Residents often do not respond equally well to all staff members; therefore, a resident should be rated on his responses to staff members whose directions

he is least likely to follow. If more than one rating applies, use the rating with the highest numerical score.

6.4.5.2 Follows Instructions. The resident usually can be depended on to receive, comprehend, remember, and follow simple instructions.

6.4.5.3 Requires Supervision. The resident generally is capable of following instruction but is not dependable. Therefore, the resident might need to be guided, reminded, reassured, or otherwise accompanied during evacuation but does not require the exclusive attention of a staff member (e.g., a staff member can lead two or more residents who fit this classification simultaneously).

6.4.5.3.1 This category includes elderly persons who sometimes show early signs of senile dementia or Alzheimer's disease (e.g., confusion, disorientation, frequent "misplacement" of possessions) and young children who cannot be depended on to follow through with instructions.

6.4.5.3.2 Residents in this category generally are capable of following instructions except in one of the following situations:

- (1) The resident is deaf or hearing impaired and sometimes misinterprets communications from staff using sign language.
- (2) The resident sometimes forgets instructions after a brief period of time.
- (3) The resident is sometimes distracted or confused and fails to follow through with instructions.
- (4) The resident is sometimes groggy and might fail to listen carefully or follow through with instructions.
- (5) The resident is sometimes uncooperative without apparent good reason.
- (6) The resident is elderly and sometimes becomes "lost" in a familiar place.
- (7) The resident is a young child who might become frightened and not follow through with instructions.

6.4.5.4 Requires Considerable Attention or Might Not Respond.

6.4.5.4.1 The resident might fail to receive, understand, or follow through with instructions; that is, the resident might not respond to instructions or general guidance. Therefore, the resident might require most of the attention of a staff member during an evacuation.

6.4.5.4.2 This category includes elderly persons who have the symptoms of senile dementia or Alzheimer's disease (e.g., severe confusion, disorientation, very limited short-term memory).

6.4.5.4.3 Residents in this category might display one or more of the following characteristics:

- (1) The resident sometimes does not understand simple instructions.
- (2) The resident might not respond to instructions from a particular staff member.
- (3) The resident is sometimes emotionally upset and is therefore unwilling to follow instructions.
- (4) The resident is deaf or hearing impaired and the staff cannot communicate reliably with the resident.
- (5) The resident is very forgetful, easily confused, or easily distracted.

6.4.6 Waking Response to Alarm (Line VI of Worksheet 6.8.2).

6.4.6.1 Line VI rates the risk that the fire alarm might fail to awaken the resident.

6.4.6.2 Residents should be rated as “response probable” unless any of the following conditions exists:

- (1) The building does not have an alarm system meeting the requirements of Chapter 32 or 33 (NFPA 101), as appropriate, or the alarm is not sufficiently loud where the resident sleeps (doors should be closed and barriers kept in place where determining the audibility of the fire alarm).
- (2) Medication taken by the resident before retiring differs in type or amount (i.e., medication is increased) from the medication taken during waking hours.
- (3) The resident has a readily apparent hearing impairment, or the resident’s hearing aid is removed before sleeping.
- (4) There is specific evidence that the resident is an exceptionally sound sleeper. Specific evidence is that the resident previously failed to be awakened by a particularly loud noise, and staff members have had to shake the resident vigorously to awaken him.

6.4.6.3 Where any of the conditions in 6.4.6.2 exist, the resident should be rated as “response not probable” unless the resident’s ability to wake up has been demonstrated. The demonstration of the resident’s ability to wake up in response to the fire alarm should be conducted after the first half hour of sleep and during the first three hours of sleep. In addition, the resident’s ability to wake up in response to the alarm should be demonstrated on two different nights under normal conditions (e.g., without hearing aid, under usual medications). Also, the resident should be alert enough to follow simple instructions within 1 minute after waking. To avoid waking other residents during demonstrations of the capability of a particular resident, a device that makes a sound that is similar to, but not louder than, the fire alarm shall be permitted to be used (e.g., an alarm clock or clock radio with a sound similar to the fire alarm).

6.4.6.4 Response Probable. Either none of the conditions in 6.4.6.2 affect the resident, or, if any of the conditions exist, the resident’s ability to be awakened has been demonstrated.

6.4.6.5 Response Not Probable. One or more of the conditions in 6.4.6.2 affect the resident, and either the resident has not been tested for the ability to be awakened by the fire alarm or the resident has failed to demonstrate the ability to be awakened by the fire alarm.

6.4.7 Response to Fire Drills (Line VII of Worksheet 6.8.2).

6.4.7.1 Line VII rates the resident’s ability to leave the facility during fire drills, as demonstrated by the resident’s performance, without guidance or advice from the staff. A resident must demonstrate three separate responses reliably and without instructions or supervision in order to be rated “yes” in each case. The resident is rated “yes” only where the resident has been specifically trained or instructed in the desired reaction and has demonstrated the desired response in at least three of the last four fire drills in which a response was demonstrated. If the resident has not been involved in four fire drills, the rating shall be permitted to be “yes” only if the resident has demonstrated the desired response during

the last two opportunities to demonstrate the response. Ratings are based on demonstrated performance, and any resident who has not been trained to participate in fire drills must be rated “no.”

6.4.7.2 This rating covers the ability of the resident to make decisions but does not relate to mobility, which is covered separately. For example, a resident might need assistance only in transferring from a bed to a wheelchair but otherwise can initiate and complete an evacuation promptly. Such a resident would be rated “yes” for “Initiates and Completes Evacuation Promptly” but would be rated “Needs Limited Assistance,” “Impaired Mobility” in Line II.

6.4.7.3 Residents should be rated assuming that an emergency could occur when they are least likely to respond well. For most residents, this is their response after being awakened. Determining the rating should not include difficulties in actually awakening the resident, since there are large differences in how easily the same individual awakens at various times.

6.4.7.4 Initiates and Completes Evacuation Promptly. The resident has demonstrated a proper response to an alarm or warning of a fire by starting and completing the evacuation without unnecessary delay. Specific evidence leading to a rating of “no” includes the following responses:

- (1) The resident might not react to the alarm until alerted by a staff member.
- (2) The resident spends an excessive amount of time preparing to leave (e.g., getting dressed, observing others).
- (3) The resident has a hearing impairment and therefore needs to be alerted by a staff member.
- (4) The resident is sometimes upset or confused and therefore might seek out a staff member before evacuating.
- (5) The resident consistently begins an evacuation but is easily distracted and needs some supervision.

6.4.7.5 Chooses and Completes Backup Strategy. The resident has demonstrated the ability to select an alternative means of escape or has taken other appropriate action if the primary escape route is blocked. Specific evidence leading to a rating of “no” is where the resident is unlikely to select a good course of action if the primary escape route cannot be used; that is, the resident has not been trained to find alternative escape routes, find an area of refuge, or perform other appropriate action(s). Where the resident lacks the conceptual ability to understand fire hazards and blocked escape routes, and therefore requires supervision, the rating should be “no.”

6.4.7.6 Remains at Designated Location. The resident must have demonstrated willingness to remain at a designated safe location during fire drills. (The whereabouts of already evacuated residents needs to be confirmed to avoid dangerous return trips to look for residents who might have returned to buildings.)

6.4.7.6.1 Specific evidence leading to a “yes” for this rating includes the following:

- (1) The resident has been specifically trained to remain at a designated location in a safe area and has demonstrated this ability without the presence of staff members in three of the previous four fire drills.
- (2) The resident is physically immobile and therefore cannot leave the designated location.

- (3) The facility uses a motor vehicle (e.g., a van or bus) or a building that is detached and remote from the facility (i.e., another building or a remote garage) as the designated location, and the resident has demonstrated in three of the previous four fire drills the ability to remain there without the presence of a staff member.
- (4) The resident might tend to wander, but a reliable resident has been assigned to keep the wandering resident at the designated location without using any force or coercion. Furthermore, this arrangement has been demonstrated as effective in at least three of the previous four fire drills.

6.4.7.6.2 Specific evidence leading to a “no” for this rating includes the following:

- (1) The resident has not been trained to remain at a designated location without any staff supervision.
- (2) The resident has been trained to remain without staff supervision at a designated location but has failed to demonstrate this capability in three of the previous four fire drills.

6.5 Rating the Staff Shift (Worksheets 6.8.5 through 6.8.11).

6.5.1 This rating is intended to predict the promptness of response of a staff member who is present in the facility, at a given time (shift), and who is capable of assisting residents in an evacuation.

6.5.2 Before rating the staff shift, there are five basic requirements relative to the staff response capability, protection plans, and fire drills that shall be met. The determination of whether or not these requirements are met is recorded on Worksheet 6.8.8, Staff Shift Score. If the corresponding requirements of 6.5.2.1 through 6.5.2.5 have been met, a “yes” rating should be given.

6.5.2.1 A protection plan shall have been promulgated, and all staff members considered in this rating shall have been trained in its implementation. Regardless of the staff’s everyday competencies, they cannot be relied upon to innovate effective life safety actions under the extreme stress and time limitation of an actual fire emergency. Notwithstanding the facility’s fire protection features, the staff must have a valid and practiced plan of action that can be put into effect immediately in an emergency. The protection plan should include the following features:

- (1) A description of all available evacuation, escape, and rescue routes and the procedures and techniques needed to evacuate all the residents using the various routes
- (2) A fundamental knowledge of fire growth, containment, and extinguishment necessary to make reasonable judgments about action priorities and viable egress routes

6.5.2.2 The total available staff at any given time shall be able to handle the individual evacuation needs of each resident who might be in the facility. In calculating evacuation capability, it might be possible to have a ratio of staff to residents that appears to be favorable but that still is unacceptable under this system. This would be the case when a resident needs assistance from two staff members but only one staff member is present. Thus, the situation should be such that every resident can be evacuated by the available staff.

Exception: The facility meets the criteria for an evacuation capability level of “impractical,” the resident whose evacuation needs cannot be handled is in a sleeping room or other room that provides adequate ref-

uge from fire outside the room, and there is at least one staff member present who can close the door to the room. For example, a very heavy resident is in a facility, meeting the criteria for impractical level of evacuation capability, with one available staff member who cannot transfer the resident from a bed to a wheelchair. Although the staff member is unable to meet all the resident’s evacuation assistance needs, the sleeping room provides adequate refuge.

6.5.2.3 Every staff member considered in this rating shall be able to participate meaningfully in the evacuation of every resident. For example, a staff member, due to his own disability, might be unable to assist one or more physically disabled residents and therefore shall not be included in the rating. However, if a staff member’s disability does not limit his ability to assist the residents, then the staff member shall be permitted to be included in the rating.

6.5.2.4 All staff members considered in this rating shall be in the facility when on duty. This rating is based on the assumption that there are staff present when residents are in the facility.

Exception No. 1: Unstaffed facilities, which are not covered by this system, shall be permitted to be assigned an evacuation capability level based on the demonstrated ability of the residents to meet the criteria of Chapter 32 or 33 (NFPA 101), as appropriate, without staff assistance.

Exception No. 2: Residents who receive only the most favorable ratings on Worksheet 6.8.3 for rating residents shall be permitted to be present in the facility without the presence of staff members.

Exception No. 3: A staff member shall be permitted to be at a location outside of the facility where his ability to respond to a fire emergency from the location is roughly equivalent to his response ability from within the facility. In determining equivalency, the authority having jurisdiction should consider the following:

(a) Whether the fire alarm meets the minimum loudness criteria (see 6.5.3.3) at the locations outside the facility or whether another staff member who is required to remain in the facility can immediately report a fire emergency to the staff member who is outside

(b) Travel time to the facility

(c) Detection of fire cues (e.g., smoke, noises) from the locations outside the facility

(d) Whether the staff member will be notified immediately about which area of the facility has the fire emergency, if the staff member who is outside is required to report fire emergencies in more than one facility or fire zone

Exception No. 4: The authority having jurisdiction shall be permitted to grant partial credit (which shall not exceed the promptness of the response score that the staff member receives where required to remain in the facility) for staff members who are permitted at locations outside the facility and who have the ability to respond promptly.

6.5.2.5 Fire drills shall be conducted monthly, and at least twelve fire drills shall have been conducted during the previous year.

Exception: A facility in operation for less than one year shall be permitted to have conducted a fire drill for each month of its operation.

6.5.3 Staff Scores (Worksheet 6.8.8).

6.5.3.1 The purpose of this rating is to determine which staff shift is likely to be the least able to respond promptly to assist residents in an evacuation. If it is not obvious which staff shift will be the least able to respond, complete separate forms for each staff shift and use the staff shift having the lowest score.

6.5.3.2 Promptness of Response Scores (Worksheet 6.8.7).

6.5.3.2.1 Staff Availability. This rating determines whether there are circumstances in which a staff member is less able to respond appropriately or might be delayed in his response to a fire emergency. A staff member shall be included in this rating only under the following conditions:

- (1) He is required to remain within the facility while on duty.
- (2) He sleeps less than 100 ft (30 m) from all locations in the portion of the facility being evaluated.
- (3) His travel time to any location in the portion of the facility being evaluated does not exceed 60 seconds.

6.5.3.2.1.1 Standby or Asleep. This rating means that the staff member does not have specific duties that ensure an immediate response to the alarm but is otherwise available to assist in a timely manner. This includes live-in staff who might be asleep, showering, or otherwise unable to respond immediately.

6.5.3.2.1.2 Immediately Available. This rating means that the staff member is required to be on duty to provide immediate assistance but is not required to remain in close proximity to the residents (e.g., the staff member is allowed to wash clothes or do bookkeeping).

6.5.3.2.1.3 Immediately Available and Close By. This rating means that the staff member, in addition to satisfying the requirement for “immediately available,” also is required to remain in close proximity to the residents except for brief periods of time.

6.5.3.2.1.4 If the facility is classed as “large” and has multiple fire or smoke zones, some staff members might have responsibilities for residents outside the fire or smoke zone being evaluated. If a staff member’s duties include rescue of residents in the fire zone being evaluated, the staff member shall be permitted to be assigned partial or full promptness of response scores. The authority having jurisdiction shall assign the points based on the proximity of the staff member to the zones and the nature of his duties in a fire emergency. This credit shall be given only if there is a smoke detection system that alerts the staff member and a system or procedure for promptly informing the staff member of the general location of the fire.

6.5.3.2.1.5 Individual residents shall be permitted to be assigned responsibilities similar to those of staff members to assist other residents during fire emergencies. The authority having jurisdiction shall be permitted to assign these individual residents as many as 8 points for promptness of response, based on their capabilities and responsibilities.

6.5.3.3 Alarm Effectiveness. This rating determines whether smoke detector-activated alarm devices are loud enough to alert the staff to a fire emergency dependably.

6.5.3.3.1 Assured. To be rated “assured,” the alarm shall be “easily noticeable” in all locations where the staff member is permitted, regardless of his rating on the promptness of response factor. “Easily noticeable” means the alarm shall be a minimum of 55 dBA measured at ear level. The authority having jurisdiction shall be permitted to require the alarm to be louder than 55 dBA where background noises could interfere with alarm audibility. For example, the alarm might need to

be more than 55 dBA in order to be heard over noise such as from a washing machine in the laundry or a television in the day room. If there are staff who are permitted to sleep, the alarm shall be a minimum of 70 dBA measured at “pillow” level in any area where the staff might be asleep. The alarm shall be activated by smoke detectors, an automatic sprinkler system, or both. If the facility has smoke detectors meeting the requirements of Chapter 32 or 33 (NFPA 101), as appropriate, the smoke detectors shall activate the alarm. If the facility has an automatic sprinkler system whose fire protection properties are considered in the evaluation of the facility, activation of the sprinkler system shall activate the alarm.

6.5.3.3.2 Not Assured. The alarm does not satisfy the conditions specified under “assured.” Doors that normally are closed during the staff shift being rated should be closed when determining the loudness of the fire alarm. Any other barriers that could reduce the loudness of the fire alarm also shall be in place.

6.6 Rating the Facility (Worksheet 6.8.9).

6.6.1 The vertical distance from sleeping rooms to a floor level with exits might affect the risk because of the time and difficulty in moving on the stairs.

6.6.2 Special Definitions.

6.6.2.1 Direct Exit. Direct exit means that there is no more than one step between the inside of the facility and either (1) ground level outside or (2) a level area outside the facility that is at least 32 ft² (3.0 m²). This level area might be a porch or a stairway landing. Where the vertical distance is greater than one step, a ramp shall be permitted to be used to comply with this definition.

6.6.2.2 Vertical Distance. Vertical distance refers to the greatest number of floors that separate any resident sleeping room from its nearest direct exit.

6.6.3 All Sleeping Rooms on Floors with Direct Exit. Every room where residents sleep is on a floor with at least one direct exit. Specific evidence of facilities that fall within this category includes the following:

- (1) A one-story building without sleeping rooms in the basement
- (2) A two-story building without sleeping rooms on the second floor
- (3) A split-level building with direct exits at each level
- (4) A two-story building with sleeping rooms on the second floor that has an exterior stairway from the second floor, with a landing at the second floor that is greater than 32 ft² (3.0 m²)

6.6.4 Any Sleeping Room One Floor from Exit. There is at least one room where residents sleep in which the shortest vertical distance to a direct exit is one floor. Specific evidence of facilities that fall within this category includes the following:

- (1) A two-story building with sleeping rooms on the second floor, in the basement, or both
- (2) A one-story building where all the exits have stairs that lead to grade without a landing or porch of, at minimum, 32 ft² (3.0 m²)

6.6.5 Any Sleeping Room Two or More Floors from Exit.

There is at least one room where residents sleep in which the shortest vertical distance to a direct exit is two or more floors. Specific evidence of buildings that fall within this category includes the following:

- (1) A three-story building with sleeping rooms on the third floor and no exterior fire escape
- (2) A three-story building with sleeping rooms on the third floor that has an exterior stairway from the third floor, but where the landing at the third floor is less than 32 ft² (3.0 m²)

6.6.6 Facilities in an Apartment House. If the facility is located in an apartment house and the unit containing the facility requires ascending or descending stairs to move from any sleeping room to the door to the corridor, a score of 1.2 for “vertical distance from sleeping rooms to exit” should be assigned. In all other apartments, the score for vertical distance from sleeping rooms to exits is 1.0.

6.7 Determining Evacuation Capability (Worksheet 6.8.10).

6.7.1 When the scores for the residents, the staff, and the vertical travel distances have been determined, the scores are entered on Worksheet 6.8.10 and the calculation made to obtain a numerical result.

6.7.2 The numerical evacuation capability score then is translated into a level of evacuation capability of either “prompt,” “slow,” or “impractical” and recorded on Worksheet 6.8.11. This evacuation capability is a valid assessment that shall be permitted to be used in Chapter 7 of this guide or in Chapter 32 or 33 (NFPA 101), as appropriate.

6.8 Worksheets for Rating Residents.

Step 1: Complete the cover sheet (Worksheet 6.8.1) found in Figure 6.8.

Step 2: Read Sections 6.3 and 6.4 before filling out Worksheets 6.8.2 and 6.8.3. Complete both forms for each resident, basing the ratings on commonly observed examples of poor performance.

Step 3: Compute the total resident evacuation assistance score.

A. List each resident’s name on Worksheet 6.8.4. Use a separate scoresheet for each zone being rated. Use additional scoresheets for a large number of residents.

B. Enter the score from each Worksheet 6.8.3, which was completed for each resident.

C. Total the scores for all residents in the facility or zone being rated, as appropriate.

Step 4: Compute the staff shift score.

A. Complete the cover sheet in Worksheet 6.8.5.

B. Complete Worksheet 6.8.6 for the time of day, week, and so on when the combined ratings for staff and residents yield the highest score. This usually is late at night. Where it is not obvious which staff shift will score highest, complete separate forms for each staff shift and utilize the highest score. Read Section 6.5 before filling out this form.

Step 5: Determine the staff shift score.

Note that in large facilities, staff members might be responsible for assisting residents in a fire or smoke zone but also might have responsibilities for residents in other zones. (See Section 6.5.)

A. On Worksheet 6.8.8, list the names of staff members who are required to be on duty in the facility during the shift being rated.

B. Determine whether the effectiveness of the alarm is “assured” or “not assured.” (See Section 6.5.3.)

C. Using the values from Worksheet 6.8.7, determine each staff member’s “promptness of response score” for the shift being rated. Enter each staff member’s name and score in the appropriate spaces on Worksheet 6.8.8.

D. Total the “promptness of response scores” for the shift rated.

Step 6: Rate the facility, using Worksheet 6.8.9. Rate the facility by checking the circle that indicates the vertical distance a resident must travel from a sleeping room (SR) to an exit.

Step 7: Determine evacuation capability. Determine the facility’s evacuation capability, using Worksheet 6.8.10. Calculate the score by multiplying the Total Resident Evacuation Assistance Score (Worksheet 6.8.4) by the Vertical Distance from Sleeping Room to Exit (Worksheet 6.8.9) and then dividing by the Staff Shift Score (Worksheet 6.8.8). The evacuation capability is determined and recorded in Worksheet 6.8.11.

FIGURE 6.8 Worksheets for rating residents.

WORKSHEET 6.8.1 COVER SHEET																																																					
Worksheet for Rating Residents																																																					
Resident's name _____		Evaluator _____																																																			
Facility _____		Zone _____		Date _____																																																	
Write any explanatory remarks here:																																																					
WORKSHEET 6.8.2 RATING THE RESIDENT ON THE RISK FACTORS Rate the resident on each of the factors below by checking the one circle for each risk factor that best describes the resident. For the first six factors, write the scores for the circles checked in the appropriate score boxes in the far right column. For "Response to Fire Drills," write the three checked scores in the large circles. Write the sum of the three scores in the large box on the right. <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; padding: 5px;">I. Risk of Resistance (Check only one)</td> <td style="width: 15%; padding: 5px;">Minimal Risk ☐ score=0</td> <td style="width: 15%; padding: 5px;">Risk of Mild Resistance ☐ score=6</td> <td style="width: 15%; padding: 5px;">Risk of Strong Resistance ☐ score=20</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> <tr> <td style="padding: 5px;">II. Impaired Mobility (Check only one)</td> <td style="padding: 5px;">Self-Starting ☐ score=0</td> <td style="padding: 5px;">Slow ☐ score=3</td> <td style="padding: 5px;">Needs Limited Assistance ☐ score=6</td> <td style="padding: 5px;">Needs Full Assistance or Very Slow ☐ score=20</td> <td style="text-align: center; vertical-align: middle;">Score Boxes</td> </tr> <tr> <td style="padding: 5px;">III. Impaired Consciousness (Check only one)</td> <td style="padding: 5px;">No Significant Risk ☐ score=0</td> <td style="padding: 5px;">Partially Impaired ☐ score=6</td> <td style="padding: 5px;">Totally Impaired ☐ score=20</td> <td></td> <td style="text-align: center; vertical-align: middle;">Score Boxes</td> </tr> <tr> <td style="padding: 5px;">IV. Need for Extra Help (Check only one)</td> <td style="padding: 5px;">Needs at Most One Staff ☐ score=0</td> <td style="padding: 5px;">Needs Limited Assistance from 2 Staff ☐ score=30</td> <td style="padding: 5px;">Needs Full Assistance from 2 Staff ☐ score=40</td> <td></td> <td style="text-align: center; vertical-align: middle;">Score Boxes</td> </tr> <tr> <td style="padding: 5px;">V. Response to Instructions (Check only one)</td> <td style="padding: 5px;">Follows Instructions ☐ score=1</td> <td style="padding: 5px;">Requires Supervision ☐ score=3</td> <td style="padding: 5px;">Requires Considerable Attention/Might Not Respond ☐ score=10</td> <td></td> <td style="text-align: center; vertical-align: middle;">Score Boxes</td> </tr> <tr> <td style="padding: 5px;">VI. Waking Response to Alarm (Check only one)</td> <td style="padding: 5px;">Response Probable ☐ score=0</td> <td style="padding: 5px;">Response Not Probable ☐ score=6</td> <td></td> <td></td> <td style="text-align: center; vertical-align: middle;">Score Boxes</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="3" style="width: 15%; padding: 5px; vertical-align: top;">VII. Response to Fire Drills (Without guidance or advice from staff)</td> <td style="width: 30%; padding: 5px;">Initiates and Completes Evacuation Promptly</td> <td style="width: 15%; padding: 5px;">Yes ☐ score=0</td> <td style="width: 15%; padding: 5px;">No ☐ score=8</td> <td rowspan="3" style="width: 10%; text-align: center; vertical-align: middle;"> ☐ + ☐ + ☐ </td> <td rowspan="3" style="width: 15%; text-align: center; vertical-align: middle;">Sum of These Three Scores</td> </tr> <tr> <td style="padding: 5px;">Chooses and Completes Back-up Strategy</td> <td style="padding: 5px;">Yes ☐ score=0</td> <td style="padding: 5px;">No ☐ score=4</td> </tr> <tr> <td style="padding: 5px;">Remains at Designated Location</td> <td style="padding: 5px;">Yes ☐ score=0</td> <td style="padding: 5px;">No ☐ score=6</td> </tr> </table> (For use with NFPA 101A-2001/NFPA 101-2000) (Page 1 of 4)						I. Risk of Resistance (Check only one)	Minimal Risk ☐ score=0	Risk of Mild Resistance ☐ score=6	Risk of Strong Resistance ☐ score=20			II. Impaired Mobility (Check only one)	Self-Starting ☐ score=0	Slow ☐ score=3	Needs Limited Assistance ☐ score=6	Needs Full Assistance or Very Slow ☐ score=20	Score Boxes	III. Impaired Consciousness (Check only one)	No Significant Risk ☐ score=0	Partially Impaired ☐ score=6	Totally Impaired ☐ score=20		Score Boxes	IV. Need for Extra Help (Check only one)	Needs at Most One Staff ☐ score=0	Needs Limited Assistance from 2 Staff ☐ score=30	Needs Full Assistance from 2 Staff ☐ score=40		Score Boxes	V. Response to Instructions (Check only one)	Follows Instructions ☐ score=1	Requires Supervision ☐ score=3	Requires Considerable Attention/Might Not Respond ☐ score=10		Score Boxes	VI. Waking Response to Alarm (Check only one)	Response Probable ☐ score=0	Response Not Probable ☐ score=6			Score Boxes	VII. Response to Fire Drills (Without guidance or advice from staff)	Initiates and Completes Evacuation Promptly	Yes ☐ score=0	No ☐ score=8	☐ + ☐ + ☐	Sum of These Three Scores	Chooses and Completes Back-up Strategy	Yes ☐ score=0	No ☐ score=4	Remains at Designated Location	Yes ☐ score=0	No ☐ score=6
I. Risk of Resistance (Check only one)	Minimal Risk ☐ score=0	Risk of Mild Resistance ☐ score=6	Risk of Strong Resistance ☐ score=20																																																		
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VII. Response to Fire Drills (Without guidance or advice from staff)	Initiates and Completes Evacuation Promptly	Yes ☐ score=0	No ☐ score=8	☐ + ☐ + ☐	Sum of These Three Scores																																																
	Chooses and Completes Back-up Strategy	Yes ☐ score=0	No ☐ score=4																																																		
	Remains at Designated Location	Yes ☐ score=0	No ☐ score=6																																																		

WORKSHEET 6.8.3 DETERMINING THE RESIDENT'S OVERALL NEED FOR ASSISTANCE			
Compare the numbers in the seven score boxes filled in. Take the highest score from the score boxes (Worksheet 6.8.2) and write it in the box at the right. Notes:			Evacuation Assistance Score
WORKSHEET 6.8.4 RESIDENT SCORES			
Resident's Name	Evac. Assist. Score	Resident's Name	Evac. Assist. Score
Evacuation Assistance Score	Total	Evacuation Assistance Score	Total

(For use with NFPA 101A-2001/NFPA 101-2000)

(Page 2 of 4)

FIGURE 6.8 Continued

WORKSHEET 6.8.5 COVER SHEET

Staff Shift Score

Facility _____ Zone _____
 Evaluator _____ Date _____
 Staff Shift: From _____ To _____

WORKSHEET 6.8.6 STAFF RESPONSE AND TRAINING

	Yes	No
A protection plan has been promulgated and all staff members considered in this rating have been trained in its implementation. <i>(See 6.5.2.1.)</i>		
The total available staff at any given time is able to handle the individual evacuation needs of each resident who is in the facility. <i>(See 6.5.2.2 and Exception.)</i>		
Every staff member considered in this rating can meaningfully participate in the evacuation of every resident. <i>(See 6.5.2.3.)</i>		
All staff members considered in this rating are required to be in the facility when on duty, except as permitted. <i>(See 6.5.2.4 and Exceptions.)</i>		
At least 12 fire drills were conducted during the previous year. <i>(See 6.5.2.5 and Exception.)</i>		

All items must score "Yes" before proceeding.

WORKSHEET 6.8.7 PROMPTNESS OF RESPONSE SCORES

Staff Availability	Alarm Effectiveness	
	Assured	Not Assured
Standby or asleep	16	2
Immediately available	20	2
Immediately available and close by	20	10

WORKSHEET 6.8.8 STAFF SCORES

Staff Name	Promptness of Response Score	Staff Name	Promptness of Response Score
Staff Shift Score	Total	Staff Shift Score	Total

(For use with NFPA 101A-2001/NFPA 101-2000)

(Page 3 of 4)

FIGURE 6.8 Continued

WORKSHEET 6.8.9 RATING THE FACILITY			
	Vertical Distance from Sleeping Rooms to Exits		
	All SR on Floors with Direct Exit	Any SR One Floor from Exit	Any SR Two or More Floors from Exit
Small Facility	☐ Score 0.8	☐ Score 1.0	☐ Score 1.2
Large Facility or Apartment	☐ Score 1.0		

NOTE: Small facilities have 16 or fewer residents. See 6.6.6 for apartments.

WORKSHEET 6.8.10 CALCULATION OF EVACUATION CAPABILITY SCORE			
Total Resident Evacuation Assistance Score (Worksheet 6.8.4)	X	Vertical Distance from Sleeping Room to Exit (Worksheet 6.8.9)	= Staff Shift Score (Worksheet 6.8.8) Evacuation Capability Score (go to Worksheet 6.8.11)

WORKSHEET 6.8.11 EVACUATION CAPABILITY SCORE		
Evacuation Capability Score	Level of Evacuation Capability	Evacuation Capability for this Facility or Zone
≤1.5	Prompt	
>1.5 to ≤5.0	Slow	
>5.0	Impractical	

(For use with NFPA 101A-2001/NFPA 101-2000)
(Page 4 of 4)

Chapter 7 Fire Safety Evaluation System for Board and Care Occupancies

7.1 Introduction.

7.1.1 This chapter is part of an NFPA guide and therefore is not mandatory. The term *shall* in this chapter is used to indicate that if the provisions of the chapter are applied, the procedures mandated are to be followed to ensure the effectiveness of the evaluation system.

Chapters 32 and 33 (NFPA 101) define three levels of evacuation capability for residents (with staff assistance): prompt, slow, and impractical. Chapters 32 and 33 (NFPA 101) also prescribe the fire safety protection requirements for each level of evacuation capability. This chapter describes a procedure for determining whether a combination of fire safety features in a board and care facility, using the known evacuation capability of its residents, provides a level of safety equivalent to that provided by explicit conformance to Chapters 32 and 33 (NFPA 101). The definition of evacuation capability is given in 3.3.56 (NFPA 101), and one procedure for determining evacuation capability is presented in Chapter 6 of this document.

7.1.2 Subsystems are provided as follows:

- (1) Section 7.2 — Evaluating the fire safety protection in a small facility
- (2) Section 7.3 — Evaluating the fire safety protection in a large facility
- (3) Section 7.4 — Evaluating the suitability of an apartment building to house a board and care occupancy

7.2 Glossary for Fire Safety Evaluation Worksheet for a Small Facility.

7.2.1 Introduction. This glossary is provided to assist in completing Figure 7.3, Worksheets for Evaluating Fire Safety for a Small Facility, to determine the suitability of a small facility to house a board and care occupancy. The instructions for the mechanisms of completing the worksheet are included in the worksheet itself. They are not repeated in this glossary. This glossary provides expanded discussion and definitions for the various items in the worksheet to assist the user where questions of definition or interpretation arise. To the maximum extent possible, the glossary does not repeat the definitions already existing in NFPA 101, *Life Safety Code*, but rather references the appropriate paragraphs (NFPA 101).

7.2.2 Areas of Application.

7.2.2.1 The evaluation shall be completed covering the entire home, including spaces that are not used by the residents of the board and care home. See Worksheet 7.3.2. Row houses, townhouses, or other forms of independent living units having all of their entrances and means of escape completely separate from any other unit shall be permitted to be calculated as small facilities where they are separated from any abutting living units. Such separation shall be by fire-resistive partitions or walls having at least a 1-hour fire resistance rating and extending to the roof if it is noncombustible or through the roof if the roof or its covering is of combustible material.

7.2.2.2 For dwelling units (apartments) in general-use apartment houses, the worksheet shall be used to evaluate the dwelling unit being used as the board and care home. The remainder of the apartment building shall be evaluated using the worksheet to determine the suitability of apartment buildings to house a board and care occupancy.

7.2.3 Maintenance. All protection systems, requirements, arrangements, and procedures shall be maintained in a dependable operating condition, and a sufficient state of readiness, and shall be used in such a manner that the intended safety function or hazard constraint is not impaired. Otherwise, they shall receive no credit in the evaluation.

7.2.4 Safety Parameters (Worksheet 7.3.2). The safety parameters are a measure of those building factors that bear upon or contribute to the safety of those persons who might be in the building at the time of a fire.

Each of the safety parameters is to be analyzed, and the safety value for each parameter that best describes the condition in the building is to be identified. Only one value for each of the parameters is to be chosen. If two or more values appear to apply, the one with the lowest point value shall be used.

7.2.4.1 Construction/Fire Resistance. Construction types are as defined in 7.2.4.1.1 and 7.2.4.1.2, except that sprinkler protection shall not be considered in determining construction classification in any case where credit is given for sprinkler protection as defined in 7.2.4.5.

7.2.4.1.1 Protected (15 minutes). Buildings meeting the requirements of 33.2.1.3.2 (NFPA 101).

7.2.4.1.2 Protected (1 hour). Buildings meeting the requirements of Type I, Type II(222), Type II(111), Type III(211), Type IV, or Type V(111) construction.

7.2.4.2 Hazardous Areas. The assignment of parameter values for hazardous areas is a four-step process.

7.2.4.2.1 Step 1 — Identify Hazardous Areas. Hazardous areas are as defined in 32.2.3.2.1 and 33.2.3.2.1 (NFPA 101).

7.2.4.2.2 Step 2 — Determine the Area Exposed.

(a) *Primary Means of Escape.* Hazardous area is on the same floor as, and is in or abuts, a primary means of escape, as defined in 32.2.3.2 and 33.2.3.2 (NFPA 101).

(b) *Sleeping Area.* Hazardous area is on the same floor as, and is in or abuts, the sleeping area (room).

7.2.4.2.3 Step 3 — Determine the Fire Protection Provided.

(a) *Sprinkler Protection.* The hazardous area is protected by sprinklers (or other appropriate automatic extinguishing system).

(b) *Smoke-Resisting Separation.* The hazardous area is separated from exposed sleeping areas and the primary means of escape routes by a separation that resists the passage of smoke. Any doors in such separation are self-closing or automatic-closing upon detection of smoke.

(c) *Half-Hour Fire Resistance-Rated Enclosure.* Enclosures meeting the requirements of 32.2.3.2.3(a) and 33.2.3.2.3(a) (NFPA 101).

(d) *1-Hour Fire Resistance-Rated Enclosure.* Enclosures meeting the requirements of 32.2.3.2.2(a) and 33.2.3.2.2(a) (NFPA 101).

7.2.4.2.4 Step 4 — Determine Degree of Deficiency and Assign Parameter Values. The parameter value ultimately is determined on the basis of the area exposed and the level of protection provided. Table 7.2.4.2.4 provides a matrix for determining the degree of deficiency to be assessed.

In some situations, more than one hazardous area with the same or differing levels of deficiency exists. The parameter value then is based on the single most serious deficiency for the hazardous area.

Table 7.2.4.2.4 Hazardous Areas — Degree of Deficiency

	Nonsprinklered		Sprinklered		
	Fire resistance rating with automatic fire detection		Unenclosed	Smoke-resistive separation	Unenclosed
	1/2 hr	1 hr			
Does not expose sleeping area or means of escape routes	No def.	No def.	Single deficiency	No deficiency	No deficiency
Exposes sleeping area or means of escape routes	Single def.	No def.	Double deficiency	No deficiency	No deficiency

7.2.4.3 Manual Fire Alarm. Manual fire alarms are defined in 7.2.4.3.1 through 7.2.4.3.3.

7.2.4.3.1 None or Incomplete. There is no manual fire alarm system, or the system is incomplete and does not meet the requirements necessary for a higher-scored category.

7.2.4.3.2 Without Fire Department Notification (W/O F.D. Notification). The credit for this level of protection is to be given for any installation that meets the requirements for a manual fire alarm system in 32.2.3.4.1 and 33.2.3.4.1 (NFPA 101).

7.2.4.3.3 With Fire Department Notification (W/F.D. Notification). There is a manual fire alarm system meeting the requirements of Section 9.6 (NFPA 101), including fire department notification as defined in 9.6.4 (NFPA 101).

7.2.4.4 Smoke Detection and Alarm. A detection system as used herein is one based on the use of smoke detectors. No recognition is given for thermal detectors. The detection system categories are described in 7.2.4.4.1 through 7.2.4.4.5.

7.2.4.4.1 None or Incomplete. There are no smoke detectors in the building, or, if any are present, they do not meet the requirements for a higher-scored category.

7.2.4.4.2 Single Level Detection, Limited Warning. There are one or more detectors in the building, but they do not meet the criteria for every level detection set forth in 7.2.4.4.3. Detectors credited in this category shall be permitted to be any approved smoke detector, including a single station detector. At least one detector must be located in the corridor or similar common space (lobbies, lounges, or other spaces that cannot be closed off) in the immediate vicinity of each separate sleeping area. If there is more than one sleeping area, each such area must be protected to obtain this credit.

7.2.4.4.3 Every Level Detection. This credit applies where the detector system meets the requirements of 32.2.3.4.3 and 33.2.3.4.3 (NFPA 101).

7.2.4.4.4 Every Level Plus Single Station Detection in Each Bedroom. To receive this credit, the requirements of 7.2.4.4.3 must be met in full with the addition of at least one single station detector in each bedroom or other sleeping area.

7.2.4.4.5 Total Coverage System. This system provides a minimum of one detector in each occupied room or other habitable space and throughout any basements, storage areas (other than normal clothing closets), or combustible loft spaces. To qualify as a total system, there must be a manual fire alarm system in the building, and the operation of any smoke detector must automatically activate the manual fire alarm system evacuation alarm for the entire building.

7.2.4.5 Automatic Sprinklers. Automatic sprinklers are defined in 7.2.4.5.1 and 7.2.4.5.2.

7.2.4.5.1 Nonsprinklered. No credit is given if there are no sprinklers or if sprinklers, though present, are not sufficient to qualify for the sprinklered category.

7.2.4.5.2 Sprinklered (“Standard Sprinklers” or “Quick-Response or Residential Sprinklers”). The building is sprinklered in accordance with 32.2.3.5.1 through 32.2.3.5.4 and 33.2.3.5.2 through 33.2.3.5.3 (NFPA 101).

7.2.4.6 Interior Finish. Except as noted in 7.2.4.6.1, classification of interior finish on the walls and ceilings of the occupied space is in accordance with Section 10.2 (NFPA 101). There are no requirements for interior floor finish.

7.2.4.6.1 No consideration is included in the safety parameter value for any finish with a flame-spread rating greater than 200 or for any material not rationally measured by NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Materials not rationally measured include foam plastics, asphalt-impregnated paper, or other materials capable of inducing extreme rates of fire growth and rapid flashover. In any case involving these materials, the resultant risk is considered beyond the capacity of this evaluation system and requires individual appraisal. The following should be noted:

- (1) Plywood of 1/4 in. (0.6 cm) or greater thickness should be considered as having a flame-spread rating of 200 or less.
- (2) Exposed wood open-joint construction or other exposed wood construction areas shall be charged as Class C interior finish, in addition to any charges under 7.2.4.1.
- (3) If a space is classified as hazardous under 7.2.4.2, no additional charge shall be made as the result of interior finish in such areas.

7.2.4.7 Separation of Sleeping Rooms (from other levels and from corridors). Separation of sleeping rooms is described in 7.2.4.7.1 through 7.2.4.7.3.

7.2.4.7.1 Separation of Sleeping Rooms from Other Levels. The classification of separation of sleeping rooms is categorized under the groups headed Unprotected Vertical Openings and Protected Vertical Openings (Parameter 7 in Worksheet 7.3.2). A facility is classed as having protected vertical openings if there are no vertical openings (as in a single-level building) or if the protection of vertical openings meets the requirements of 32.2.3.1.1 and 33.2.3.1.1 (NFPA 101); otherwise this parameter is assessed on the basis of Unprotected Vertical Openings.

7.2.4.7.2 Separation of Sleeping Rooms from Corridors and Common Spaces. The charge for “None or Incomplete” (Parameter 7 in Worksheet 7.3.2) is assessed in any case where

the separation of sleeping rooms from corridors and common spaces is insufficient to meet any of the other classifications in this parameter.

7.2.4.7.3 The following are definitions of the other classifications of sleeping room separation:

(a) *Smoke Resisting*. Sleeping rooms are separated from corridors or other common spaces in accordance with 32.2.3.6 and 33.2.3.6 (NFPA 101) without the door closer.

(b) *Smoke Resisting with Door Closer*. Sleeping rooms are separated in accordance with 32.2.3.6 and 33.2.3.6 (NFPA 101).

(c) *Half-Hour Fire Resistance*. Meets the requirements of 32.2.3.6 and 33.2.3.6 (NFPA 101) without the door closer.

(d) *Half-Hour Fire Resistance with Door Closer*. Sleeping rooms are separated in accordance with 32.2.3.6 and 33.2.3.6 (NFPA 101) with door closer.

(e) *Half-Hour Fire Resistance with Automatic-Closing Doors*. Automatic-closing doors shall be permitted if the doors have an arrangement that holds them open in a manner such that they are released by a smoke detector-operated device (e.g., magnetic or pneumatic hold-open device) prior to the passage of significant smoke from the space of fire origin into the corridor or from the corridor into the protected room. Smoke detectors for operation of such doors are either integral with the door closers, mounted at each door, or operated from a total smoke detection system covering both the room and corridor.

7.2.4.8 Means of Escape. Means of escape is defined in 7.2.4.8.1 through 7.2.4.8.6.

7.2.4.8.1 Means of Escape on All Sleeping Levels. A building shall be considered as having means of escape on all sleeping levels, provided the following conditions exist:

- (1) The entire building is on a single level.
- (2) All guest rooms used for sleeping are on a level having an exit door.

7.2.4.8.2 Primary Route. A normal means of escape that might involve interior or exterior stairs, corridors, doors, or other common means of movement through and out of a dwelling unit.

(a) *Protected*. A primary route is classed as “protected” if it provides a path of travel to the outside of the building without traversing any corridor or space exposed to an unprotected vertical opening. Also, where the sleeping room is above or below the level of exit discharge, the primary means is an enclosed interior stair in accordance with 32.2.2.4 or 33.2.2.4 (NFPA 101), an exterior stair, or a horizontal exit.

(b) *Unprotected*. A primary route is classed as “unprotected” if it does not meet the requirements for “protected.”

7.2.4.8.3 Fewer Than Two Remote Routes. The egress capability is classed as “<2 remote routes” if each bedroom does not have access to two routes leading to two separate building exit doorways.

7.2.4.8.4 With Alternative Means. The credit for this level of protection applies to any facility that meets the requirements for a second means of escape in 32.2.2.3 and 33.2.2.3 (NFPA 101).

7.2.4.8.5 Two Remote Routes. To meet the requirement for “two remote routes,” each bedroom has access to two routes leading to two separate building exit doorways.

(a) *Separated*. To meet the requirement for “two remote routes separated,” the facility must meet the requirements of 32.2.2.1 and 33.2.2.1 (NFPA 101).

(b) *Unseparated*. The two remote routes do not meet the requirements for the classification “separated.”

7.2.4.8.6 Direct Exit from Each Bedroom. To be credited, each bedroom must have a door that is operable by the room occupant(s) and opens directly to grade without more than one step, or have a ramp to grade, or have an external porch or landing with external stairs or other suitable access to grade.

Some buildings have a nonsleeping occupants use area (e.g., staff lounge) on a floor without any exit, and the building otherwise qualifies to receive credit for direct exits or for two remote exits. To receive credit for direct exits or for two remote exits, there must be either a protected egress route or two remote routes from the occupants use area.

7.3 Worksheets for Evaluating Fire Safety for a Small Facility. A small facility normally means a capacity for 16 or fewer residents. For each individual residence or apartment used as a board and care home, use the cover sheet (Worksheet 7.3.1) found in Figure 7.3, and complete Steps 1 through 5.

Step 1: Determine safety parameter values using Worksheet 7.3.2. Select and circle the safety value for each safety parameter in Worksheet 7.3.2 that best describes the conditions in the facility. Choose only one value for each of the 8 parameters. If two or more values appear to apply, choose the one with the lowest point value.

Step 2: Complete individual safety evaluation, using Worksheet 7.3.3.

A. Transfer each of the 8 circled safety parameter values from Worksheet 7.3.2 to every unshaded block in the line with the corresponding safety parameter in Worksheet 7.3.3. Where the block is marked “÷ 2 =,” enter one-half the value from Worksheet 7.3.2.

B. Add the four columns, keeping in mind that any negative numbers need to be deducted.

C. Transfer the resulting values for S_1 , S_2 , S_3 , and S_4 to the corresponding blocks in Worksheet 7.3.5.

Step 3: Determine mandatory requirements, using Worksheet 7.3.4.

A. Select the level of requirements from Worksheet 7.3.4 based on evacuation capability (*see 3.3.56 of NFPA 101*). Circle the appropriate values.

B. Transfer the circled values from Worksheet 7.3.4 to the corresponding blocks for S_w , S_b , S_o , and S_d in Worksheet 7.3.5.

Step 4: Determine the equivalency evaluation.

A. Perform the subtractions indicated in Worksheet 7.3.5. Enter the differences in the appropriate answer blocks.

B. For each row, check “yes” if the value in the answer block is zero (0) or greater. Check “no” if the value in the answer block is a negative number.

Step 5: Evaluate other considerations.

A. Evaluate considerations not previously addressed, using Worksheet 7.3.6.

B. The equivalency covered by Worksheets 7.3.2 through 7.3.5 includes the majority of the considerations covered by the *Life Safety Code*. Some considerations are not evaluated by this method and must be considered separately. These additional considerations are covered in Worksheet 7.3.6, Facility Fire Safety Requirements Worksheet.

Step 6: Determine equivalency considerations.

A. Conclude whether the level of life safety is at least equivalent to that prescribed by the *Life Safety Code*, using Worksheet 7.3.7.

B. Worksheet 7.3.7, Conclusions, combines the zone fire safety equivalency evaluation of Worksheet 7.3.5 and the additional considerations of Worksheet 7.3.6.

FIGURE 7.3 Worksheets for evaluating fire safety in a small facility.

WORKSHEET 7.3.1 COVER SHEET Fire Safety Evaluation Worksheet for a Small Facility										
Facility Identification _____										
Evaluator _____ Date _____										
WORKSHEET 7.3.2 SAFETY PARAMETER VALUES — SMALL FACILITY										
Safety Parameters		Parameter Values								
1. Construction/ Fire Resistance	Exposed Structural Members	Protected 15 min			Protected 1 hr					
	0	1			3					
2. Hazardous Areas	Double Deficiency	Single Deficiency			None or No Deficiency					
	-7	-4			0					
3. Manual Fire Alarm	None or Incomplete	W/O F.D. Notification			W/ F.D. Notification					
	0	1			2					
4. Smoke Detection & Alarm	None or Incomplete	Single Lev. Det./ Limited Warning	Warning to All Bedrooms				Total Coverage System			
			Every Lev. Det. ^e		Every Lev. Plus Det. in Each Bdrm.					
	-4	0	2	3(4) ^f		4				
5. Automatic Sprinklers	Nonsprinklered	Standard Sprinklers			Quick-Response or Residential Sprinklers					
	0	8			10					
6. Interior Finish	Flame-Spread Ratings									
	>75 to ≤200			>25 to ≤75			≤25			
	-3			-1			0			
7. Separation of Sleeping Rooms (from other levels and from corridors)	Unprotected Vertical Openings			Protected Vertical Openings ^d						
	None or Incomp.	Smoke Resisting w/o Closers	Smoke Resisting w/ Closers	None or Incomp.	Smoke Resisting	½ hr	½ hr Auto Closing	Smoke Res. w/ Door Closer	½ hr w/ Door Closer	
	-6	-4	0(0) ^c	-2	0	1(0) ^a	2(0) ^a	1	2(1) ^a	
8. Means of Escape	Means of Escape on All Sleeping Levels	<2 Remote Routes		2 Remote Routes Unseparated		2 Remote Routes Separated		Direct Exit from Each Bdrm.		
		w/o Alt. Means	w/ Alt. Means							
		-1	0	1(0) ^b	2(0) ^b	3(0) ^b				
	Means of Escape Not on All Sleeping Levels	Primary Route Not Protected			Primary Route Protected					
		<2 Remote Routes			2 Remote Routes			< 2 Remote Routes		
		w/o Alt. Means	w/ Alt. Means	w/o Alt. Means				w/ Alt. Means	2 Remote Routes	
		-4	-3	0	-1	0	2(0) ^b			

NOTES:

^a Use () if Parameter 1 is 0 and Parameter 5 is 0.

^b Use (0) if Parameter 7 is based on a “none or incomplete” situation.

^c Use (0) if door is 20-minute and has automatic closer.

^d Consider a single level building as having protected vertical openings.

^e Every level detection is permitted to be omitted with quick-response automatic sprinklers throughout; however, detection in each bedroom is required.

^f Use (4) in existing buildings if detection in each bedroom and quick-response automatic sprinklers throughout.

(For use with NFPA 101A-2001/NFPA 101-2000, B & C Small) (Page 1 of 3)

FIGURE 7.3 Continued

WORKSHEET 7.3.3 INDIVIDUAL SAFETY EVALUATIONS — SMALL FACILITY

Parameters	Fire Control (S_1)	Egress (S_2)	Refuge (S_3)	General Fire Safety (S_4)
1. Construction				
2. Hazardous Areas		$\div 2 =$		
3. Manual Fire Alarm	$\div 2 =$	(See note.)		
4. Smoke Detection and Alarm	$\div 2 =$		$\div 2 =$	
5. Automatic Sprinklers		$\div 2 =$		
6. Interior Finish	$\div 2 =$			
7. Separation of Sleeping Rooms				
8. Means of Escape				
Total	$S_1 =$	$S_2 =$	$S_3 =$	$S_4 =$

NOTE: Maximum value of manual fire alarm for means of escape is 1.

WORKSHEET 7.3.4 MANDATORY SAFETY REQUIREMENTS

Level of Evacuation Difficulty	Control Requirement (S_a)		Egress Requirement (S_b)		Refuge Requirement (S_c)		General Fire Safety Requirement (S_d)	
	New	Exist.	New	Exist.	New	Exist.	New	Exist.
Prompt	10($1\frac{1}{2}$) ^a	0	5(5) ^a	4	11($2\frac{1}{2}$) ^a	2	7(2) ^a	1
Slow	10	2	9	7	11	4	11	7
Slow ^b		1		6		2		5
Impractical	10	8	10	9	11	9	12	10

^a Use () for small board and care facility conversion serving eight or fewer residents with an evacuation capability rating of “prompt.”

^b In existing buildings only, use these mandatory safety requirements if evacuation time is 8 minutes or less or if the evacuation capability score is 3 or less as determined by Chapter 6.

FIGURE 7.3 Continued

WORKSHEET 7.3.5 EQUIVALENCY EVALUATION						Yes	No
Control Provided (S_1)	minus	Required Control (S_a)	$\geq$	0	S_1 $-$ S_a $=$		
Egress Provided (S_2)	minus	Required Egress (S_b)	$\geq$	0	S_2 $-$ S_b $=$		
Refuge Provided (S_3)	minus	Required Refuge (S_c)	$\geq$	0	S_3 $-$ S_c $=$		
General Fire Safety (S_4)	minus	Required Gen. Fire Safety (S_d)	$\geq$	0	S_4 $-$ S_d $=$		

WORKSHEET 7.3.6 FACILITY FIRE SAFETY REQUIREMENTS WORKSHEET		
Considerations	Met	Not Met
Complies with the applicable requirements of Sections 32.7 and 33.7 (NFPA 101).		

WORKSHEET 7.3.7 CONCLUSIONS
1. ☐ All of the checks in Worksheet 7.3.5 are in the "Yes" column. The level of fire safety is at least equivalent to that prescribed by NFPA 101, <i>Life Safety Code</i>.* 2. ☐ One or more of the checks in Worksheet 7.3.5 are in the "No" column. The level of fire safety is not shown by this system to be equivalent to that prescribed by NFPA 101 for small dwelling units. * The equivalency covered by this worksheet includes the majority of considerations covered by NFPA 101, <i>Life Safety Code</i>. There are some considerations that are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 7.3.6, "Facility Fire Safety Requirements Worksheet." One copy of this worksheet is to be completed for each facility.

(For use with NFPA 101A-2001/NFPA 101-2000, B & C Small)

(Page 3 of 3)

7.4 Glossary for Fire Safety Evaluation Worksheet for a Large Facility.

7.4.1 Introduction. This glossary is provided to assist in completing the “Fire Safety Evaluation Worksheet for a Large Facility” to determine the suitability of a large facility to house a board and care occupancy. The instructions for the mechanisms of completing the worksheet are included in the worksheet itself. They are not repeated in this glossary. This glossary provides expanded discussion and definitions for the various items in the worksheet to assist the user where questions of definition or interpretation arise. To the maximum extent possible, the glossary does not repeat the definitions already existing in NFPA 101, *Life Safety Code*, but rather references the appropriate paragraphs (NFPA 101).

7.4.2 Areas of Application. The entire residence is evaluated on a single worksheet to the degree indicated by each item on the worksheet. See Worksheet 7.5. However, spaces that are not used for living units, not in direct utility or maintenance support of the living units, not provided for resident use, or not in any way involved in resident emergency egress shall be permitted to be omitted from the calculation where such space is separated from all of the resident spaces and resident-support spaces by 2-hour fire resistance-rated construction (including any building members that support the resident areas and emergency egress routes). In such a case, however, any appropriate charges under Safety Parameter 2, Hazardous Areas, in Worksheet 7.5.2 shall be charged. Also, the assignment of values for Safety Parameter 3, Manual Fire Alarm; Safety Parameter 7, Exit System; and Safety Parameter 8, Exit Access, shall not consider conditions in unoccupied spaces that do not involve any egress paths.

Note that zoning of buildings shall be permitted, and individual zones shall be permitted to have different safety values (levels). Such zoning shall, however, be limited to considerations of differences in Safety Parameters 6, 7, and 8, which cover exits and separation of sleeping areas. Zoning shall be by separate fire/smoke zones. A fire/smoke zone is a portion of the building separated from all other portions of the building by building construction having at least a 1-hour fire resistance rating or smoke barriers, or both, conforming to the requirements of Section 8.3 of NFPA 101, *Life Safety Code*, using smoke barriers of at least a $1\frac{1}{2}$ -hour fire resistance rating. Zoning of the facility also shall be permitted in nonfire-resistive sprinklered buildings, provided the construction separating one zone from another is sound resistant and smoke resistant.

7.4.3 Maintenance. All protection systems, requirements, arrangements, and procedures shall be maintained in a dependable operating condition, and a sufficient state of readiness, and shall be used in such a manner that the intended safety function or hazard constraint is not impaired. Otherwise, they shall receive no credit in the evaluation.

7.4.4 Safety Parameters (Worksheet 7.5.2). The safety parameters are a measure of those building factors that bear on or contribute to the safety of those persons who might be in the building at the time of a fire.

Each of the safety parameters is to be analyzed, and the safety value for each parameter that best describes the condition in the building is to be identified. Only one value for each of the parameters is to be chosen. If two or more values appear to apply, the one with the lowest point value shall be used.

7.4.4.1 Construction.

7.4.4.1.1 Story height is defined in 32.3.1.3.2 and 33.3.1.3.2 (NFPA 101).

7.4.4.1.2 Where the facility includes additions or connected structures of different construction, the rating and classification of the structure shall be based on the following:

- (1) Separate buildings where a 2-hour or greater fire resistance-rated separation exists between the portions of the building
- (2) The lower safety parameter point score involved where such a separation does not exist

7.4.4.1.3 The safety parameter values for Type V(000), Type III(200), and Type II(000) receive a higher parameter credit if the building is fully sheathed. This credit is to be given if all portions of the bearing walls, bearing partitions, floor construction, and roofs [or a roof/loft system if the space above the highest ceiling is inaccessible and either is provided with draft stops or other barriers on 30-ft (9.1-m) spacing or is provided with heat- or smoke-actuated fire detectors that sound the building fire alarm], and all columns, beams, girders, trusses, or similar bearing members either have an inherent fire resistance or are sheathed, encased, or otherwise treated to provide approximately a $1\frac{1}{2}$ -hour or greater fire resistance rating. Buildings fully sheathed with sound lath and plaster, gypsum board, or equivalent sheathing are considered as meeting these criteria.

7.4.4.2 Hazardous Areas. The assignment of parameter values for hazardous areas is a four-step process.

7.4.4.2.1 Step 1 — Identify Hazardous Areas. Hazardous areas are those having a degree of hazard greater than that normal to the general occupancy of the building, such as areas for storage of combustibles or flammables, for heat-producing appliances, or for maintenance purposes.

7.4.4.2.2 Step 2 — Determine the Level of Hazard. There are two levels of hazard: structurally endangering and not structurally endangering.

(a) *Structurally Endangering.* A hazardous occupancy with sufficient fire or explosion potential to defeat the basic integrity of the building framing as defined in 7.4.4.1.

(b) *Not Structurally Endangering.* A hazardous occupancy with sufficient fire potential to build to full involvement and present a danger of propagating through openings or wall partitions but not possessing sufficient total potential to endanger the structural framing or floor decking as defined in 7.4.4.1.

Table 7.4.4.2.2 provides an analysis of typical types of hazardous areas relative to inherent potential structural danger to different classes of structural systems.

Table 7.4.4.2.2 Hazardous Areas — Level of Hazard

Large Facility — Inherent Structural Danger from Typical Hazardous Areas			
Exposure (area, space, activity, condition)	Minimum Fire Resistance Rating of Bearing Walls, Bearing Partitions, Columns, Beams, Girders, Trusses, and Floor/Ceiling Assemblies Exposed to Hazardous Area		
	≥2 hours	≥1 hour to <2 hours	<1 hour
Occupational therapy space	N/SE	Varies*	SE
Craft shop	N/SE	Varies*	SE
General storage area	N/SE	Varies*	SE
Garage	N/SE	N/SE	SE
Boiler, heater, or incinerator rooms	N/SE	Varies*	SE
Fuel storage	N/SE	SE	SE
Trash chutes	N/SE	SE	SE
Trash rooms	N/SE	SE	SE
Small trash collection room	N/SE	N/SE	SE
Laundries (institutional type)	N/SE	N/SE	SE
Repair shops	N/SE	Varies*	SE

*Must be judged on the combustibles involved in the individual situation.

N/SE: not structurally endangering SE: structurally endangering

7.4.4.2.3 Step 3 — Determine the Fire Protection Provided.

The parameter value for hazardous areas is based on the presence or absence of the fire protection necessary to control or confine the hazard. Two different types of fire protection are considered. The first consists of automatic sprinklers or other appropriate extinguishing systems covering the entire hazard. The second is a complete fire resistance-rated enclosure, including the separation of the hazardous area from any bearing members, partitions separating the hazardous area from all other spaces, and doors to the space sufficient to exceed the potential of the fire load involved. Any hazardous space that has either of these protection systems is classed as having single protection. Any hazardous space that is both fully enclosed — as described above — and sprinklered is classed as having both (i.e., double level protection). On this basis, any hazardous area with a fuel load that has the potential of overwhelming the available structural capability could, as a minimum, have a single deficiency as determined in 7.4.4.2.4.

Note that where the hazardous area is within a living unit or abuts an egress route (exit or exit access) addressed in 7.4.4.7 and 7.4.4.8, the credit for sprinklers shall not be permitted unless the hazardous area is separated from the rest of the living unit or the egress route by reasonably smoke-resisting barriers and doors.

7.4.4.2.4 Step 4 — Determine Degree of Deficiency and Assign Parameter Values. The parameter value ultimately is determined by the degree of the deficiency of the hazardous area based on the level of protection needed. Table 7.4.4.2.4 provides a matrix for determining the degree of deficiency to be assessed.

In some situations, more than one hazardous area with the same or differing levels of deficiency exists. The overall parameter value then is based on the single most serious deficiency for the hazardous area.

Table 7.4.4.2.4 Hazardous Areas — Degree of Deficiency

	No protection	Sprinkler protection	Fire resistance-rated enclosure	Sprinklered and fire resistance-rated enclosure
Not structurally endangering	Single deficiency	No deficiency		
Structurally endangering	Double deficiency	Single deficiency	No deficiency ^a Double deficiency ^b	No deficiency ^a Single deficiency ^b

^aIf fire resistance and structural strength exceed maximum potential of hazard.

^bIf fire resistance and structural strength are not sufficient to withstand potential of hazard.

7.4.4.3 Manual Fire Alarm. Fire alarms are defined in 7.4.4.3.1 through 7.4.4.3.3.

7.4.4.3.1 None or Incomplete. There is no fire alarm system, or the system is incomplete and does not meet the requirements for a higher-scored category.

7.4.4.3.2 Without Fire Department Notification (W/O F.D. Notification). There is a fire alarm system that meets the requirements of 32.3.3.4 and 33.3.3.4 (NFPA 101), as appropriate.

7.4.4.3.3 With Fire Department Notification (W/F.D. Notification). There is a fire alarm system that complies with 7.4.4.3.2 and automatically transmits a signal to the fire department in accordance with 9.6.4 (NFPA 101).

7.4.4.4 Smoke Detection and Alarm. All references to detectors herein refer to smoke detectors. No credit is given for thermal detectors in habitable spaces except as specifically noted. Heat detectors can be credited in uninhabitable spaces where ambient temperatures can be expected to exceed 120°F (50°C) or fall below 0°F (-18°C) (such as in unfinished attics or cocklofts), provided separation from inhabited spaces is at least 1/2-hour fire resistance rated. The categories under this parameter are described in 7.4.4.4.1 through 7.4.4.4.4.

7.4.4.4.1 None or Incomplete. There are no detectors, or those that are present do not meet the requirements for a higher-scored category.

7.4.4.4.2 Single Station Units in Each Bedroom. There is one single station detector (sounds the alarm only at the responding detector) in each bedroom or sleeping room.

7.4.4.4.3 Interconnected System. Interconnected systems are those systems where the operation of any detector sounds alarm devices that alert all of the occupants. The alarm sounding device shall be permitted to be on other interconnected detectors or shall be permitted to be other separate alarm devices. Where the systems are of the total building variety, the credit shall be permitted to be given only if the system includes manual fire alarm features or the building has a manual fire alarm system and the operation of the detection system sounds the manual fire alarm as though a fire alarm box on that floor had been operated.

(a) *Corridors and Common Spaces without Bedroom/Suite Detectors.* The system meets the requirements of 32.3.3.4.8 and 33.3.3.4.8 (NFPA 101).

(b) *Corridors and Common Spaces with Single Station Bedroom/Suite Detectors.* There is one single station detector in each bedroom or sleeping room and interconnected detectors in corridors and common spaces that are spaced as described in 7.4.4.4.3(a).

(c) *Corridors and Common Spaces with Interconnected Bedroom/Suite Detectors.* The system is as in 7.4.4.4.3(b), except bedroom/suite detectors are interconnected with corridor/common space detectors. In buildings in which construction as specified in 7.4.4.1 is based on all members having a fire resistance rating of at least 1/2-hour or more, a system as described in 7.4.4.4.3(b) that also has a thermal detector in each bedroom/suite connected to the building fire alarm system shall be permitted to be credited in this category.

7.4.4.4.4 Total Building System. This system includes detectors located in every bedroom throughout the building and also provides detector coverage throughout all corridors, common spaces, and hazardous areas, with the system meeting the

requirements for an automatic fire alarm system in accordance with the NFPA 72, *National Fire Alarm Code*.

7.4.4.5 Automatic Sprinklers. Any sprinkler installation that meets the requirements of 32.3.3.5.1 and 33.3.3.5.1 (NFPA 101).

7.4.4.5.1 None or Incomplete. No credit is given if there are no sprinklers or if sprinklers, though present, are not sufficient to qualify for one of the other categories specified herein.

Note that any space that is credited as being protected by automatic sprinklers and abuts a hazardous area judged deficient in accordance with 7.4.4.2 shall not be permitted to be considered as sprinkler protected unless the hazardous area also is sprinkler protected.

7.4.4.5.2 Bedrooms/Suites Only. All bedrooms/suites have sprinkler protection.

7.4.4.5.3 Corridors and Common Spaces. Sprinkler protection covers all of the corridors and public spaces that separate, directly expose, or are in the egress path from the bedrooms/suites (except fire resistance-rated, enclosed, noncombustible stairwells). Sprinklers shall be installed along the corridor ceiling, and, in addition, one sprinkler shall be installed opposite the center of and inside of any bedroom door opening onto the corridor.

7.4.4.5.4 Bedrooms/Suites, Corridors, and Common Spaces. Sprinkler protection meets the combined requirements for 7.4.4.5.2 and 7.4.4.5.3 and is equipped with an automatic alarm initiating device that activates the building manual fire alarm system or an alternate evacuation alarm.

7.4.4.5.5 Total Building. The building is totally sprinkler protected and is equipped with an automatic alarm initiating device that activates the building manual fire alarm system or an alternate evacuation alarm.

7.4.4.6 Separation of Sleeping Rooms from Exit Access. Separation of sleeping rooms from exit access is based on the wall partitions that make up the separation and the protection of the openings in those partitions.

7.4.4.6.1 The charge for “None or Incomplete” (Safety Parameter 6 in Worksheet 7.5.2) is assessed in any case where the separation of sleeping rooms from exit access is insufficient to meet any of the other classifications in this parameter.

7.4.4.6.2 Definitions for “expectation of door closing” are the following:

(a) *Expectation — Not High.* This credit is given if the requirements for “expectation — high” are not met.

(b) *Expectation — High.* High expectation of a door closing (or being closed at time of fire) shall be considered to be met if the requirements of 32.3.3.6.6 and 33.3.3.6.6 (NFPA 101) are met.

7.4.4.6.3 Smoke Resisting. Sleeping rooms are separated from corridors or other common spaces by walls, partitions, or other constructions that resist the passage of smoke. There are no louvers, transfer grilles, operable transoms, or other air passages penetrating the wall except properly installed heating and utility installations.

Doors, in walls or partitions that separate sleeping rooms from corridors or other common spaces, resist the passage of smoke and are provided with latches, door closers, or other mechanisms suitable for keeping the doors tightly closed.

Vision panels shall be permitted to be installed in doors or partitions without respect to glass type or size.

7.4.4.6.4 Half-Hour. The credit is given if the requirements of 32.3.3.6.3 through 32.3.3.6.5 and 33.3.3.6.3 through 33.3.3.6.5 (NFPA 101) are met.

7.4.4.6.5 1-Hour Walls, 20-Minute Doors. Sleeping rooms are separated from corridors or other common spaces by walls or partitions and doors meeting the requirements of 7.4.4.6.4, and the walls and partitions have at least a 1-hour fire resistance rating.

Exception: Where doors meet the requirements of 7.4.4.6.4 and automatic sprinklers are provided on both sides of the door.

7.4.4.7 Exit System. Exit systems are the paths of travel from the facility to the outside. For the purposes of this parameter, however, only those exit routes used in fire drills in accordance with Sections 32.7 and 33.7 (NFPA 101) shall be credited.

7.4.4.7.1 Exposed Route. An exit route is exposed if a segment of that route is the only available route for one or more residents and that segment of the exit route is not separated from all other rooms or areas by walls and doors of equivalent separation to that credited in 7.4.4.6.

Exception No. 1: Where rooms or spaces are provided with an automatic sprinkler system.

Exception No. 2: Where rooms or spaces are provided with a smoke detection and alarm system connected to activate the building evacuation alarm; where furnishings, finishes, and furniture, in combination with all other combustibles within the space, are of such minimum quantity and are so arranged that a fully developed fire is unlikely to occur.

7.4.4.7.2 Multiple Routes. Multiple routes exist where the occupants of any sleeping room have, either from the sleeping room or through access in a corridor adjacent to the sleeping room, a choice of two separate exit routes to the outside.

7.4.4.7.3 Deficient. An exit route is deficient if it fails to meet any of the applicable criteria in 32.3.2 and 33.3.2 (NFPA 101), except those related to travel distances and dead ends. These conditions are evaluated separately in 7.4.4.8.

7.4.4.7.4 Without Horizontal Exit (W/O Horiz. Exit). An egress system is based on this charge if there are multiple routes that are not deficient but the arrangement does not include a horizontal exit as defined in 7.4.4.7.5 or that have an acceptable direct exit from each sleeping room as defined in 7.4.4.7.7.

7.4.4.7.5 With Horizontal Exit (W/ Horiz. Exit). The presence of a single horizontal exit meeting the criteria in 7.2.4 (NFPA 101) on each floor containing sleeping rooms shall be considered as sufficient criteria to meet this requirement, provided that the space created is of sufficient size to provide at least 3 ft² (0.28 m²) of accessible space for all of the potential occupants already present in or evacuating to such space.

7.4.4.7.6 Smokeproof Enclosure. Credit for a smokeproof enclosure shall be permitted to be given for a stairway designed and tested in accordance with the requirements of 7.2.3 (NFPA 101) for a smokeproof enclosure. To receive credit for a smokeproof enclosure, all exit stairs credited in Safety Parameter 7, Exit System, and Safety Parameter 8, Exit Access, of Worksheet 7.5.2 shall meet the smokeproof enclosure requirements.

7.4.4.7.7 Direct Exit. To be credited for direct exits, each sleeping room shall have within that unit a door that opens to the exterior at grade level or onto an unenclosed exterior balcony with direct access to an exterior exit or smokeproof enclosure. Where such openings are directly onto grade in a location where any person egressing can move directly away from the building without further exposure, the credit for direct exit shall be permitted, even if there are no other exit routes from the involved living unit.

Note that this parameter value does not cover the charges for the dead-end conditions, travel distance, interior finish in the egress routes (exits or exit access), or enclosure of stairways or other exit routes that pass from floor to floor. These elements are covered separately in 7.4.4.8, 7.4.4.9, and 7.4.4.10.

7.4.4.8 Exit Access. Exit access is a measurement of the travel distance from the sleeping rooms to the outside or to any other point of safety as defined in 3.3.151 (NFPA 101), whichever is shorter.

7.4.4.9 Interior Finish.

7.4.4.9.1 Classification of interior finish on walls and ceilings of the occupied space shall be in accordance with Section 10.2 (NFPA 101).

Exception: Exposed portions of structural members complying with the requirements of Type IV(2HH) construction shall be permitted.

Only floor coverings in the exit and exit access system are considered. For purposes of assigning the parameter values in Worksheet 7.5.2, such floor coverings are considered as having a flame spread ≤25 if they meet the requirements for Class I or Class II and as otherwise having a flame spread >75.

Exception: Previously installed floor coverings shall be permitted, subject to the approval of the authority having jurisdiction.

7.4.4.9.2 No consideration is included in the safety parameter value for any finish with a flame-spread rating greater than 200 or for any material not rationally measured by NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Materials not rationally measured include foam plastics, asphalt-impregnated paper, or other materials capable of inducing extreme rates of fire growth and rapid flashover. In any case involving these materials, the resultant risk is considered beyond the capacity of this evaluation system and requires individual appraisal.

Note that plywood of 1/4 in. (0.6 cm) or greater thickness should be considered as having a flame-spread rating of 200 or less.

7.4.4.10 Vertical Openings.

7.4.4.10.1 These values apply to vertical openings and penetrations including exit stairways, ramps, and any other vertical exits, pipe shafts, ventilation shafts, duct penetrations, and laundry and incinerator chutes. The charge for vertical openings shall be based on the presence or lack of enclosure and the fire resistance rating of the enclosure, if provided.

7.4.4.10.2 A vertical opening or penetration shall be classified as open, provided the following conditions apply:

- (1) It is unenclosed.
- (2) It is enclosed but does not have doors.
- (3) It is enclosed but has openings other than doorways.
- (4) It is enclosed with cloth, paper, or similar materials without any sustained firestopping capabilities, except as permitted by 32.3.3.1 and 33.3.3.1 (NFPA 101), as appropriate.

7.4.4.10.3 If a shaft other than a credited exit route (i.e., credited as one of the multiple routes required in 7.4.4.7.2 or in determining travel distance in 7.4.4.8) is enclosed on all floors but one and this results in an unprotected opening between that shaft and one, and only one, floor, the parameter value assigned to that shaft shall be 0. If a required egress route is contained in that shaft, the parameter value shall be (-2).

7.4.4.11 Smoke Control. Smoke control definitions are provided in 7.4.4.11.1 through 7.4.4.11.5.

7.4.4.11.1 None. There are no smoke barriers (or horizontal exits) on the floor, the floor is not served by a smokeproof enclosure, and there are no mechanically assisted smoke control systems serving the floor.

7.4.4.11.2 Smoke Barrier. Smoke barriers consist of installations conforming to the requirements of 33.3.3.7 (NFPA 101), as appropriate.

7.4.4.11.3 Mechanically Assisted Systems — by Floor. Mechanically assisted smoke control on a corridor basis is a tested and accepted smoke control system initiated by a method of smoke detection that ensures operation of the smoke control system before significant smoke has entered into the corridor involved. One method of judging the acceptability of smoke control systems is contained in NFPA 92A, *Recommended Practice for Smoke-Control Systems*.

The mechanism must be capable of pressurizing the corridor sufficiently to prevent smoke from the room/suite or space of origin from entering the corridor during the entire course of the fire. Such a system must be able to hold back the smoke through the expected maximum severity of the fire. It also must be capable of exhausting smoke from the corridor based on the assumption that the emergency evacuation procedures and other activities involving the opening and closing of doors will cause occasional brief periods during which the smoke control system is overpowered.

This results in the movement of the smoke from the fire area into the corridor. (The exhausting of the smoke normally would be accomplished by having an exhaust fan of lower capacity than the fan supplying air for pressurization exhaust from the corridor. The net pressurization force would occur from the effect of the pressurizing fan minus the effect of the removal or purging fan.)

The corridor's pressurizing system could involve early warning smoke detection, automatic closing of all room/suite doors, sprinkler protection, or all three. Where these additional protection devices are provided in order to effect such a smoke control system, the individual credits for each of the involved protection devices are in addition to the credits for the smoke control system.

7.4.4.11.4 Mechanically Assisted Systems — by Zone. Mechanically assisted smoke control on a zone basis shall include a smoke barrier (or a horizontal exit) supported by a tested and accepted smoke control system to provide a pressure differential that assists in confining smoke to the compartment of origin. One method of judging the acceptability of smoke control systems is contained in NFPA 92A, *Recommended Practice for Smoke-Control Systems*. Special smoke control fans shall be permitted to be used, or special adjustments of the normal building air movement fans shall be permitted to be made.

7.4.4.11.5 Mechanically Assisted Systems — by Room/Suite. Mechanically assisted smoke control on a room/suite basis is a tested and accepted smoke control system so designed as to provide a mechanism of automatically controlled fans, smoke vent

shafts, or a combination thereof to ensure a positive pressure differential that prevents intrusion of smoke into any room or suite not involved in fire. One method of judging the acceptability of smoke control systems is contained in NFPA 92A, *Recommended Practice for Smoke-Control Systems*. In this method, the rooms have a pressure differential higher than that of the corridor and of any room where fire has been detected. Such systems shall be so arranged that there is detection in each room or suite that prevents a room involved in fire from becoming positively pressurized.

7.5 Worksheets for Evaluating Fire Safety in a Large Facility. A large facility normally is one that has a capacity for more than 16 residents. For each facility to be evaluated, in Figure 7.5 complete Worksheet 7.5.1 and then Worksheets 7.5.2 through 7.5.7.

Step 1: Determine safety parameter values, using Worksheet 7.5.2. Select and circle the safety value for each safety parameter that best describes the conditions in the facility. Choose only one value for each of the 11 parameters. If two or more values appear to apply, choose the one with the lowest point value.

Step 2: Complete individual safety evaluations, using Worksheet 7.5.3.

A. Transfer each of the 11 circled safety parameter values from Worksheet 7.5.2 to every unshaded block in the line with the corresponding safety parameter in Worksheet 7.5.3. Where the block is marked “÷ 2 =,” enter one-half the value from Worksheet 7.5.2.

B. Add the four columns, keeping in mind that any negative numbers need to be deducted.

C. Transfer the resulting values for S_1 , S_2 , S_3 , and S_4 to the corresponding blocks in Worksheet 7.5.5.

Step 3: Determine mandatory requirements, using Worksheet 7.5.4(A) or 7.5.4(B).

A. Select the level of requirements from Worksheet 7.5.4(A) or 7.5.4(B), based on evacuation capability (see 3.3.5.6 of NFPA 101). Circle the appropriate values.

B. Transfer the circled values from Worksheet 7.5.4(A) or 7.5.4(B) to the corresponding blocks for S_a , S_b , S_c , and S_d in Worksheet 7.5.5.

Step 4: Evaluate equivalency.

A. Perform the subtractions indicated in Worksheet 7.5.5. Enter the differences in the appropriate answer blocks.

B. For each row, check “yes” if the value in the answer block is zero (0) or greater. Check “no” if the value in the answer block is a negative number.

Step 5: Evaluate other considerations.

A. Evaluate considerations not previously addressed, using Worksheet 7.5.6.

B. The equivalency covered by Worksheets 7.5.2 through 7.5.5 includes the majority of the considerations covered by the *Life Safety Code*. Some considerations are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 7.5.6, the Facility Fire Safety Requirements Worksheet. Complete one copy of this worksheet for each facility.

Step 6: Determine equivalency conclusions.

Conclude whether the level of life safety is at least equivalent to that prescribed by the *Life Safety Code*, using Worksheet 7.5.7. Worksheet 7.5.7, Conclusions, combines the zone fire safety equivalency evaluation of Worksheet 7.5.5 and the additional considerations of Worksheet 7.5.6.

FIGURE 7.5 Worksheets for evaluating fire safety in a large facility.

WORKSHEET 7.5.1 COVER SHEET															
Fire Safety Evaluation Worksheet for a Large Facility															
Facility Identification _____					Zone(s) Evaluated _____										
Evaluator _____					Date _____										
WORKSHEET 7.5.2 SAFETY PARAMETER VALUES — LARGE FACILITY															
Safety Parameters	Parameter Values														
1. Construction	Combustible					Noncombustible									
	Building Height	Type V(000)	Type V(111)	Type III(200)	Type III(211)	Type IV (2HH)	Type II(000)	Type II(111)	Type II(222) & Type I						
	1 Story	-2() ^a	0	-2() ^a	0	0	0	2	2						
	2 Stories	-6() ^a	0	-6() ^a	0	0	-5() ^a	2	2						
	3-4 Stories	-8() ^a	-2(0) ^q	-8() ^a	0	-2(0) ^q	-6() ^a	2	2						
	5-6 Stories	-8	-2(0) ^q	-8() ^a	0	-2(0) ^q	-6() ^a	2	2						
	Over 6 Stories	-10	-4	-10	-2(0) ^q	-4(0) ^q	-8	0	2						
2. Hazardous Areas	Within Bdrms./Suite or on Exit Routes				Elsewhere in Building			None, or No Deficiency							
	Double Deficiency		Single Deficiency		Double Deficiency		Single Deficiency								
	NP		-4		-4(-7) ^b		0(-4) ^b		0						
3. Manual Fire Alarm	None or Incomplete			Manual Alarm											
				W/O F.D. Notification		W/ F.D. Notification									
	0(2) ^f			2		3									
4. Smoke Detection and Alarm	None or Incomplete	Single Station Units in Each Bedroom	Interconnected System ⁱ				Total Building								
			W/O Bdrm./Suite Detectors	Single Station Bdrm./Suite Detectors		Interconnected Bdrm./Suite Detectors									
			-10(0) ^j	0(2) ^j	2(0) ^e				3(0) ^e (6) ^p		5(6) ^p				
5. Automatic Sprinklers	None or Incomplete		Bdrms./Suites Only		Corrs., Common Spaces		Bdrms./Suites, Corrs., Common Spaces		Total Building						
									AS	QRS					
	0		2(0) ^c		4(0) ^c		6		8	10					
6. Separation of Sleeping Rooms From Exit Access	None or Incomplete	Fire Resistance/Walls and Doors—Expectation of Door Closing													
		Expectation—Not High			Expectation—High										
		Smoke Resisting ^g	½-hr Walls 20-min Doors ^g		Smoke Resisting ^g	½-hr Walls 20-min Doors ^g				½-hr Walls 20-min Doors ^g					
		-6	-1(0) ^k		0(1) ^k		1			2(3) ^l		3(4) ^l			
7. Exit System	Single or Exposed Route		Multiple Routes												
			Deficient	W/O Horiz. Exit	W/ Horiz. Exit	Smokeproof Enclosure		Direct Exit							
	-6(0) ^m		-2(0) ^m	0		2		2		4					
8. Exit Access (from living unit)	Max. Dead End			No Dead End >50 ft and Travel Is:											
	>100 ft	>50 ft to ≤100 ft		>200 ft	>125 ft to ≤200 ft		>50 ft to ≤125 ft		≤50 ft						
	-6(0) ^d	-4(0) ^d		-2	-1		0		2						
9. Interior Finish	Flame-Spread Ratings														
	Exit Routes			>75 to ≤200			>25 to ≤75			≤25					
	Rooms/Suites			>75 to <200		≤75		>75 to ≤200		≤75		>25 to ≤200		≤25	
	-3		-1		0		1		1		2				
10. Vertical Openings	Open (or Incomplete Enclosure)					Enclosed ^h									
	Involving 5 or More Floors		3-4 Floors		2 Floors		<30 min	≥30 min <1 hr		≥1 hr					
	-10		-7		-2		-1	0		1(0) ^b					

Worksheet 7.5.2 continues.

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FIGURE 7.5 Continued

Worksheet 7.5.2 Continued

11. Smoke Control	None	Smoke Barriers	Mechanically Assisted Systems			
			By Floor		By Zone	By Rm./Suite
			W/O Part.	W/ Part.		
	0(2) ⁿ	2	2	3	3	4

NOTES:

- ^a Use (–1 X height in stories) if building is fully sheathed with plaster, gypsum board, or similar materials, but not < –2 if Parameter 5 is 8.
- ^b Use () if Parameter 1 is based on Type V(000), Type III(200), or Type II(000), if Note A does not apply, and if Parameter 5 is ≤4.
- ^c Use () if Parameter 1 is based on Type V(000), Type III(200), or Type II(000).
- ^d Use () if Parameter 7 is –6.
- ^e Use () if Parameter 6 is based on “none or incomplete,” or “walls or doors” are ½-hr walls/20-min doors and Parameter 5 is ≤4.
- ^f Use () for levels “prompt” and “slow” if Parameter 7 is 4 and building height is ≤3 stories.
- ^g Rate separation as:
- ½ hour (or actual rating, if greater) if Parameter 5 is ≥6.
 - Smoke resisting if Parameter 1 is based on Type V(000), Type III(200), or Type II(000), if building is not fully sheathed per Note A, and if Parameter 5 is ≥4.
- ^h Use 0 in 1-story building.
- ⁱ Interconnected system covers corridors and common spaces plus indicated bedroom or suite detectors.
- ^j Use () if Parameter 5 is ≥6.
- ^k Use () in facilities where each bedroom/suite has occupant controlled personal security access locks.
- ^l Use () if separations between bedrooms/suites also meet criteria.
- ^m Use () if requirements for 33.3.3.6.1 Exception No. 2 (NFPA 101) are met.
- ⁿ Use () if floor travel does not exceed 150 ft.
- ^p Use (6) if facility is protected throughout by quick-response automatic sprinklers and bedroom/suite detectors.
- ^q Use (0) if Parameter 5 is 8.
- NP – not permitted—system not usable while this condition exists.

For SI units: 1 ft = 0.348 m.

WORKSHEET 7.5.3 INDIVIDUAL SAFETY EVALUATIONS — LARGE FACILITY

Safety Parameters	Fire Control (S ₁)	Egress Provided (S ₂)	Refuge Provided (S ₃)	General Fire Safety Provided (S ₄)
1. Construction				
2. Hazardous Areas		÷ 2 =		
3. Manual Fire Alarm	÷ 2 =			
4. Smoke Detection and Alarm	÷ 2 =		÷ 2 =	
5. Automatic Sprinklers		÷ 2 =	÷ 2 = (See note.)	
6. Separation of Sleeping Rooms from Exit Access		÷ 2 =		
7. Exit System			÷ 2 =	
8. Exit Access (from living unit)				
9. Interior Finish	÷ 2 =			
10. Vertical Openings	÷ 2 =			
11. Smoke Control				
Total	S₁ =	S₂ =	S₃ =	S₄ =

NOTE: Use full value if Safety Parameter 1 is based on Type V(000), Type III(200), or Type II(000) construction.
Divide by 2 (÷2) in all other cases.

(For use with NFPA 101A-2001/NFPA 101-2000, B & C Large)

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FIGURE 7.5 Continued

**WORKSHEET 7.5.4A MANDATORY REQUIREMENTS — LARGE FACILITIES
(FOR USE IN ANY LARGE FACILITY)**

Level of Evacuation Difficulty and Building Height	Control Requirement (S_a)			Egress Requirement (S_b)			Refuge Requirement (S_c)			General Fire Safety Requirement (S_d)		
	New	Conv.	Exist.	New	Conv.	Exist.	New	Conv.	Exist.	New	Conv.	Exist.
Prompt ≤30 residents 1 Story	9	8	1.5	6	5.5	7.5	9.5	8.5	2	9	8	6
Prompt or slow 1 Story	11	8	3.5	7	5.5	8	11.5	8.5	4	11	8	8
2 Stories	7.5	4.5	2.5	8	6.5	8	8.5	5.5	3	8	5	7
3–6 Stories	11.5	8.5	4.5	8	6.5	8	12.5	9.5	5	12	9	9
Over 6 Stories	13.5	10.5	6.5	8	6.5	8	9.5	6.5	7	14	11	11

**WORKSHEET 7.5.4B MANDATORY REQUIREMENTS — EXISTING,
SPRINKLER PROTECTED, LARGE FACILITIES**

Level of Evacuation Difficulty and Building Height	Control Requirement (S_a)			Egress Requirement (S_b)			Refuge Requirement (S_c)			General Fire Safety Requirement (S_d)		
	Exist.			Exist.			Exist.			Exist.		
Prompt ≤30 residents 1 Story	5.5			3.5			6			5		
Prompt or slow 1 Story	5.5			3.5			6			5		
2 Stories	1.5			3.5			2			1		
3–6 Stories	5.5			3.5			6			5		
Over 6 Stories	7.5			3.5			4			7		

WORKSHEET 7.5.5 EQUIVALENCY EVALUATION

					Yes		No		
Control Provided (S_1)	minus	Required Control (S_a)	≥	0	$S_1 - S_a =$				
Egress Provided (S_2)	minus	Required Egress (S_b)	≥	0	$S_2 - S_b =$				
Refuge Provided (S_3)	minus	Required Refuge (S_c)	≥	0	$S_3 - S_c =$				
General Fire Safety (S_4)	minus	Required Gen. Fire Safety (S_d)	≥	0	$S_4 - S_d =$				

(For use with NFPA 101A-2001/NFPA 101-2000, B & C Large)

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7.6 Glossary for Fire Safety Evaluation Worksheet for an Apartment Building with Board and Care Occupancies.

7.6.1 Introduction. This glossary is provided to assist in completing Figure 7.7, Worksheets for Evaluating Fire Safety in an Apartment Building with Board and Care Occupancies to determine the suitability of an apartment building to house a board and care occupancy. This is the second step in a two-step procedure. The first step is to evaluate the portion of the building used as a board and care home; this second step evaluates the remainder of the building. The instructions for completing Figure 7.7 are included in its worksheets. They are not repeated in this glossary. This glossary provides expanded discussion and definitions for the various items in the worksheets to assist the user where questions of definition or interpretation arise. To the maximum extent possible, the glossary does not repeat the definitions already existing in NFPA 101, *Life Safety Code*, but rather references the appropriate paragraphs (NFPA 101).

7.6.2 Areas of Application.

7.6.2.1 The entire apartment building is evaluated on a form to the degree indicated by each item on the worksheet. See Worksheet 7.7.1. However, spaces that are not used for living units, not in direct utility or maintenance support of the living units, not provided for tenant use, or not in any way involved in resident emergency egress shall be permitted to be omitted from the calculation where such space is separated from all of the tenant and tenant-support spaces by 2-hour fire resistance-rated construction (including any members that bear the load of tenant-use space and with 1½-hour fire doors in any communicating opening). In such case, however, any appropriate charges under 7.6.4.2 in Worksheet 7.7.2 shall be charged.

7.6.2.2 The suitability of the apartment unit actually used as the board and care home is evaluated separately and shall be permitted to be evaluated before or after evaluating the suitability of the apartment building.

7.6.2.3 Where evaluating an apartment unit, consider the common corridor as equivalent to the outside where evaluating egress routes. Also, where evaluating egress routes, credit a window only if it can be used in an emergency evacuation.

7.6.3 Maintenance. All protection systems, requirements, arrangements, and procedures shall be maintained in a dependable operating condition and a sufficient state of readiness and shall be used in such a manner that the intended safety function or hazard constraint is not impaired. Otherwise, they shall receive no credit in the evaluation.

7.6.4 Safety Parameters (Worksheet 7.7.2). The safety parameters are a measure of those building factors that bear on or contribute to the safety of those persons who might be in the building at the time of a fire.

Each of the safety parameters is to be analyzed and the safety value for each parameter that best describes the condition in the building is to be identified. Only one value for each of the parameters is to be chosen. If two or more values appear to apply, the one with the lowest point value shall be used.

7.6.4.1 Construction. The construction parameter values are applied to the entire building as defined in 7.6.4.1.1 through 7.6.4.1.3.

7.6.4.1.1 In evaluating the construction values, the height of the building is the height of the board and care dwelling unit above grade regardless of the total height of the building.

7.6.4.1.2 Where the facility includes additions or connected structures of different construction, the rating and classification of the structure shall be based on the following:

- (1) Separate buildings where a 2-hour or greater fire resistance-rated separation exists between the portions of the building
- (2) The lower safety parameter point score involved where such a separation does not exist

7.6.4.1.3 The safety parameter values for Type V(000), Type III(200), and Type II(000) receive a higher parameter credit if the building is fully sheathed. This credit is to be given if all portions of the bearing walls, bearing partitions, floor construction, roofs [or a floor/loft system if the space above the highest ceiling is inaccessible and either is provided with draft stops or other barriers on 30-ft (9.1-m) spacing or is provided with heat- or smoke-actuated fire detectors that sound the building fire alarm], and all columns, beams, girders, trusses, or similar bearing members either have an inherent fire resistance or are sheathed, encased, or otherwise treated to provide approximately a 1½-hour or greater fire resistance rating. Buildings fully sheathed with sound lath and plaster, gypsum board, or equivalent sheathing are considered to meet this criterion.

7.6.4.2 Hazardous Areas. The hazardous area parameter applies to the entire building except the apartment(s) actually used for the residential board and care facility. The assignment of charges for hazardous areas is a four-step process.

7.6.4.2.1 Step 1 — Identify Hazardous Areas. Hazardous areas are those having a degree of hazard greater than that normal to the general occupancy of the building, such as areas for storage of combustibles or flammables, for heat-producing appliances, or for maintenance purposes.

7.6.4.2.2 Step 2 — Determine the Level of Hazard. There are two levels of hazard as follows:

(a) *Structurally Endangering.* A hazardous occupancy with sufficient fire or explosion potential to defeat the basic integrity of the building framing as defined in 7.6.4.1.

(b) *Not Structurally Endangering.* A hazardous occupancy with sufficient fire potential to build to full involvement and present a danger of propagating through openings or wall partitions but not possessing sufficient total potential to endanger the structural framing or floor decking as defined in 7.6.4.1.

7.6.4.2.3 Step 3 — Determine the Fire Protection Provided. The parameter value for hazardous areas is based on the presence or absence of the fire protection necessary to control or find the hazard. Two different types of fire protection are considered. The first consists of automatic sprinklers or other appropriate extinguishing systems covering the entire hazard. The second is a complete fire resistance-rated enclosure, including the separation of the hazardous area from any bearing members, partitions separating the hazardous area from all other spaces, and doors to the space sufficient to exceed the potential of the fire load involved. Any hazardous space that has either of these protection systems is classed as having single protection. Any hazardous space that is both fully enclosed — as described above — and sprinklered is classed as having both (i.e., double level protection). On this basis, any hazardous area with a fuel load that has the potential of overwhelming the available structural capability could as a minimum have a single deficiency as determined in 7.6.4.2.4.

Note that, where the hazardous area abuts an egress route (exit or exit access) addressed in 7.6.4.7 and 7.6.4.8, the credit

for sprinklers shall not be permitted unless the hazardous area is separated from the rest of the living unit or the egress route by reasonably smoke-resisting barriers and doors.

7.6.4.2.4 Step 4 — Determine Degree of Deficiency and Assign Parameter Values. The parameter value ultimately is determined by the degree of the deficiency of the hazardous area based on the level of protection needed. Table 7.6.4.2.4 provides a matrix for determining the degree of deficiency to be assessed.

In some situations, more than one hazardous area with the same or differing levels of deficiency exists. The overall charge is based on the single most serious deficiency for the hazardous area.

7.6.4.3 Manual Fire Alarm. Manual fire alarms are defined in 7.6.4.3.1 through 7.6.4.3.3.

7.6.4.3.1 None or Incomplete. There is no manual fire alarm system, or the system is incomplete and does not meet the requirements for a higher-scored category.

7.6.4.3.2 Without Fire Department Notification (W/O F.D. Notification). There is a manual fire alarm system, regardless of the number of stories or units, meeting the appropriate requirements of 30.3.4.1 through 30.3.4.3 (NFPA 101) and those requirements applicable to existing Option 1 apartment buildings in 31.3.4.1 through 31.3.4.3 (NFPA 101).

7.6.4.3.3 With Fire Department Notification (W/F.D. Notification). There is a manual fire alarm system that complies with the requirements of 7.6.4.3.2 and, in addition, automatically transmits a signal to the fire department in accordance with 9.6.4 (NFPA 101).

7.6.4.4 Smoke Detection and Alarm. These parameter values apply only to apartments other than the group residence and to the areas used for apartment corridors and other common spaces. A detection system as used herein is one based on the use of smoke detectors. No credit is given for thermal detectors.

7.6.4.4.1 None or Incomplete. There are no detectors, or, if any are present, they do not meet the requirements for a higher-scored category.

7.6.4.4.2 Single Station Detectors — Living Units Only. Single station detectors are those detectors that sound the alarm only at the location of the detector itself.

(a) *Single Level.* This value applies if each apartment covered by this parameter has at least one smoke detector and a higher value does not apply.

(b) *Every Level.* This parameter applies to those situations where there is one detector or more in each single level living unit or one detector or more on each level of any multilevel living unit. To receive this credit, at least one detector on each level must be loud enough to be heard in each sleeping room of the apartment involved.

The operation of single station units does not involve the transmission of the alarm beyond the sounding of the alarm device in the unit itself.

7.6.4.4.3 Interconnected Systems. Interconnected systems are those systems where the operation of any detector sounds alarm devices on other detectors, or other separate alarm systems, that are spread out sufficiently to alert all of the building occupants. Where the systems are of the total building variety, the credit shall be permitted to be given only if the building has a manual fire alarm system and the operation of the detection system sounds the manual fire alarm as though a fire alarm box on that floor had been operated. Interconnected systems must provide sounding devices that are sufficient in location and loudness to ensure the awakening of persons who sleep normally.

(a) *Corridors and Common Spaces.* This parameter applies to those situations where there is at least one detector spaced every 30 ft (9.1 m) in corridors and an additional detector in all common use spaces for each 900 ft² (83.6 m²) or less of floor space. Detectors shall be permitted to be omitted from common use spaces that comply with one of the following:

- (1) They are both sprinklered and protected from any egress routes or area of refuge or staging that serves the board and care home by the use of automatic-closing doors operated by smoke detection or activation of the sprinkler system.
- (2) They are separated from the egress route or area of refuge or staging in 7.6.4.4.3(a)(1) by fire resistance-rated construction and by automatic-closing doors of sufficient fire resistance rating to withstand the maximum fire potential in the common space.

(b) *Corridors and Common Spaces Plus Single Station Living Units.* To be credited in this category, detectors that comply with the requirements for detectors for every level in the living units specified in 7.6.4.4.2(b) and with the requirements for corridor and common spaces system in 7.6.4.4.3(a) must be provided.

7.6.4.4.4 Total Building System. A dwelling has a total building system if it meets the requirements of 31.3.4.4 for Option 2 (NFPA 101).

7.6.4.5 Automatic Sprinklers. The parameter values for automatic sprinklers are based on the protection of spaces outside the apartment used for group residences.

7.6.4.5.1 None or Incomplete. No credit is given if there are no sprinklers or if sprinklers, though present, are not sufficient to qualify for one of the other categories specified herein.

Note that any space that is credited as being protected by automatic sprinklers and abuts a hazardous area judged deficient in accordance with 7.6.4.2 shall not be permitted to be considered as sprinkler protected unless that hazardous area also is sprinkler protected.

Table 7.6.4.2.4 Hazardous Areas — Degree of Deficiency

	No protection	Sprinkler protection	Fire resistance-rated enclosure	Sprinklered and fire resistance-rated enclosure
Not structurally endangering	Single deficiency	No deficiency		
Structurally endangering	Double deficiency	Single deficiency	No deficiency ^a Double deficiency ^b	No deficiency ^a Single deficiency ^b

^aIf fire resistance and structural strength exceed maximum potential of hazard.

^bIf fire resistance and structural strength are not sufficient to withstand potential of hazard.

7.6.4.5.2 Corridors, Public Spaces. Sprinkler protection covers all of the corridors and public spaces that separate, directly expose, or are in the egress path from the living units (except fire resistance-rated, enclosed, noncombustible stairwells). Sprinklers shall be installed along the corridor ceiling, and, in addition, one sprinkler shall be installed opposite the center of and inside of any living unit door opening onto the corridor.

7.6.4.5.3 Living Units Only. All living units have sprinkler protection complying with the requirements for light hazard protection in NFPA 13, *Standard for the Installation of Sprinkler Systems*; NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, as appropriate.

7.6.4.5.4 Corridor and Habitable Space. Such space meets the combined requirements for 7.6.4.5.2 and 7.6.4.5.3.

7.6.4.5.5 Total Building. The building is totally sprinkler protected in accordance with Section 9.7 (NFPA 101) and is equipped with an automatic alarm initiating device that activates the building manual fire alarm system. Credit for total sprinkler protection shall not be given unless the living unit used for board and care purposes also is provided with total sprinkler protection.

7.6.4.6 Separation of Board and Care Home Unit and Its Exit Route from Other Spaces.

7.6.4.6.1 This parameter applies to all living units abutting corridors that might be used or involved in the exit system or to any areas of refuge or staging servicing the board and care unit. The separation requirements also apply to any common wall partitions between the board and care unit and any other living unit in the building.

7.6.4.6.2 Separation of living units from each other and from common spaces shall be based on the wall partition that makes up the separation and the protection of the openings in those partitions.

7.6.4.6.3 Duct penetrations where the duct is open on only one side of the partition and is of sheet steel construction shall be considered as equivalent to doors having a fire protection rating of at least 20 minutes. Where there are duct openings on both sides of the partition, the opening shall be considered unprotected unless there is a fire damper in the duct opening or the duct otherwise meets the requirements for omission of fire dampers as specified in NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

7.6.4.6.4 The partition shall be considered as “none or incomplete” if it has unprotected openings (louvers, gaps, transfer grilles, plain glass windows, or plain glass transoms) between the floor and the ceiling. If openings exist above the ceiling level (or even if the partition stops at the ceiling level), the walls shall be considered as complete if the ceiling itself is a complete membrane (such as plasterboard or lath and plaster). In this case, the fire resistance rating shall be based on that of the wall or ceiling system, whichever is less.

7.6.4.6.5 Walls shall be considered to have less than a $1\frac{1}{2}$ -hour fire resistance rating if they are not equivalent to $1\frac{1}{2}$ -in. (1.3-cm) gypsum wallboard, on both sides of studs, that is well nailed or fastened to the studs with appropriate taping and finishing of joints and fasteners. Walls shall be considered to be equivalent to or greater than a 1-hour fire resistance rating if

they are part of any of the established systems recognized as having 1-hour or more fire resistance in accordance with recognized tests or approved listings.

7.6.4.6.6 Doors shall be considered as “none or incomplete” if any living unit does not have a door, or if the living unit has a door but there is some mechanism or obstruction that prevents closing of the door or otherwise leaves a significant opening between the door and the corridor, or the door has open louvers, or the door has ordinary glass lights or transoms. Doors that have been blocked open by doorstops, chocks, tiebacks, or other devices that need manual unlatching or releasing action to close the door shall be classified as “none or incomplete.” Doors that are not provided with a latch or other device suitable for keeping the door tightly closed also shall be classified as “none or incomplete.”

Note that ordinary glass lights shall not be considered as requiring the “none or incomplete” classification in locations where both sides of the glass light are protected by automatic sprinklers.

7.6.4.6.7 Doors shall be considered as having 20-minute or greater fire protection rating if they are of $1\frac{3}{4}$ -in. (4.4-cm) thick solid bonded wood core construction or an arrangement of equivalent or greater stability in fire integrity. The thermal insulation capability of the door is not considered. Hollow steel or sheet steel doors, therefore, meet the 20-minute requirement.

7.6.4.6.8 Doors shall be considered automatic-closing if they are provided with either traditional self-closing mechanisms or release mechanisms actuated by smoke detectors. In the case of doors separating living units from each other or from common spaces, self-closing doors shall be permitted whether or not they are equipped with devices that can be used to hold them in the open position, provided the normal routine of the living unit is to keep the door closed, particularly after the occupants have retired for the night.

Note that this parameter category does not cover the charges for dead-end conditions, travel distance, interior finish in the egress routes (exit or exit access), or enclosure of stairways or other egress routes that pass from floor to floor. These elements are covered separately in 7.6.4.8, 7.6.4.9, and 7.6.4.10.

7.6.4.6.9 A separation is considered standard (i.e., rated as equivalent to walls greater than 1 hour, doors greater than 20 minutes) if the fire resistance of the doors and walls is equivalent to that specified by Chapters 30 and 31 (NFPA 101) for the protection level involved.

7.6.4.7 Exit System. This parameter applies to the entirety of the exit routes serving the group residence. Exit routes are the paths of travel from the living unit to the outside, using any of the types and arrangements described in Chapter 7 (NFPA 101).

7.6.4.7.1 Multiple Routes. Multiple routes exist where the occupants of any living unit have a choice of two separate exit routes to the outside, using those types permitted by Section 30.2 or 31.2, as appropriate (NFPA 101). Occupants have a choice of routes either from the living unit or through access in a corridor adjacent to the living unit. Single exit routes complying with Exception No. 2 to 30.2.4 or Exception No. 2 or Exception No. 3 to 31.2.4 (NFPA 101) qualify as multiple routes. [See 7.6.4.7.6 for facilities complying with the single exit route provisions of Exception No. 1 to 30.2.4 or Exception No. 1 to 31.2.4 (NFPA 101).]

7.6.4.7.2 Deficient. An exit route is deficient if it fails to meet any of the applicable criteria covered by Chapter 7 (NFPA 101). The exit system also is classed as deficient if a smoke barrier, as required by 31.3.7 (NFPA 101), is not provided.

7.6.4.7.3 Without Horizontal Exit (W/O Horiz. Exit). An egress system is based on this charge if there are multiple routes that are not deficient but the arrangement does not include a horizontal exit as defined in 7.6.4.7.4 or have an acceptable direct exit from each living unit as defined in 7.6.4.7.6.

7.6.4.7.4 With Horizontal Exit (W/ Horiz. Exit). A single horizontal exit on each floor containing living units shall be considered a horizontal exit if the space created is of sufficient size to provide at least 3 ft² (0.28 m²) of accessible space for all of the potential occupants, including those already present in and those evacuating to such space. The details of horizontal exits also shall meet the requirements of 7.2.4 (NFPA 101). A horizontal exit acts as a smoke barrier, and, where provided, is credited as both a smoke barrier in 7.6.4.11 and a horizontal exit in 7.6.4.7.

7.6.4.7.5 Smokeproof Enclosure. Credit for a smokeproof enclosure shall be permitted to be given if either the stairway so designated meets the requirements for a smokeproof enclosure specified in 7.2.3 (NFPA 101) or the stairway has an acceptably designed smoke pressurization system maintaining a positive pressure in the stairwell sufficient to prevent intolerable contamination of the stairwell by smoke or other fire effects. To receive the credit for smokeproof enclosures, all exit stairs credited in 7.6.4.7 and 7.6.4.8 must meet the smokeproof enclosure requirement.

7.6.4.7.6 Direct Exit. To be credited for direct exits, each living unit shall have within that unit a door that opens to the exterior at grade or onto an unenclosed exterior balcony with direct access to an unenclosed exterior exit or smokeproof enclosure. The credit for direct exit is applicable even if there are no other exit routes from the involved living unit and if the following apply:

- (1) The opening is directly onto a grade.
- (2) The exit is located so that any person egressing can move directly away from the building without further exposure.

Single exit routes complying with Exception No. 1 to 30.2.4 or Exception No. 1 to 31.2.4 (NFPA 101) qualify as direct exits. [See 7.6.4.7.1 for facilities complying with the single exit route provisions of Exception No. 2 to 30.2.4 or Exception No. 2 or Exception No. 3 to 31.2.4 (NFPA 101).] Existing buildings more than six stories in height with exterior exit access in accordance with Exception No. 1 to 31.3.5.6 (NFPA 101) qualify as having a direct exit.

7.6.4.8 Exit Access. This parameter applies only to the exit access route from the board and care home.

7.6.4.8.1 Exit access is a measurement of travel distance from the living unit to the outside or to an enclosed interior stairway or other exit (e.g., horizontal exit) or to a smoke barrier meeting the requirements in 7.6.4.11, whichever is shorter.

7.6.4.8.2 The charge for dead ends shall be made where any corridor affords access in only one direction to a required exit from the corridor. The calculation of the distance to determine the level of charge is the measurement from the centerline of the doorway exiting the living unit to the nearest point

where a person has a choice of two directions or routes of egress.

7.6.4.9 Interior Finish (Egress Routes). This parameter applies to all egress routes and areas serving or open to the egress path from the board and care home.

7.6.4.9.1 The interior finish within the living units is evaluated separately from the interior finish in the corridor and egress routes and other public space. Classification of interior finish is based on the flame-spread rating of the interior finish in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. The requirements apply to wall and ceiling finish materials as described in Section 10.2 (NFPA 101).

Exception: Exposed portions of structural members complying with the requirements of Type IV(2HH) construction shall be permitted.

7.6.4.9.2 Only floor coverings in the exit and exit access system are considered. For purposes of assigning the parameter values in Worksheet 7.7.2, such floor coverings are considered as having a flame spread ≤ 25 if they meet the requirements for Class I or II and as otherwise having a flame spread > 75 .

Exception: Previously installed floor coverings shall be permitted, subject to the approval of the authority having jurisdiction.

7.6.4.9.3 No consideration is included in the safety parameter value for any finish with a flame-spread rating greater than 200 or for any material not rationally measured by NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Materials not rationally measured include foam plastics, asphalt-impregnated paper, or other materials capable of inducing extreme rates of fire growth and rapid flashover. In any case involving these materials, the resultant risk is considered beyond the capacity of this evaluation system and requires individual appraisal.

Note that plywood of $1/4$ in. (0.6 cm) or greater thickness should be considered as having a flame-spread rating of 200 or less.

7.6.4.10 Vertical Openings. This parameter applies to those portions of vertical openings exposing the floor containing the group residence or the exit routes from an apartment.

7.6.4.10.1 These values apply to vertical openings and penetrations including exit stairways, ramps, and any other vertical exits, pipe shafts, ventilation shafts, duct penetrations, and laundry and incinerator chutes. The charge for vertical openings shall be based on the presence or lack of enclosure and the fire resistance rating of the enclosure, if provided.

7.6.4.10.2 A vertical opening or penetration shall be classified as open or incomplete provided the following conditions apply:

- (1) It is unenclosed.
- (2) It is enclosed but does not have doors.
- (3) It is enclosed but has openings other than doorways.
- (4) It is enclosed with cloth, paper, or similar materials without any sustained firestopping capabilities.

7.6.4.10.3 If a shaft other than a credited exit route (i.e., credited as one of the multiple routes required in 7.6.4.7.1 or in determining travel distance in 7.6.4.8.1) is enclosed on all floors but one and this results in an unprotected opening between that shaft and one, and only one, floor, the parameter value assigned to that shaft shall be 0. If a required egress route is contained in that shaft, the parameter value shall be (-2).

7.6.4.11 Smoke Control. This parameter applies to the floor containing the board and care home. Smoke control definitions are provided in 7.6.4.11.1 through 7.6.4.11.5.

7.6.4.11.1 None. There are no smoke barriers (or horizontal exits) on the floor, the floor is not served by a smokeproof enclosure, and there are no mechanically assisted smoke control systems serving the floor.

7.6.4.11.2 Smoke Barriers. Smoke barriers are partitions extending across the entire width of the building or so arranged as to combine a partition in the corridor with existing building elements and subdividing partitions and walls to partition the building into two completely separate units. The smoke barrier must be equipped with doors in the corridor that are self-closing, closed upon detection by smoke detectors located at the door arches, or closed by smoke detector systems that have been credited with a 6-point parameter value in 7.6.4.4. Smoke barriers also shall conform to the requirements of Section 8.3 (NFPA 101). A horizontal exit acts as a smoke barrier and is credited as both a smoke barrier in 7.6.4.11 and a horizontal exit in 7.6.4.7.

7.6.4.11.3 Mechanically Assisted Automatic Systems — by Zone. Mechanically assisted smoke control systems protected on a zone basis shall include a smoke barrier (or a horizontal exit) supported by a mechanism of automatic control fans, smoke vent shafts, or a combination thereof to provide a pressure differential that assists in confining smoke to the compartment of origin. Fans shall be permitted to be special smoke control fans, or special adjustments of the normal building air movement fans shall be permitted to be made.

7.6.4.11.4 Mechanically Assisted Automatic Systems — by Unit. Mechanically assisted smoke control systems protected on a living unit basis are systems so designed as to provide a mechanism of automatically controlled fans, smoke vent shafts, or a combination thereof to ensure a positive pressure differential that prevents intrusion of smoke into any living unit not involved in fire. Therefore, the living unit has a pressure differential higher than that of the corridor and higher than that of any living unit where fire has been detected. Such systems shall be so arranged that the detection mechanism in each living unit prevents a fire-involved living unit from becoming positively pressurized.

7.6.4.11.5 Mechanically Assisted Automatic Systems — by Corridor. A mechanically assisted smoke control system protected on a corridor basis is a system initiated by a method of smoke detection that ensures operation of the smoke control system before significant smoke has entered into the corridor involved. The mechanism must be capable of pressurizing the corridor sufficiently to prevent smoke from the living unit or space of origin from entering the corridor during the entire course of the fire.

Such a system must be able to hold back the smoke through the expected maximum severity of the fire. It also must be capable of exhausting smoke from the corridor based on the assumption that the emergency evacuation procedures and other activities involving the opening and closing of doors will cause occasional brief periods during which the smoke control system is overpowered. This results in the movement of the smoke from the fire area into the corridor. (The exhausting of the smoke normally would be accomplished by having an exhaust fan of lower capacity than that of the fan supplying air for pressurization exhaust from the corridor. The net pres-

surization force would occur from the effect of the pressurizing fan minus the effect of the removal or purging fan.)

The corridor's pressurizing system could involve early warning smoke detection, automatic closing of all living unit doors, or sprinkler protection, or all three. Where these additional protection devices are provided in order to effect such a smoke control system, the individual credits for each of the involved protection devices are in addition to the credits for the smoke control system.

7.7 Worksheets for Evaluating Fire Safety in an Apartment Building with Board and Care Occupancies.

For each apartment house containing one or more apartment units with a board and care occupancy, using Figure 7.7, complete the cover sheet in Worksheet 7.7.1 and Worksheets 7.7.2 through 7.7.7.

Step 1: Determine safety parameter values, using Worksheet 7.7.2. First, select and circle the safety value for each safety parameter in Worksheet 7.7.2 that best describes the conditions in the facility. Then choose only one value for each of the parameters. If two or more values appear to apply, choose the one with the lowest point value.

Step 2: Complete individual safety evaluations, using Worksheet 7.7.3.

A. Transfer each of the 11 circled safety parameter values from Worksheet 7.7.2 to every unshaded block in the line with the corresponding safety parameter in Worksheet 7.7.3. Where the block is marked “÷ 2 =,” enter one-half the value shown in Worksheet 7.7.2.

B. Add the four columns, keeping in mind that any negative numbers need to be deducted.

C. Transfer the resulting values for S_1 , S_2 , S_3 , and S_4 to the corresponding blocks in Worksheet 7.7.5.

Step 3: Determine mandatory requirements, using Worksheets 7.7.4(A) through 7.7.4(D).

A. Using the classifications of the building (i.e., “new” or “existing”), the building height, and the level of requirements established for small dwelling units, circle the appropriate value in each of the four columns in Worksheet 7.7.4(A), 7.7.4(B), 7.7.4(C), or 7.7.4(D), as appropriate.

B. Transfer the circled values from Worksheet 7.7.4(A), 7.7.4(B), 7.7.4(C), or 7.7.4(D) to the corresponding blocks for S_w , S_b , S_p , and S_d in Worksheet 7.7.5.

Step 4: Evaluate fire safety equivalency.

A. Perform the subtractions indicated in Worksheet 7.7.5. Enter the differences in the appropriate answer blocks.

B. For each row, check “yes” if the value in the answer block is zero (0) or greater. Check “no” if the value in the answer block is a negative number.

Step 5: Evaluate other considerations not previously addressed, using Worksheet 7.7.6. The equivalency covered by Worksheets 7.7.2 through 7.7.5 includes the majority of the considerations covered by the *Life Safety Code*. Some considerations are not evaluated by this method and must be considered separately. These additional considerations are covered in Worksheet 7.7.6, the Facility Fire Safety Requirements Worksheet. Complete one copy of this separate worksheet for each facility.

Step 6: Determine equivalency conclusions. First conclude whether the level of life safety is at least equivalent to that prescribed by the *Life Safety Code*, using Worksheet 7.7.7, Conclusions. This worksheet combines the zone fire safety equivalency evaluation of Worksheet 7.7.5 and the additional considerations of Worksheet 7.7.6.

FIGURE 7.7 Worksheets for evaluating fire safety for an apartment building with board and care occupancies.

WORKSHEET 7.7.1 COVER SHEET									
Fire Safety Evaluation Worksheet for an Apartment Building with Board and Care Occupancies									
Building Identification _____									
Evaluator _____ Date _____									
WORKSHEET 7.7.2 SAFETY PARAMETER VALUES — APARTMENT BUILDING									
Safety Parameters	Parameter Values								
1. Construction Building Height	Combustible					Noncombustible			
	Type V (000)	Type V (111)	Type III (200)	Type III (211)	Type IV (2HH)	Type II (000)	Type II (111)	Type II(222) & Type I	
	1 Story	-2() ^a	0	-2() ^a	0	0	0	2	2
	2 Stories	-6() ^a	0	-6() ^a	0	0	-5() ^a	2	2
	3-4 Stories	-8() ^a	-2(0) ^k	-8() ^a	0	-2(0) ^k	-6() ^a	2	2
	5-6 Stories	-8	-2(0) ^k	-8() ^a	0	-2(0) ^k	-6() ^a	2	2
	Over 6 Stories	-10	-4	-10	-2(0) ^k	-4(0) ^k	-8	0	2
2. Hazardous Areas (outside board & care home units)	Double Deficiency		Single Deficiency			None or No Deficiency			
	-4(-7) ^{b,g}		0(-4) ^g			0			
3. Manual Fire Alarm	None or Incomplete		Manual Alarm						
	0(2) ⁱ		W/O F.D. Notification			W/ F.D. Notification			
			2			3			
4. Smoke Detection and Alarm (outside board & care home units)	None or Incomplete	Single Station Living Units Only		Interconnected System		Total Building			
		Single Level	Every Level	Corrs. & Common Spaces	Corrs., Common Spaces, & Living Units				
		-4(0) ^j	0	2(0) ^e	3(0) ^e	4	6		
5. Automatic Sprinklers (outside board & care home units)	None or Incomplete	Corrs., Public Spaces	Living Units Only	Corrs., Hab., & Public Spaces	Total Building				
	0	2(0) ^c	4(0) ^c	6	8				
6. Separation of Board & Care Home Unit and Its Exit Route from Other Spaces	None or Incomplete	Walls <30 min		Walls ≥30 min to <1 hr		Walls ≥1 hr			
		Doors <20 min W/O Closer	Doors ≥20 min W/O Closer	Doors <20 min W/Closer	Doors ≥20 min W/Closer	Doors <20 min W/Closer	Doors ≥20 min W/Closer		
		-6	-2	0(-2) ^b	1(-2) ^b	2(-2) ^b	1(-2) ^b	4(-2) ^b	
7. Exit System (serving board & care home units)	<2 Standard Routes	Multiple Routes							
	-6	Deficient	W/O Horiz. Exit	W/ Horiz. Exit	Smokeproof Enclosure	Direct Exit			
		-2	0	2	2	4			
8. Exit Access (serving board & care home units)	Max. Dead End Is		No Dead End > 50 ft and						
	>100 ft	>50 ft or corridor common path >35 ft	>200 ft	>150 ft to ≤200 ft	>100 ft to ≤150 ft	>50 ft to ≤100 ft	≤50 ft		
	-6(0) ^d	-4(0) ^d	-2	-1	0	1	2		
9. Interior Finish (egress routes serving board & care home units)	Flame-Spread Ratings								
	>75 to ≤200		>25 to ≤75			≤25			
	-3		-1			0			

Worksheet 7.7.2 continues.

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FIGURE 7.7 Continued

Worksheet 7.7.2 Continued

10. Vertical Openings	Open or Incomplete Enclosure			Enclosed ^h	
	Thru 5 or More Floors	3–4 Floors	2 Floors	<1 hr ^f	≥1 hr ^f
	–10	–7	–2	0	1(0) ^b
11. Smoke Control (serving floors having board & care home units)	Mechanically Assisted Systems				
	None	Smoke Barriers	By Zone	By Unit	By Corridor
	0(2) ^l	2	3	3	4

NOTES:

^a Use (–1 X height in stories) if building is fully sheathed with plaster, gypsum board, or similar materials but not <–2 if Parameter 5 is 8.

^b Use () if Parameter 1 is based on Type V(000), Type III(200), or Type II(000), if Note ^a does not apply, and if Parameter 5 is ≤4.

^c Use () if Parameter 1 is based on Type V(000), Type III(200), or Type II(000).

^d Use () if Parameter 7 is –6.

^e Use () if Parameter 6 is based on “None or Incomplete,” or “Walls or Doors” are ½-hr walls/20-min doors and Parameter 5 is ≤4.

^f ≥30 min in existing building.

^g Use () if hazardous area is on exit route or in refuge area serving group home unit.

^h Use 0 in 1-story building.

ⁱ Use (2) in 1–3 story buildings with <12 living units.

^j Use () if Parameter 5 is ≥6.

^k Use (0) if Parameter 5 is 8.

^l Use () where exceptions to 31.3.7 (NFPA 101) apply.

For SI units: 1 ft = 0.348 m.

WORKSHEET 7.7.3 INDIVIDUAL SAFETY EVALUATIONS — APARTMENT BUILDINGS

Safety Parameters	Fire Control (S ₁)	Egress Provided (S ₂)	Refuge Provided (S ₃)	General Fire Safety Provided (S ₄)
1. Construction				
2. Hazardous Areas		÷ 2 =		
3. Manual Fire Alarm	÷ 2 =			
4. Smoke Detection and Alarm	÷ 2 =			
5. Automatic Sprinklers		÷ 2 =	÷ 2 = (See note.)	
6. Separation of Living Units		÷ 2 =		
7. Exit System			÷ 2 =	
8. Exit Access				
9. Interior Finish				
10. Vertical Openings	÷ 2 =			
11. Smoke Control				
Total	S₁ =	S₂ =	S₃ =	S₄ =

NOTE: Use full value if Safety Parameter 1 is based on Type V(000), Type III(200), or Type II(000) construction.
Divide by 2 (÷2) in all other cases.

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FIGURE 7.7 Continued

WORKSHEET 7.7.4A MANDATORY REQUIREMENTS — SPRINKLERED AND NONSPRINKLERED APARTMENT BUILDINGS									
Building Height	Level of Evacuation Difficulty	Control Requirements (S_a)		Egress Requirements (S_b)		Refuge Requirements (S_c)		General Fire Safety Requirements (S_d)	
		New	Exist.	New	Exist.	New	Exist.	New	Exist.
1 Story	Prompt/Slow Impractical	10	3	4.5	6	8	3	8	6
		11	6	4.5	6	5	6	9	9
2–6 Stories	Prompt/Slow Impractical	10.5	4.5	6	7	9	5	9	8
		14.5	6.5	6	7	9	7	13	10
>6 Stories	Prompt/Slow Impractical	12.5	11.5	6	7.5	7	8	11	10
		14.5	13.5	6	7.5	9	10	13	14

WORKSHEET 7.7.4B MANDATORY REQUIREMENTS — NEW NONSPRINKLERED APARTMENT BUILDINGS MEETING EXCEPTION TO 30.3.5.2 (NFPA 101)					
Building Height	Level of Evacuation Difficulty	Control Requirements (S_a)	Egress Requirements (S_b)	Refuge Requirements (S_c)	General Fire Safety Requirements (S_d)
1 Story	Prompt/Slow	5	10	5	11
2 Stories	Prompt/Slow	2.5	8	3	7
3–6 Stories	Prompt/Slow	6.5	11	7	13
>6 Stories	Prompt/Slow	8.5	11	9	15

WORKSHEET 7.7.4C MANDATORY REQUIREMENTS — NEW FACILITIES LOCATED IN EXISTING NONSPRINKLERED APARTMENT BUILDINGS					
Building Height	Level of Evacuation Difficulty	Control Requirements (S_a)	Egress Requirements (S_b)	Refuge Requirements (S_c)	General Fire Safety Requirements (S_d)
1 Story	Prompt ≤30 residents	4	6	2	6
	Prompt >30 residents or slow	5	6	3	7
2 Stories	Prompt/Slow	4.5	7	3	7
3–6 Stories	Prompt/Slow	6.5	11	7	13

WORKSHEET 7.7.4D MANDATORY REQUIREMENTS — NEW FACILITIES LOCATED IN EXISTING SPRINKLERED APARTMENT BUILDINGS					
Building Height	Level of Evacuation Difficulty	Control Requirements (S_a)	Egress Requirements (S_b)	Refuge Requirements (S_c)	General Fire Safety Requirements (S_d)
1 Story	Prompt/Slow/Impractical	9	4.5	3	7
2 Stories	Prompt/Slow	10.5	6	5	9
	Impractical	12.5	6	7	11
3–6 Stories	Prompt/Slow	10.5	6	9	9
	Impractical	14.5	6	9	13
>6 Stories	Prompt/Slow	12.5	6	7	11
	Impractical	14.5	6	9	13

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FIGURE 7.7 Continued

WORKSHEET 7.7.5 EQUIVALENCY EVALUATION						Yes	No
Control Provided (S_1)	minus	Required Control (S_a)	≥	0	$S_1 - S_a =$		
Egress Provided (S_2)	minus	Required Egress (S_b)	≥	0	$S_2 - S_b =$		
Refuge Provided (S_3)	minus	Required Refuge (S_c)	≥	0	$S_3 - S_c =$		
General Fire Safety (S_4)	minus	Required Gen. Fire Safety (S_d)	≥	0	$S_4 - S_d =$		

WORKSHEET 7.7.6 FACILITY FIRE SAFETY REQUIREMENTS WORKSHEET			
Considerations	Met	Not Met	Not Applic.
A. Utilities comply with the provisions of 32.3.6.1 and 33.3.6.1.	☐	☐	☒
B. Heating, ventilating, and air conditioning equipment comply with the provisions of 32.3.6.2 and 33.3.6.2, except for enclosure of vertical openings, which have been considered in Safety Parameter 10 of Worksheet 7.7.2.	☐	☐	☒
C. Elevators, dumbwaiters, and vertical conveyors comply with the provisions of 32.3.6.3 and 33.3.6.3.	☐	☐	☐
D. Rubbish chutes, incinerators, and laundry chutes comply with the provisions of 32.3.6.4 and 33.3.6.4.	☐	☐	☒
E. Complies with the applicable requirements of Sections 32.7 and 33.7.	☐	☐	☐

All references are to NFPA 101, *Life Safety Code*.

WORKSHEET 7.7.7 CONCLUSIONS
1. ☐ All of the checks in Worksheet 7.7.5 are in the “Yes” column. The level of fire safety is at least equivalent to that prescribed by NFPA 101, <i>Life Safety Code</i> , for apartments to house a board and care occupancy.*
2. ☐ One or more of the checks in Worksheet 7.7.5 are in the “No” column. The level of fire safety is not shown by this system to be equivalent to that prescribed by NFPA 101 for apartments to house board and care occupancy.
* The equivalency covered by this worksheet includes the majority of considerations covered by NFPA 101, <i>Life Safety Code</i> . There are some considerations that are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 7.7.6, Facility Fire Safety Requirements Worksheet. One copy of this worksheet is to be completed for each facility.

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Chapter 8 Fire Safety Evaluation System for Business Occupancies

8.1 Introduction. This chapter is part of an NFPA guide and therefore is not mandatory. The term *shall* in this chapter is used to indicate that if the provisions of the chapter are applied, the procedures mandated are to be followed to ensure the effectiveness of the evaluation system.

The Fire Safety Evaluation System (FSES) is a measuring system. It compares the level of safety provided by an arrangement of safeguards that differ from those specified in NFPA 101, *Life Safety Code*, to the level of safety provided in a building that conforms exactly with the details of the *Code*.

8.2 Procedure for Determining Equivalency.

8.2.1 Evaluate the factors affecting either every fire zone or the building as a whole using Figure 8.6, Worksheets for Evaluating Fire Safety in Business Occupancies.

8.2.1.1 Zoning must divide the building into units that consist of one or more complete fire/smoke zones. A fire/smoke zone is a portion of a building that is separated from all other portions of the building by vertical or horizontal fire barriers having at least a 1-hour fire resistance rating or vertical smoke barriers conforming to the requirements of Section 8.3 (NFPA 101), or a combination of both.

Any vertical openings (shafts, stairs) involved also must provide 1-hour separation (except that stair doors shall be permitted to be 45-minute fire resistance-rated doors). In facilities completely protected by automatic sprinkler protection, these fire resistance requirements do not apply. The elements separating one zone from another, however, must be of sound, smoke-resisting construction. Doors in zone separations must be either self-closing or equipped with automatic closers operated by smoke detectors.

8.2.1.2 Zones shall be permitted to be either adjacent to each other (e.g., separate wings or building sections) or above each other (e.g., floors or groups of floors).

8.2.1.3 Each zone containing spaces used for business occupancy can be evaluated using this system.

8.2.1.4 Each of the safety parameters is to be analyzed, and the safety value for each parameter that best describes the condition in the building is to be identified.

8.2.2 Using the Facility Fire Safety Requirements Worksheet (Worksheet 8.6.6), determine the acceptability of the general building systems (utilities; HVAC; elevator installations; standpipes and fire extinguishers; and rubbish chutes, incinerators, and laundry chute installations).

8.2.3 Equivalency is achieved if the building or fire/smoke zone evaluations show equivalency or better in each and every zone and the requirements of the Facility Fire Safety Requirements Worksheet (Worksheet 8.6.6) are met.

8.3 Glossary for Fire Safety Evaluation Worksheet for Business Occupancies.

8.3.1 Introduction. This glossary is provided to assist in completing the Worksheets for Evaluating Fire Safety in Business Occupancies. This glossary provides expanded discussion and definitions for the various items in the worksheets to assist the user where questions of definition or interpretation arise. To

the maximum extent possible, the glossary does not repeat the definitions already existing in NFPA 101, *Life Safety Code*, but rather references the appropriate paragraphs (NFPA 101).

8.3.2 Areas of Application.

8.3.2.1 The entire building can be evaluated on a single set of worksheets. The building might, however, be zoned by considering each zone separately or by using any convenient grouping of zones. The choice of zoning normally is based on the approach that produces the most functional or economical results.

8.3.2.1.1 Charges for Safety Parameter 2, Segregation of Hazards, in Worksheet 8.6.2, apply to any hazardous area in the zone being evaluated and to any hazardous area in zones adjacent to or below the zone being evaluated.

8.3.2.1.2 Where zones are located above each other, the value assigned to Parameter 1, Construction, in Worksheet 8.6.2, in each zone is based on the highest story used for regular human occupancy in that "stack of zones" and the type of construction for that stack of zones.

8.3.2.1.3 The assignment of values for Safety Parameter 5, Fire Alarm; 10, Egress Route; and 9, Exit Access, in Worksheet 8.6.2, does not consider conditions in unoccupied spaces in other zones where such are not involved in any egress paths.

8.3.2.1.4 The evaluation of Safety Parameter 10, Egress Route, in Worksheet 8.6.2, includes those portions of any egress route that serve the zone being evaluated. Any exposures or deficiencies pertaining to any part of the egress route must be taken into account in the evaluation of the zone.

8.3.2.2 Zones that do not involve regular human occupancy, are evaluated the same as those with regular human occupancy, with the following variations.

- (1) Any such zone shall be permitted to be omitted from the numerical evaluation if both of the following conditions are met:
 - a. The zone is not involved in the egress route from any space with regular human occupancy.
 - b. The zone conforms to NFPA 101, *Life Safety Code*, requirements applicable to its use.
- (2) Alternatively, such zones shall be permitted to be evaluated using this system, on the condition that any additional egress capabilities and arrangements appropriate to the specific use of the space are provided.

8.4 Maintenance. All protection systems, requirements, arrangements, and procedures shall be maintained in a dependable operating condition, and a sufficient state of readiness, and shall be used in such a manner that the intended safety function or hazard constraint is not impaired. Otherwise, they shall receive no credit in the evaluation.

8.5 Safety Parameters (Worksheet 8.6.2). The safety parameters are a measure of those building factors that bear on or contribute to the safety of those persons who might be in the building at the time of a fire. The safety parameters in Worksheet 8.6.2 are described in the following subsections.

8.5.1 Construction. Construction types are classified in accordance with the definitions of NFPA 220, *Standard on Types of Building Construction*. Where the facility includes additions or

connected structures of different construction, the rating and classification of the structure is based on one of the following:

- (1) Separate buildings where the separation between the portions of the building is a fire barrier having at least a 1-hour fire resistance rating and any opening protectives have at least a 45-minute fire protection rating
- (2) The lower safety parameter point score involved where such a separation does not exist

8.5.2 Segregation of Hazards. The assignment of charges for unsegregated hazardous areas is a four-step process.

8.5.2.1 Step 1 — Identify Hazardous Areas. A hazardous area is any space or compartment in which a storage or other activity exists that is not a part of normal office space arrangements and that possesses the potential for producing a fully involved fire.

8.5.2.2 Step 2 — Determine the Level of Hazard. There are two levels of hazard: structurally endangering and not structurally endangering.

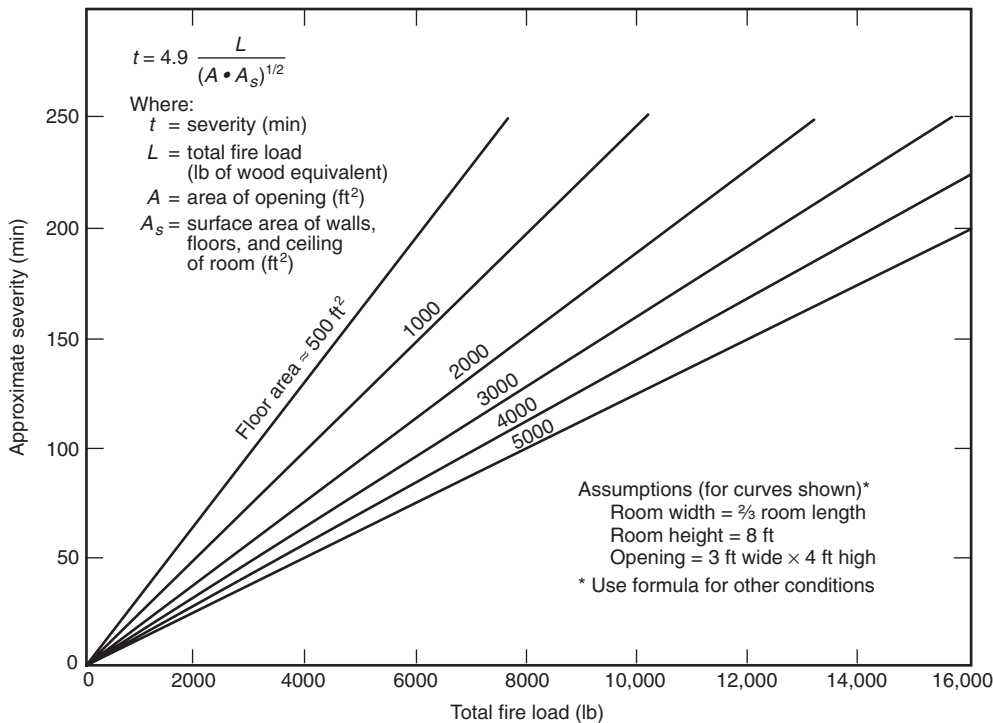
(a) *Structurally Endangering.* A hazardous area with a potential fire severity that might exceed the tested resistance of the

enclosure and defeat the basic structural integrity of the building framing as defined in Safety Parameter 1, Construction, of Worksheet 8.6.2. [See Figure 8.5.2.2(a) for determining approximate potential fire severity.]

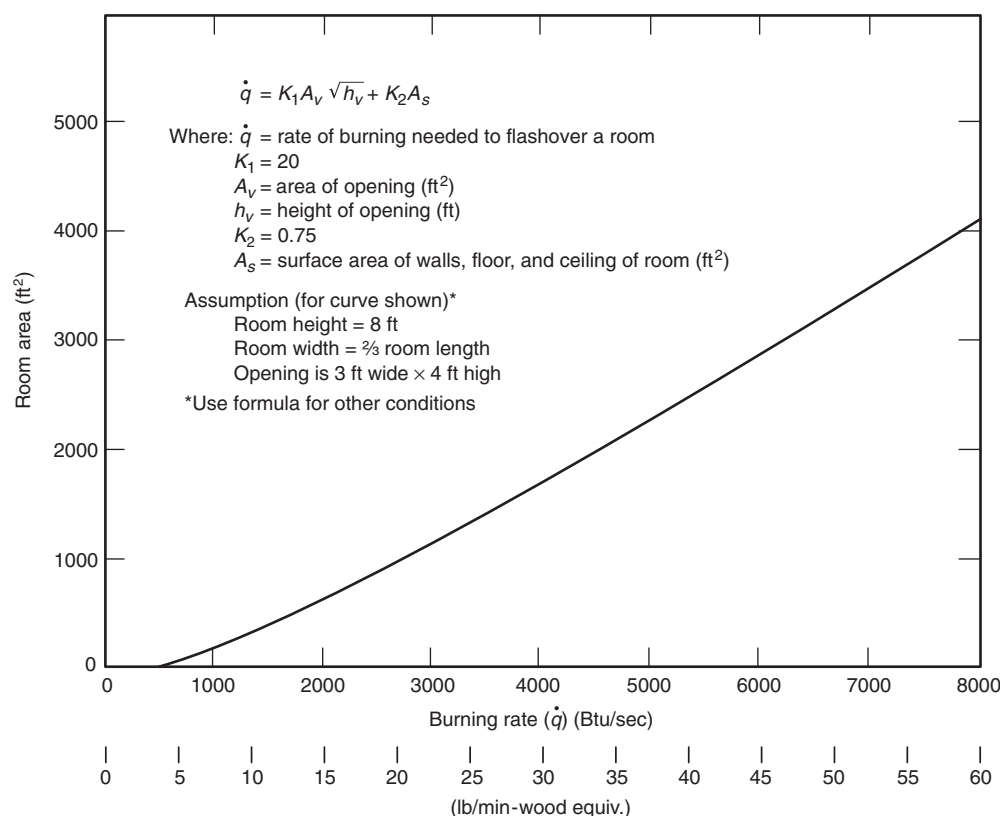
Example: For a room 20 ft × 30 ft × 8 ft high (6.1 m × 9.1 m × 2.4 m high) with a (window) opening 3 ft wide × 4 ft high (0.9 m wide × 1.4 m high), 3000 lb (1361 kg) of ordinary fuel can produce a fire severity of approximately 95 minutes. If the fire resistance of the hazardous area enclosure is less than 95 minutes and the fire is likely to continue to its estimated duration, the hazardous area shall be permitted to be classed as structurally endangering.

(b) *Not Structurally Endangering.* A hazardous area with sufficient fire potential to build to full involvement (flashover) and present a danger of propagating through openings or wall partitions but not possessing sufficient total potential to endanger the structural framing or floor decking as defined in Safety Parameter 1 of Worksheet 8.6.2. [See Figure 8.5.2.2(b) for assistance in estimating the fire size needed to flash over the area containing various combustible contents.]

FIGURE 8.5.2.2(a) Approximate fire severity.



For SI units: 1 lb = 0.4536 kg; 1 ft = 0.3048 m; 1 ft² = 0.0929 m²

FIGURE 8.5.2.2(b) Approximate flashover energy.

For SI units: 1 lb = 0.4536 kg; 1 ft = 0.3048 m; 1 ft² = 0.0929 m²; 1 Btu/sec = 1.055 kW

8.5.2.3 Step 3 — Determine the Fire Protection Provided. The parameter value for hazardous areas is based on the presence or absence of the fire protection necessary to control or confine the hazard. Two different types of fire protection are considered. The first consists of automatic sprinklers or other appropriate extinguishing systems covering the entire hazard. The credit for sprinklers shall not be given unless the hazardous area is separated from the rest of human occupancy or the egress route by reasonably smoke-resistant partitions and doors. The second is a complete fire enclosure having a sufficient fire resistance rating to contain the potential fire severity of the hazardous area. This includes the following:

- (1) The separation of the hazardous area from any structural framing members
- (2) Partitions separating the hazardous area from all other spaces

- (3) Fire protection rated doors sufficient to exceed the potential of the fire load involved

Any hazardous space that has any of these protection systems is classified as having single protection.

8.5.2.4 Step 4 — Determine Degree of Deficiency and Assign Parameter Values.

8.5.2.4.1 The parameter value ultimately is determined by the degree of the deficiency of the hazardous area based on the level of protection needed. Table 8.5.2.4.1 provides a matrix for determining the degree of deficiency to be assessed.

8.5.2.4.2 In some situations, more than one hazardous area with the same or differing levels of deficiency exists. The overall charge is based on the single most serious deficiency for the hazardous area.

Table 8.5.2.4.1 Segregation of Hazards — Degree of Deficiency

	No protection	Sprinkler protection	Fire-resistive enclosure*	Sprinklered and fire-resistive enclosure*
Not structurally endangering	Single deficiency	No deficiency		
Structurally endangering	Double deficiency	Single deficiency	No deficiency	

*Complete enclosure having sufficient fire resistance to contain the potential of the hazardous area.

8.5.2.4.3 Open-Plan Office Space.

8.5.2.4.3.1 A sprinkler-protected open-plan office space is not considered a hazardous space.

8.5.2.4.3.2 An unsprinklered open-plan office space is not considered a hazardous space unless it involves such a collection of fuel that flashover is likely to occur. This can be estimated in the following manner.

(a) Appraise the largest fuel concentrations. A fuel concentration is a collection of combustible materials (desks, files, or other material or items) that is separated from other fuel concentrations by a clear space that is 2 ft (61 cm) wide or one-half the height of the collection, whichever is greater. Floor covering is not considered in this estimate.

(b) The burning rate is based on the best available data. If test data are available, use those data; otherwise use Table 8.5.2.4.3.2. If data are not available and Table 8.5.2.4.3.2 is not sufficient, the burning rate is based on 125 Btu/sec · ft² of actual fuel-covered floor space for typical wooden desk modules. Ignore space occupied by metal desks or metal file cabinets. For open-shelf storage or similar piled or stacked concentrations of combustible materials, estimate 100 Btu/sec/ft² of covered floor space for each foot of height of combustible material. Double these figures for the portion of the fuel assembly that is foamed plastic.

(c) Based on the estimated burning rate, appraise the flashover potential. Use Figure 8.6.2.2(b).

(d) If flashover is shown as a potential, use Figure 8.6.2.2(a) to appraise severity, classify the space as a hazardous area, and assign charges, as appropriate.

8.5.3 Vertical Openings. These values apply to vertical openings and penetrations including exit stairways, ramps, and any other vertical exits, pipe shafts, ventilation shafts, duct penetrations, and laundry and incinerator chutes. The charge for vertical openings is based on the fire resistance of the enclosure, if provided. Where the protection of vertical openings (other than exits) meets the requirements of 38.3.1 and 39.3.1 (NFPA 101), the parameter is assessed on the basis of "Enclosed, >1 hr" for new buildings >75 ft in height, and "Enclosed, 30 min to 1 hr" for all other buildings.

8.5.3.1 A vertical opening or penetration is classified as open if it has any of the following characteristics:

- (1) Unenclosed
- (2) Enclosed but has doorways (or similar portals) that are without doors
- (3) Enclosed but has unprotected openings other than doorways
- (4) Enclosed with cloth, paper, or similar materials without any sustained firestopping capabilities

8.5.3.2 The credit for vertical opening protection varies depending on the number of stories connected by the vertical opening and the degree of enclosure.

8.5.4 Sprinklers.

8.5.4.1 Where an automatic sprinkler is installed for either total or partial building coverage, the system shall be in accordance with the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

8.5.4.2 To receive credit for protection, the sprinkler system must be equipped with an automatic alarm initiating device that activates the building manual fire alarm system or other-

wise sounds an alarm sufficiently audible to be heard in all occupied areas.

8.5.4.3 To receive credit for "total building" sprinkler protection, the entire building must be provided with sprinkler coverage and must cover all zones of the building.

8.5.5 Fire Alarm. Fire alarms are defined in 8.5.5.1 through 8.5.5.4.

8.5.5.1 None. There is no fire alarm system, or the system is incomplete and does not meet the requirements for a higher-scored category.

8.5.5.2 Without Fire Department Notification. There is a fire alarm system that meets the requirements of Section 9.6 (NFPA 101).

8.5.5.3 With Fire Department Notification. There is a fire alarm system that complies with the requirements of 8.5.5.2 and, in addition, automatically transmits a signal to the fire department that is committed to serve the area in which the building is located through a direct connection, through an approved central station, or through other acceptable means.

8.5.5.4 With Voice Communication. There is a fire alarm system with voice alarm in accordance with 11.8.3 (NFPA 101).

8.5.6 Smoke Detection.

8.5.6.1 All references to detectors herein refer to smoke detectors. No credit is given for heat detectors in habitable space except as specifically noted in 8.5.6.2 through 8.5.6.5. Heat detectors can be credited in uninhabitable spaces where ambient temperatures can be expected to reach 120°F (50°C) or fall below 0°F (-18°C), provided separation from inhabited spaces is at least 1/2-hour fire resistance-rated.

8.5.6.2 To meet the requirements for smoke detector coverage, the spaces must be provided with smoke detectors installed in accordance with NFPA 72, *National Fire Alarm Code*.

8.5.6.3 Only those detectors whose activation will sound the alarm throughout the zone of origin are to be credited in this parameter.

8.5.6.4 If the building is evaluated by zones as defined in 8.3.2, the evaluation is based solely on detection within the zone.

8.5.6.5 To receive credit for smoke detection in corridors only, all corridors in the building or zone must have smoke detectors.

8.5.7 Interior Finish.

8.5.7.1 Classification of interior finish is based on the flame-spread rating of the interior finish tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. The requirements apply to wall and ceiling finish materials as described in Section 10.2 (NFPA 101).

8.5.7.2 No consideration is included in the safety parameter value for any finish with a flame-spread rating of more than 200 or for any finish not rationally measured by NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Thus, this FSES should not be used where such conditions exist. Such materials include foamed plastics, asphalt-impregnated paper, materials that melt, drip, or delaminate, or those capable of inducing extreme rates of fire growth and rapid flashover. In any case involving these materials, the resultant risk is considered beyond the capacity of this evaluation system and requires individual appraisal.

Table 8.5.2.4.3.2 Some Typical Peak Rates of Heat Release

Btu/sec · ft ²	Growth Rate	Potential Fuel
1.5	S	Fire retardant–treated mattress (including normal bedding)
15*	M	Lightweight Type C upholstered furniture**
35*	S	Moderate weight Type C upholstered furniture**
35	F	Mail bags (full) stored 5 ft high
50*	M	Cotton/polyester innerspring mattress (including bedding)
60*	M	Lightweight Type B upholstered furniture**
60*	S	Medium weight Type C upholstered furniture**
65*	VF	Methyl alcohol pool fire
70*	S	Heavy weight Type C upholstered furniture**
80*	F	Polyurethane innerspring mattress (including bedding)
90*	M	Moderate weight Type B upholstered furniture**
125	M	Wooden pallets 1½ ft high
145*	M	Medium weight Type B upholstered furniture**
150*	F	Lightweight Type A upholstered furniture**
150	F	Empty cartons 15 ft high
175*	M	Heavy weight Type B upholstered furniture**
175	F	Diesel oil pool fire (> about 3 ft dia.)
175	VF	Cartons containing polyethylene bottles 15 ft high
220*	F	Moderate weight Type A upholstered furniture**
225*	F	Particleboard wardrobe/chest of drawers
290	VF	Gasoline pool fire (> about 3 ft dia.)
340*	VF	Thin plywood wardrobe with fire-retardant paint on all surfaces (50 in. × 24 in. × 72 in. high)
350	F	Wooden pallets 5 ft high
360*	F	Medium weight Type A upholstered furniture**
450*	F	Heavy weight Type A upholstered furniture**
600*	VF	Thin plywood wardrobe (50 in. × 24 in. × 72 in. high)

For SI units:

(Btu/sec)/ft² = 11.35 kW/m²

1 Btu/sec = 1.055 kW

1 lb = 0.4536 kg

1 in. = 2.54 cm

1 ft = 0.3048 m

1 ft² = 0.0929 m²

NOTES:

* Peak rates of heat release were of short duration. These fuels typically showed a rapid rise to the peak and a corresponding rapid decline. In each case, the fuel package tested consisted of a single item.

** The classification system used to describe upholstered furniture is as follows:

Lightweight — Less than about 5 lb/ft² of floor area. A typical 6-ft long couch weighs under 75 lb.

Moderate weight — About 5 lb/ft² to 10 lb/ft² of floor area. A typical 6-ft long couch weighs between 75 lb and 150 lb.

Medium weight — About 10 lb/ft² to 15 lb/ft² of floor area. A typical 6-ft long couch weighs between 150 lb and 300 lb.

Heavy weight — More than about 15 lb/ft² of floor area. A typical 6-ft long couch weighs over 300 lb.

Type A — Furniture with untreated or lightly treated foam plastic padding and nylon or other melting fabric.

Type B — Furniture with untreated or lightly treated foam plastic padding or with nylon or other melting fabric, but not both.

Type C — Furniture with cotton or heavily treated foam plastic padding and having cotton or other fabric that resists melting.

The estimated heat release rates are based on furniture having simple lines. For ornate or convoluted shapes, increase the indicated rates by up to 50 percent based on elaborateness.

Growth Rates:

S — Slow: Burning rate in the range of a *t*-squared fire that reaches 1000 Btu/sec in 600 seconds.

M — Moderate: Burning rate in the range of a *t*-squared fire that reaches 1000 Btu/sec in 300 seconds.

F — Fast: Burning rate in the range of a *t*-squared fire that reaches 1000 Btu/sec in 150 seconds.

VF — Very Fast: Burning rate in the range of a *t*-squared fire that reaches 1000 Btu/sec in 75 seconds.

Additional potential fuel heat release information can be found in NFPA 72, *National Fire Alarm Code*; NFPA 204, *Guide for Smoke and Heat Venting*; the SFPE *Handbook of Fire Protection Engineering*; and other references.

8.5.7.3 Any interior finish having a flame spread of 75 or less that is protected by automatic sprinklers is evaluated as having a flame spread not exceeding 25. Any interior finish having a flame spread of more than 75 but not more than 200 that is protected by automatic sprinklers is evaluated as having a flame spread not exceeding 75.

8.5.8 Smoke Control. Smoke control definitions are provided in 8.5.8.1 through 8.5.8.2.2.

8.5.8.1 No Control. There are no smoke barriers or horizontal exits to a separated fire/smoke zone on the floor and no mechanically assisted smoke control systems serve the floor.

8.5.8.2 Smoke Barriers. Smoke barriers consist of installations conforming to the requirements of Section 8.3 (NFPA 101).

8.5.8.2.1 Passive. The smoke control system is passive if it consists of continuous vertical membranes designed to restrict the movement of smoke. Passive smoke barriers might or might not have a fire resistance rating and might have protected openings.

8.5.8.2.2 Active. The smoke control system is active if it has a tested and accepted smoke control system that obstructs the leakage of smoke between compartments or zones. One method of judging acceptance of smoke control systems is contained in NFPA 92A, *Recommended Practice for Smoke-Control Systems*.

8.5.9 Exit Access.

8.5.9.1 The charge for dead-end access is made where any corridor affords access in only one direction to a required exit.

8.5.9.2 If dead-end distances exceed 100 ft (30 m), a separate analysis must be made to evaluate the potential of flashover of any spaces that could block egress from the dead end and to determine the potential rate of smoke-filling of the egress system involved. If the safe time is shorter than the expected egress time, the evaluation should be discontinued unless a corrective action is specified.

8.5.9.3 The 50-ft (15-m) dead-end limit is applicable to existing buildings or new fully sprinklered buildings. A value of 20 ft (6 m) should be used for other new buildings.

8.5.9.4 Any system with common path of travel in excess of that permitted by NFPA 101 should be considered deficient under Safety Parameter 10, Egress Route.

8.5.10 Egress Routes.

8.5.10.1 Egress routes are the paths of travel from any point within a room to the public way using any types and arrangements described in Sections 38.2 or 39.2 (NFPA 101).

8.5.10.2 Egress routes are defined in 8.5.10.2.1 through 8.5.10.2.5.

8.5.10.2.1 Single Egress Route. A single egress route exists where the occupants on any floor do not have either a direct exit to the public way or multiple egress routes as defined in 8.5.10.2.2.

8.5.10.2.2 Multiple Egress Routes. Multiple egress routes exist where the occupants on a floor have a choice of two separate means of egress routes to the public way using the permitted types in Sections 38.2 or 39.2 (NFPA 101).

8.5.10.2.3 Deficient — Multiple Routes. An egress route is deficient if it fails to meet any of the applicable criteria of NFPA 101, *Life Safety Code*, including capacity. Any system with

a common path of travel in excess of that permitted by NFPA 101 should be considered deficient under Parameter 10, Egress Route.

8.5.10.2.4 Smokeproof Enclosure. Credit for a smokeproof enclosure shall be permitted to be given for a stairway designed and tested in accordance with the requirements of 7.2.3 (NFPA 101) for a smokeproof enclosure. To receive credit for a smokeproof enclosure, all exit stairs credited in Safety Parameter 10, Egress Route, shall meet the smokeproof enclosure requirements.

8.5.10.2.5 Direct Exit. To be credited for direct exits, each room shall have within that unit a door that opens to the exterior at grade level or onto an exterior balcony with direct access to an exterior exit. Where such openings are directly onto grade in a location where any person egressing can move directly away from the building without further exposure, the credit for direct exit shall be given even if there are no other exit routes from the space.

8.5.11 Corridor/Room Separation. The values assigned in Safety Parameter 11, Corridor/Room Separation, are based on the quality of separation between the room and the corridor. For purposes of this evaluation, corridor separation in new buildings is considered as complete (i.e., 1 hour with door closer) if it meets the requirements of 38.3.6 (NFPA 101) or its exceptions.

8.5.11.1 Corridor/room separation is defined in 8.5.11.1.1 through 8.5.11.1.3.

8.5.11.1.1 Incomplete. The separation is judged as “incomplete” if the wall to the corridor has unprotected openings (no door, or there are louvers, gaps, or transfer grilles) between the floor and ceiling. If openings exist above the ceiling level, the separation is considered complete if the ceiling in the room is a completed membrane. In this case, the separation rating is based on the level of resistance involved in the wall/ceiling system.

The score for incomplete separation is based on the potential time that at least the lower 5 ft (1.5 m) of the corridor could be expected to remain free of smoke if a fully involved fire were to occur in an exposing room. This is dependent on the amount of leakage from the leakiest exposing room and the size of the corridor (see Figure 8.5.11.1.1). The scores are shown in Table 8.5.11.1.1.

8.5.11.1.2 Complete Separation. The separation, if not judged to be “incomplete” based on the criteria in Table 8.5.11.1.1, is considered “complete.”

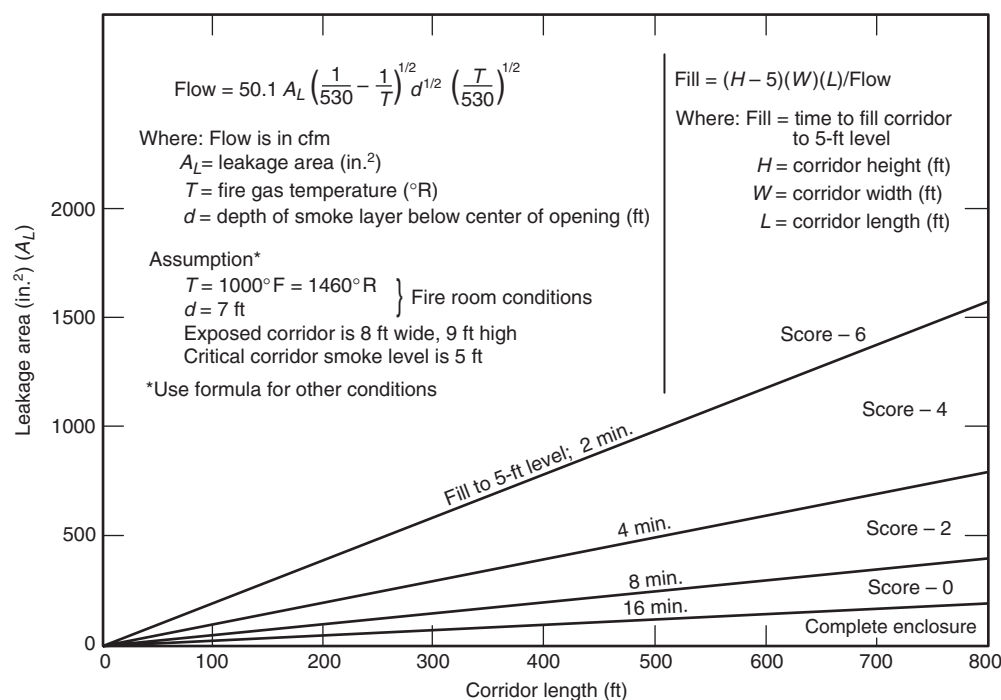
8.5.11.1.3 No Separation. There is “no separation” if the floor or the smoke zone is not subdivided (i.e., there is no corridor leading to an exit). [See 38.3.6.1 *Exceptions* (NFPA 101).]

8.5.11.2 For information on credit for door closers, “smoke resistive” versus “ $\geq 1/2$ hr” or “1 hr,” see note (e) to Worksheet 8.10.2.

8.5.12 Occupant Emergency Program.

8.5.12.1 The value of this parameter is determined by the number of fire exit drills conducted in the building each year. If no fire exit drills are conducted, the parameter is assessed a value of -2. If drills are conducted once or twice a year, the value is zero (0). If drills are conducted more than twice a year, this parameter is given a value of 1. If the building occupant load is fewer than 500 persons with fewer than 100 persons above or below the street level, this parameter should be given, as a minimum, a value of 1.

FIGURE 8.5.11.1.1 Approximate time to smoke impact.



For SI units: 1 in.² = 0.155 cm²; 1 ft = 0.3048 m; $\frac{5}{9} (^\circ\text{F} - 32) = ^\circ\text{C}$

Table 8.5.11.1.1 Incomplete Separation Scores

Safe Time	Score
<2 min	-6
≥2 min but <4 min	-4
≥4 min but <8 min	-2
≥8 min but <16 min	0
≥16 min	Complete separation

8.5.12.2 To qualify for credit, a majority of the building or zone occupants must take part in scenario-oriented fire exit drills. The scenarios should be based on the hazardous conditions that could develop during a fire in the facility.

8.5.12.3 The fire exit drills should be conducted in accordance with the appropriate provisions of NFPA 101, *Life Safety Code*.

8.6 Worksheets for Evaluating Fire Safety in Business Occupancies.

Step 1: Complete the cover sheet (Worksheet 8.6.1) found in Figure 8.6.

Step 2: Determine individual safety evaluations, using Worksheet 8.6.2.

A. Select and circle the safety value for each parameter in Worksheet 8.6.2 that best describes the conditions in the facility. Only one value for each of the parameters is to be chosen. If two or more values appear to apply, the one with the lowest point value governs.

B. Transfer each of the 12 circled safety parameter values from Worksheet 8.6.2 to the unshaded blocks corresponding to each safety parameter in Worksheet 8.6.3. Where the blocks indicate “÷ 2 =”, enter one-half the value from Worksheet 8.6.2.

C. Add the three columns, keeping in mind that any negative numbers need to be deducted.

D. Transfer the resulting values for S_1 , S_2 , and S_3 to Worksheet 8.6.5.

Step 3: Determine mandatory requirements, using Worksheet 8.6.4.

A. Circle the mandatory values in Worksheet 8.6.4 for the building being evaluated.

B. Transfer the circled values from Worksheet 8.6.4 to the boxes marked S_a , S_b , and S_c in Worksheet 8.6.5.

Step 4: Evaluate fire safety equivalency, using Worksheet 8.6.5.

A. Subtract the mandatory values in Worksheet 8.6.5 for Required Control, Required Egress, and Required General Fire Safety from the respective provided values calculated in Worksheet 8.6.3. Enter the difference in the appropriate boxes.

B. For each row, check “yes” if the value in the answer box is zero (0) or greater. Check “no” if the value in the answer box is negative.

Step 5: Determine equivalency conclusions. Conclude whether the level of life safety is at least equivalent to that prescribed by the *Life Safety Code*, using Worksheet 8.6.7, Conclusions. Worksheet 8.6.7 combines the fire safety equivalency evaluation of Worksheet 8.6.5 and the additional considerations of Worksheet 8.6.6.

FIGURE 8.6 Worksheets for evaluating fire safety in business occupancies.**WORKSHEET 8.6.1 COVER SHEET**

Fire Safety Evaluation Worksheet for Business Occupancies

Facility Identification _____

Evaluator _____ Date _____

Notes:

WORKSHEET 8.6.2 SAFETY PARAMETERS

Safety Parameters	Parameter Values							
1. Construction	Noncombustible				Combustible			
NFPA 220 Bldg. Constr. Types	Type I (443) or (332) Type II(222)	Type II (111)	Type II (000)	Type III (211)	Type IV (200)	Type IV (2HH)	Type V (111)	Type V (000)
1 Story	0	0	0	0	−1	0	0	−1
2 Stories	2	2	−4	0	−2	0	0	−4
3 Stories	2	2	−6	0	−6	0	0	−12
4−5 Stories but ≤75 ft	2	2	−10	0	−12	0	−3	−12
>5 Stories but ≤75 ft	2	2	NV	0	NV	0	−6	NV
>75 ft but <150 ft	2	−1	NV	0	NV	0	NV	NV
≥150 ft	2	NV	NV	0	NV	0	NV	NV
2. Segregation of Hazards	Exposed Exit System			Segregation from Exit Routes			None or No Deficiencies	
	Double Def.	Single Def.	Double Def.	Single Def.				
	−7	−4	−4	0	0			
3. Vertical Openings ^a	Open (or incomplete enclosure)				Enclosed			
	Connects 5 or More Floors	4 Flrs.	3 Flrs.	2 Flrs.	<30 min	30 min to 1 hr	>1 hr ^g	
	−10	−7	−4	−2	−1	0	1	
4. Sprinklers	None	Corridors Only	All but Corridors and Lobbies			Total Building		
			Standard	Fast Resp.	Standard	Fast Resp.		
	0	0	4	6	10	12		
5. Fire Alarm	None	W/O Fire Department Notification			W/Fire Department Notification			
		W/O Voice Commun.	W/ Voice Commun.	W/O Voice Commun.	W/ Voice Commun.			
	0 (−2) ¹	1 (0) ¹ (−1) ^P	2 (0) ^P	2 (1) ¹ (−1) ^P	4 (2) ^P			

Worksheet 8.6.2 continues.

FIGURE 8.6 Continued

Worksheet 8.6.2 Continued							
6. Smoke Detection	None 0		Corridor 1		Rooms 2		Total Bldg. (zone) 4
7. Interior Finish	Flame-Spread Ratings ^b						
Exit Routes	>75 to ≤200		>25 to ≤75		≤2		
Rooms/Suites	>75 to ≤200	≤75	>75 to ≤200	≤75	>25 to ≤200	≤25	
	-3	-1	0	1	1	2	
8. Smoke Control	None 0		Passive 3		Active 4(3) ^k		
9. Exit Access	Max. Dead Ends		No Dead End >50 ft and Travel Is				
	>75 ft to ≤100 ft	>50 ft (20 ft) ^h to ≤75 ft	>200 ft ^c to <400 ft	>100 ft to 200 ft ^c	>50 ft to 100 ft	≤50 ft	
	-2 ^d	-1	-1	0	1	3	
10. Egress Route	Single -6(0) ^j	Multiple Routes					
		Deficient	Not Deficient	Smokeproof Enclosures	Direct Exits		
		-2	0	3	5		
11. Corridor/Room Separation (compartmentation)	Separation Exists and Level of Protection Is					No Separation, or Single Tenant, or Parameter 4 Value ≥10	
	Smoke Resistive ^e		≥½ hr ^e		≥1 hr ^e		
Incomplete	W/O Door Closer	W/Door Closer	W/O Door Closer	W/Door Closer	W/Door Closer		
	-6 to 0 ^m	0	1(2) ^f	1	2(3) ^f	3(4) ^f	3
12. Occupant Emergency Program	Number of Fire Drills Conducted Per Year						
	0		1 to 2		>2		
	-2(-3) ⁿ		0(1) ^o		1(2) ^o		

NOTES:

NV – Where these conditions exist, this FSES does not evaluate overall safety. Other analysis techniques shall be permitted to be applied in accordance with the equivalency concept of Section 1.5 of NFPA 101, *Life Safety Code*.

^a Use 0 if building is one level.

^b In any sprinkler-protected spaces, consider flame-spread rating to be 25 or 75 if the interior finish material flame spread does not exceed 75 or 200, respectively.

^c Increase 200 to 300 if Parameter 4 is 10 or more.

^d Use 0 if Parameter 11 is -6.

^e Rate separation as ½ hr (or use actual separation, if greater) if Parameter 4 is 10 or more. Rate separation as “smoke resistive” if Parameter 1 is based on construction Type II(000), III(200), or V(000) and Parameter 4 value < 10.

^f Use () if separation between rooms also meets criteria.

^g Use only if all vertical openings have more than 1-hr enclosure and meet the requirements of 7.1.3 and 38.3.1 or 39.3.1 (NFPA 101).

^h Use (20 ft) for new construction and 50 ft for existing buildings.

^j Use () for single exit in accordance with exceptions to 38.2.4.2 and 39.2.4.2 (NFPA 101).

^k Use (3) if Parameter 4 value < 10.

^l Use () for building that has:

(a) ≥2 stories above level of exit discharge, or

(b) Occupant load ≥50 (≥100 in existing buildings) above or below level of exit discharge, or

(c) Total occupant load ≥300 (≥1,000 in existing buildings).

^m See 8.5.11.1.1 for guidance.

ⁿ Use () in buildings over 150 ft in height with no formal occupant emergency organization program.

^o Use () in any building, regardless of height, with a formal occupant emergency organization program.

^p Use () for new high-rise buildings.

For SI units: 1 ft = 0.348 m.

(For use with NFPA 101A-2001/NFPA 101-2000)

(Page 2 of 4)

FIGURE 8.6 Continued

WORKSHEET 8.6.3 INDIVIDUAL SAFETY EVALUATION

Safety Parameters	Fire Control (S ₁)	Egress Provided (S ₂)	General Fire Safety Provided (S ₃)
1. Construction			
2. Segregation of Hazards			
3. Vertical Openings	÷ 2 =		
4. Sprinklers		÷ 2 =	
5. Fire Alarm	÷ 2 =		
6. Smoke Detection	÷ 2 =		
7. Interior Finish	÷ 2 =		
8. Smoke Control		÷ 2 =	
9. Exit Access			
10. Exit Systems			
11. Corridor/Room Separation	÷ 2 =	÷ 2 =	
12. Occupant Emergency Program			
Total	S₁ =	S₂ =	S₃ =

WORKSHEET 8.6.4 MANDATORY REQUIREMENTS

Building Height	Control Requirement (S _a)		Egress Requirement (S _b)		General Fire Safety (S _c)	
	New	Existing	New	Existing	New	Existing
1 Story	0.5	-1.0	1.5	0	2	-1
2 Stories	-2.5	-4.0	1.5	0	-1	-4
3 Stories	1.5	0	1.5	0	3	0
>3 Stories and ≤75 ft	4.0	2.0	2.5	0	6	2
>75 ft but <150 ft	9.5	7.5	7.5	5	10	6
≥150 ft	12.5	10.5	7.5	5	10	9

(For use with NFPA 101A-2001/NFPA 101-2000)

(Page 3 of 4)

FIGURE 8.6 Continued

WORKSHEET 8.6.5 EQUIVALENCY EVALUATION					Yes	No
Control Provided (S_1)	minus	Required Control (S_a)	$\geq$	0	S_1 - =	
Egress Provided (S_2)	minus	Required Egress (S_b)	$\geq$	0	S_2 - =	
General Fire Safety (S_3)	minus	Required Gen. Fire Safety (S_c)	$\geq$	0	S_3 - =	

WORKSHEET 8.6.6 FACILITY FIRE SAFETY REQUIREMENTS WORKSHEET				
	Considerations	Met	Not Met	Not Applicable
A.	Building utilities conform to the requirements of Section 9.1.			
B.	The air conditioning, heating, and ventilating systems conform to Section 9.2, except for enclosure of vertical openings, which have been considered in Safety Parameter 3 of Worksheet 8.6.2.			
C.	Elevator installations are made in accordance with the requirements of Section 9.4.			
D.	Rubbish chutes, incinerators, and laundry chutes are installed in accordance with Section 9.5.			
E.	Portable fire extinguishers are installed and maintained in accordance with the requirements of 38.3.5/39.3.5 and 9.7.4.1.			
F.	Standpipes are provided in all new high-rise buildings as required by 38.4.2.			

All references are to NFPA 101, *Life Safety Code*.

WORKSHEET 8.6.7 CONCLUSIONS	
1.	☐ All of the checks in Worksheet 8.6.5 are in the "Yes" column. The level of fire safety is at least equivalent to that prescribed by NFPA 101, <i>Life Safety Code</i> , business occupancies.*
2.	☐ One or more of the checks in Worksheet 8.6.5 are in the "No" column. The level of fire safety is not shown by this system to be equivalent to that prescribed by NFPA 101, <i>Life Safety Code</i> , for business occupancies.
* The equivalency covered by this worksheet includes the majority of considerations covered by NFPA 101, <i>Life Safety Code</i>. There are some considerations that are not evaluated by this method. These must be considered separately. These additional considerations are covered in Worksheet 8.6.5, Facility Fire Safety Requirements Worksheet. One copy of this worksheet is to be completed for each facility.	

(For use with NFPA 101A-2001/NFPA 101-2000)

(Page 4 of 4)

Chapter 9 Computerized Fire Safety Evaluation System for Business Occupancies

NOTICE: This chapter contains the user manual for the Computerized Fire Safety Evaluation System (CFSES) for Business Occupancies. Like its Chapter 8 counterpart, the CFSES compares the level of safety provided to a business occupancy by an arrangement of safeguards that differ from those specified in NFPA 101, *Life Safety Code*, to the level of safety provided in a building that conforms exactly with the details in the *Code*.

The CFSES provides the user with guidance and help in making the decision involved. It also provides means of rapidly determining the impact on comparative safety effected by changes in the building features or its emergency preparedness. In addition, the CFSES gives the user the option of inserting parameter scores based on the user's justified judgment and several analytically based refinements of the assigned scores.

The program is in the public domain and is available for downloading at the NFPA Web site. The Web page with links to the downloadable installer and pdf file of the user manual can be found by going to <http://www.nfpa.org> and using the search feature to find "FSES," then clicking on the one dealing with NFPA 101A.

The CFSES program was developed by Hughes Associates, Inc., for the National Institute of Standards and Technology. The remainder of this chapter is an extract from the user manual developed by Hughes. Microsoft, MS, and MS-DOS are registered trademarks. Windows and Visual C/C++ are trademarks of Microsoft Corporation in the United States and other countries.

9.1 Overview. This manual is designed to familiarize the user with the PC-based Computerized Fire Safety Evaluation System (CFSES) for Business Occupancies, Version 1.2.03. This version is an upgrade from the Fire Safety Evaluation System (FSES), Version 1.0, the Enhanced Fire Safety Evaluation System (EFSES), Version 1.1B, and the Enhanced Fire Safety Evaluation System (EFSES), Version 1.2 [NIST-GCR-96-692, 1996; Budnick, 1997; Hughes Associates, 1999]. Some additional features to the CFSES software package include expanded calculation algorithms, cost and risk evaluation capabilities, and building upgrade options. The evaluation system for risk and acceptance is based on the methodology contained in NFPA 101A, *Guide on Alternative Approaches to Life Safety*, 1998 ed. [NFPA 101A, 1998]. The CFSES program development was sponsored by the General Services Administration (GSA) and the National Institute of Standards and Technology's (NIST) Building and Fire Research Laboratory (BFRL). The development was performed by Hughes Associates, Inc., under a grant from NIST. This effort is part of a broad based technology development underway at NIST to expand applications of fire protection performance/risk based methods in building design and evaluation.

The methodology in this PC-based EFSES is intended for use in comparing levels of safety and acceptance which may differ from specific requirements in the NFPA 101 *Life Safety Code* [NFPA 101, 2000]. It is assumed that the user has a working knowledge of both the NFPA 101, *Life Safety Code* and NFPA 101A. In addition, fundamental knowledge of the Microsoft Windows™ environment by the user is required.

9.2 Installation. The PC-based Computerized Fire Safety Evaluation System (CFSES), Version 1.2.03, is a self-installing, Windows™ based computer program. CFSES can be installed

on any system running Windows™ 3.1, Windows™ 95/98, Windows™ NT, and Windows™ 2000. The program is contained on a single 3¹/₂ inch floppy diskette or a single compact disk (CD-ROM). Problems may be encountered when attempting to run the CFSES software on some versions of Windows™ NT. In such cases, some of the bitmaps may load improperly or not at all. It is important to note that the software may still be used and the problem is only cosmetic. If users encounter this problem, they should verify that they have installed all Microsoft Windows NT patches, available from Microsoft at no charge.

The CFSES may be installed from an internet web site. The procedure may be slightly different than that cited below. Because the actual installation depends on the web site software, installation instructions are provided at the download locations.

9.2.1 Installing CFSES. CFSES can be installed using the Windows™ Program Manager if the computer is running Windows™ 3.1 or an earlier version of Windows™ NT. If the computer is running Windows™ 95/98, Windows™ 2000, or a later version of Windows™ NT, then CFSES is installed using the local computer explorer, typically accessed by clicking an icon called "My Computer" or by using the "Start" button. Alternatively, CFSES can be installed at the MS-DOS prompt in any version of Windows™ 3.1 or higher.

9.2.1.1 Starting the Install Procedure. To install CFSES Version 1.2.03 through the Windows™ Program Manager:

- (1) Start the PC and make sure Windows™ is running.
- (2) Make sure all old versions of CFSES have been removed. Refer to 9.2.3 if there is an old CFSES version still on the computer.
- (3) Insert the CFSES Version 1.2.03 diskette or CD-ROM into a compatible drive on the computer, commonly drive A or B for a floppy diskette and drive D or E for a CD-ROM.
- (4) In Windows™, with the Program Manager open, select the "Run" command under the "File" menu. Type in the drive letter containing the CFSES installation disk or CD-ROM, followed by a colon, followed by the command setup. Click the mouse on the "OK" button or highlight the "OK" button and depress the "Enter" key. This will invoke the installation procedure. You may also use the "Browse..." button to select the setup.exe file on the installation disk or CD-ROM.

To install CFSES Version 1.2.03 with the Windows™ NT/Windows™ 95/Windows™ 98 and Windows™ 2000 platforms:

- (1) Start the PC.
- (2) Make sure all old versions of CFSES have been removed. Refer to 9.2.3 if there is an old CFSES version still on the computer.
- (3) Insert the CFSES Version 1.2.03 diskette or CD-ROM into a compatible drive on the computer, commonly drive A or B for a floppy diskette and drive D or E for a CD-ROM.
- (4) Click on the "My Computer" icon and select the floppy disk drive or CD-ROM drive where the installation software is located. Select and double click on the setup.exe program. This will invoke the installation procedure. The "Start" button may be used instead of "My Computer" for Windows™ 95, Windows™ 98, and Windows™ 2000 platforms. After depressing the "Start" button, select the "Run ..." option. Type in the drive letter containing the CFSES installation disk or CD-ROM, followed by a colon, followed by the command setup. Click the mouse on the

“OK” button or highlight the “OK” button and depress the “Enter” key. This will also invoke the installation procedure. You may also use the “Browse...” button to select the setup.exe file on the installation disk or CD-ROM. Use the setup.exe icon when using the “My Computer” explorer program to install CFSES.

To install CFSES, Version 1.2.03, at the MS-DOS prompt when using any version of Windows™ 3.1 or higher:

- (1) From the MS-DOS prompt enter: `<diskette drive>\setup`

The installation program will restore Windows™ and the installation procedure will be invoked.

9.2.1.2 Running the Install Procedure. Once the setup file has been executed, the install procedure begins. Several screens prompt the user for information regarding where the program should be installed and what the program folder should be named. The first screen after the installation has

begun prompts the user to choose the directory that CFSES will be installed. This screen is shown in Figure 9.2.1.2(a). The default directory is `<root>\CFSES`. If there is already a directory called CFSES, the installation program will overwrite the old files in the CFSES directory. The second screen allows the user to choose the name of the program folder. Figure 9.2.1.2(b) shows this screen. The program folder is the name of the group window when using the Windows™ 3.1 Program Manager and it is the menu name under the Start/Programs Windows™ 95/98/2000 button. The default folder name is CFSES. If there is already an CFSES folder, the contents will be replaced and the uninstall program will be renamed “Uninstall CFSES-1”. Refer to 9.2.3 for more information about this. The last screen shows a summary of the installation settings and is shown in Figure 9.2.1.2(c). At any time before this screen, the user may select the “<Back” button and change the settings.

FIGURE 9.2.1.2(a) Setup screen prompting for the CFSES install directory.

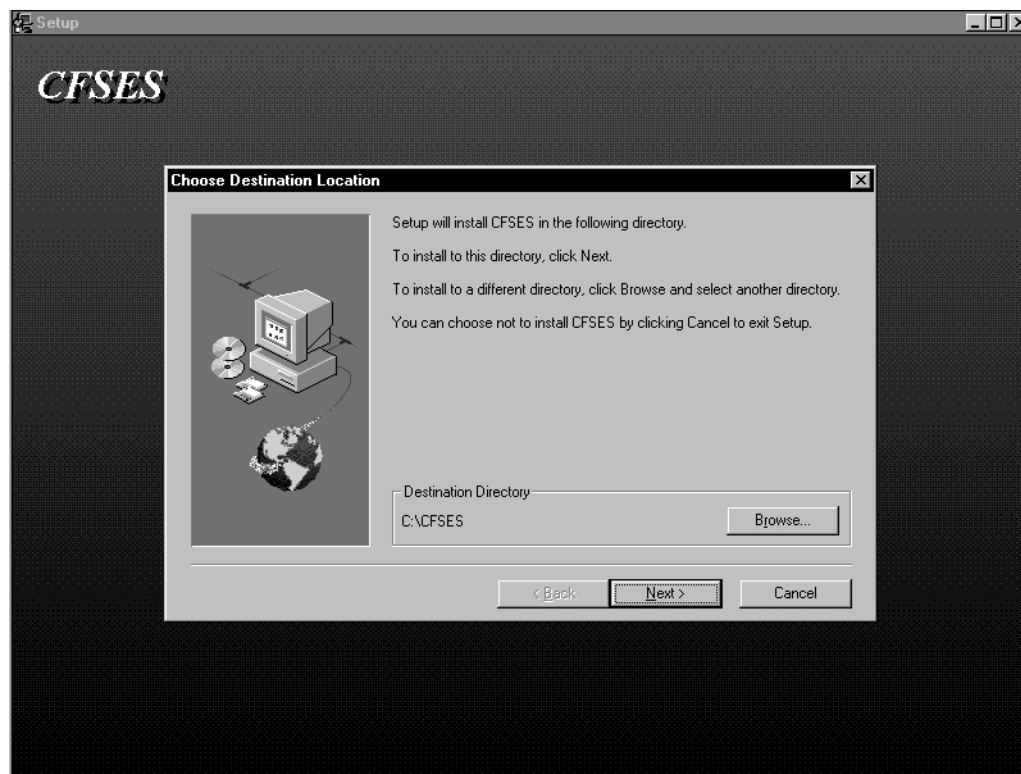
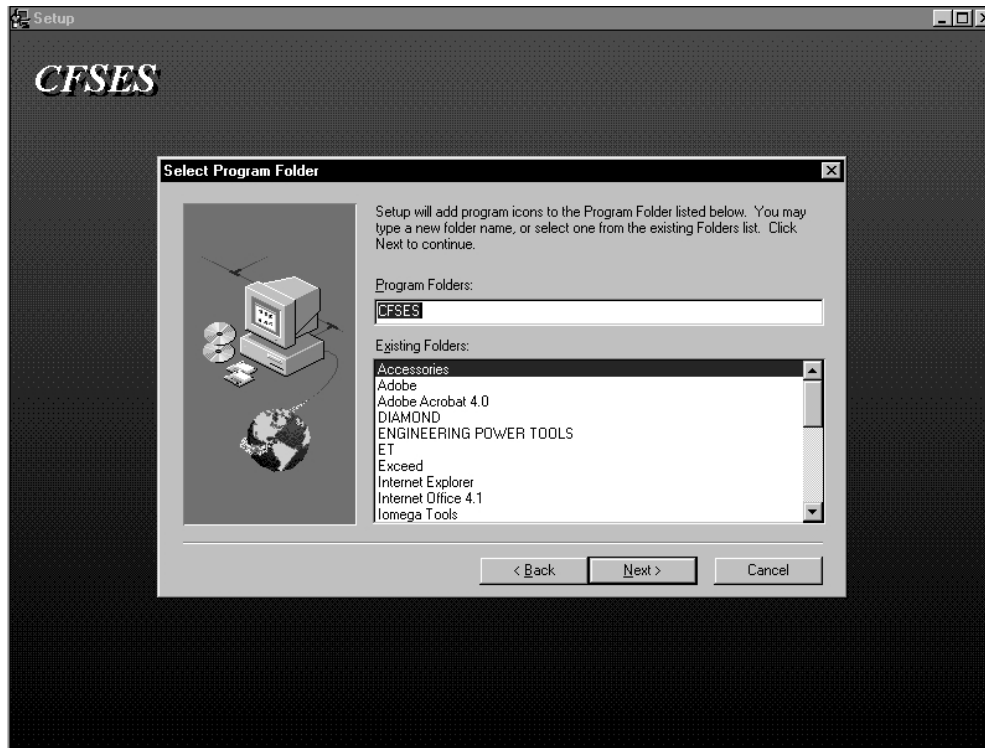
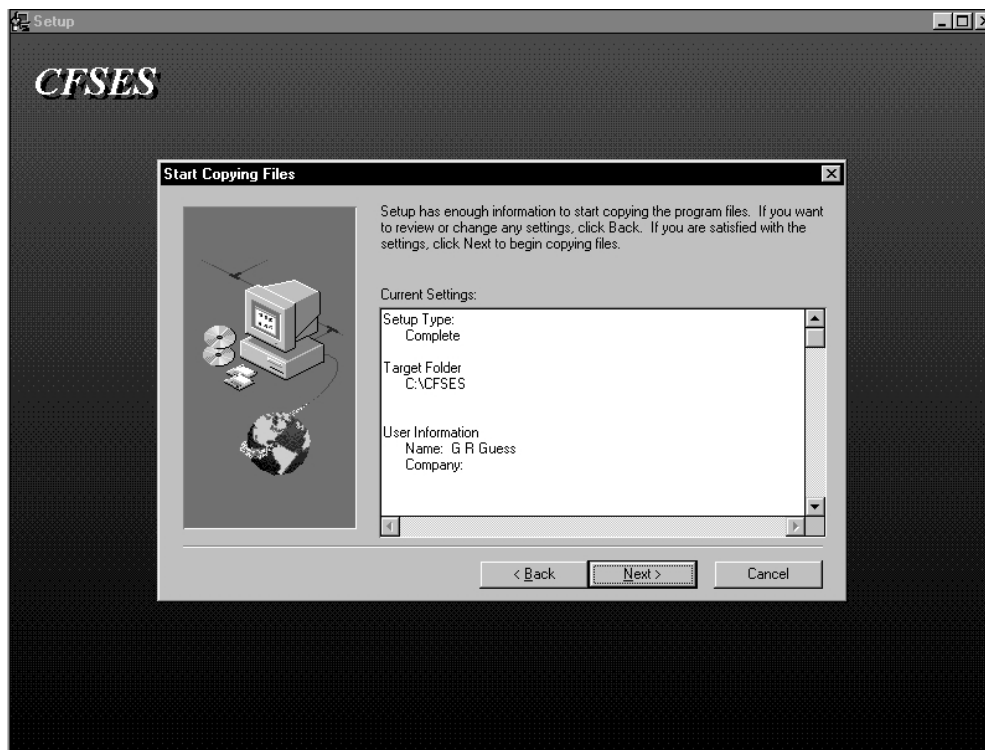


FIGURE 9.2.1.2(b) Setup screen prompting for the CFSES program folder.**FIGURE 9.2.1.2(c) Setup summary screen.**

9.2.2 Starting CFSES. CFSES Version 1.2.03 can be started by clicking the CFSES icon under the folder where the program was installed. Figure 9.2.2(a) shows the CFSES icon on the Windows™ 98 platform. When properly executed, the program will display the information screen shown in Figure 9.2.2(b) for thirty seconds. This screen can be cleared before thirty seconds by clicking the mouse or by depressing any keyboard button.

9.2.3 Uninstalling CFSES. The CFSES installation procedure automatically installs a program that will remove CFSES, Version 1.2.03, from the computer when it is no longer wanted. The default name for this removal program is “Uninstall CFSES”. The program can be found in the same folder as the CFSES program [see Figure 9.2.2(a)]. In some cases, more than one uninstall program may be found in the same folder. This occurs when the CFSES program is installed more than once

and the old version has not been removed. The additional removal programs should be deleted by highlighting them with the mouse and depressing the “Delete” key before “Uninstall CFSES” is started. When the uninstall program is executed, the user will be asked to verify that it is OK to remove the CFSES program. Once this is done, all of the program files, directories, and folders will be deleted. When “Uninstall CFSES” has finished, it will inform the user what has been done, as shown in Figure 9.2.3(a). If an old version had not been deleted, then a warning will be displayed indicating that CFSES was not properly removed [Figure 9.2.3(b)]. If this happens, the executable program file, the program folder, and the MS-DOS directory where CFSES was installed must be manually removed. You should consult the Windows™ manual for assistance if unsure how to do this.

FIGURE 9.2.2(a) CFSES correctly installed in Windows 95/98/NT.

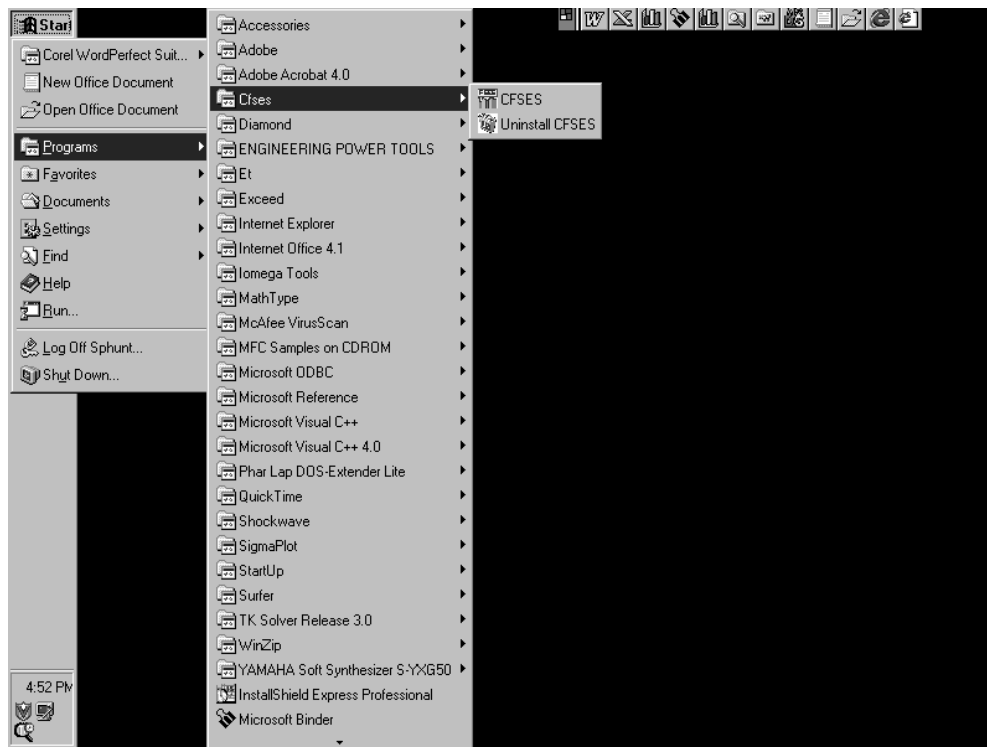


FIGURE 9.2.2(b) Initial CFSES display screen.

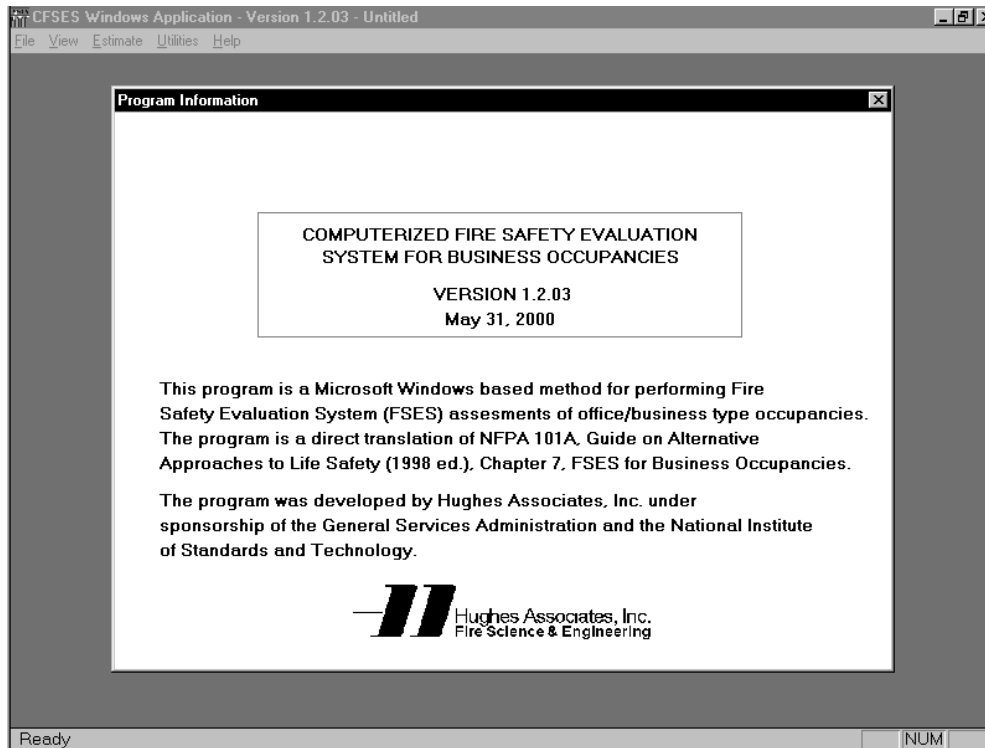


FIGURE 9.2.3(a) Correct CFSES uninstall execution.

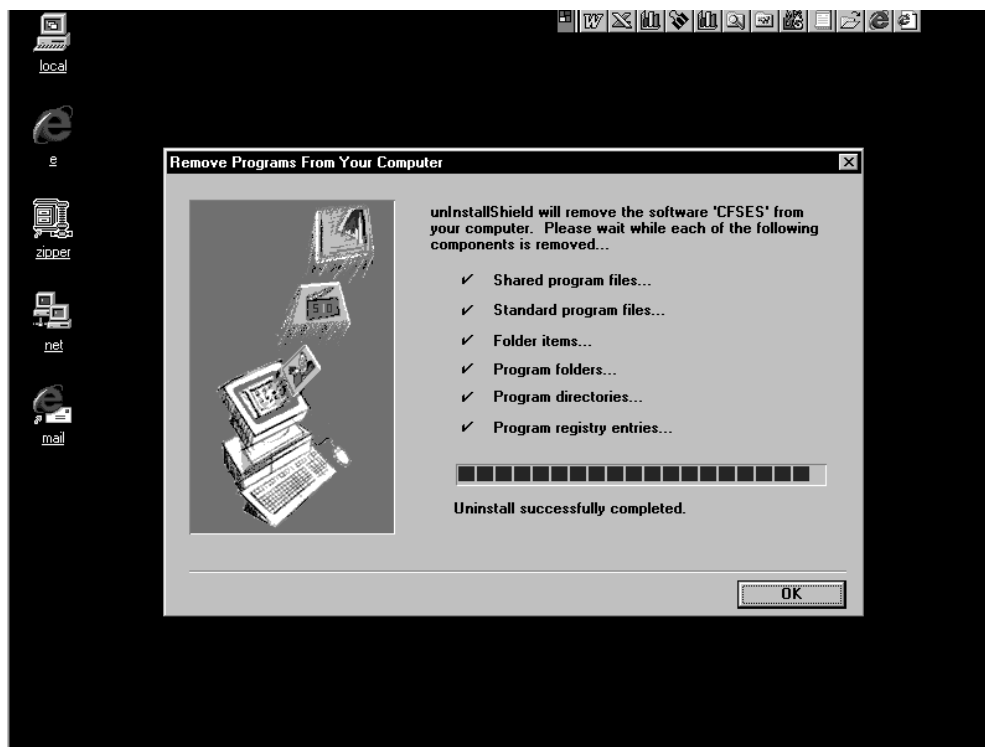


FIGURE 9.2.3(b) CFSES uninstall unable to remove all files.



9.3 Using CFSES. An CFSES evaluation can be divided into three parts: entering the background information, setting the Base Case, and setting Options. The background information consists of data such as the project title, the name of the analyst, and general building information that does not change during an analysis. This type of information includes whether the structure is new or old, the building height, and the number of floors. The Base Case is defined as the NFPA 101A parameter selections for the building as it exists or is currently planned. The Options are parameter settings that result in an acceptable building score given a Base Case that does not meet the minimum requirements.

9.3.1 Background Information. The background information is used to identify a building case and to set the building parameters that would generally not change for building fire safety upgrades. The first screen after the information screen [Figure 9.2.2(b)] is the program version and version date. Clicking the “Continue” button clears this screen. The first screen that the user enters information in is the “Analysis Information” screen, as shown in Figure 9.3.1(a). The name of the

user, the organization, the date, the time, and the project file are all entered here. The name, the organization, and the date are printed on all hardcopy output. The date and the time default to the current computer date and time. When complete with this screen, the “Next Screen” button should be selected. The “Exit” button will terminate the session immediately. If the file has not been saved, then a window box will be displayed asking if the project should be saved before exiting. The “Help” button invokes a brief help text that assists the user in making screen selections navigating around. Figure 9.3.1(b) shows a typical help message.

The “General Building Data” screen comes after the “Analysis Information” screen, shown in Figure 9.3.1(c). The information in this screen is also for identification only. The building name appears on all hardcopy output from this program. The building address, ID, and notes are all for internal use. They may be left blank if this information is not needed. There is only one new button — “Back Screen,” which brings the user back to the “Analysis Information” screen.

FIGURE 9.3.1(a) Analysis information screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

ANALYSIS INFORMATION

Analyst Name Your Name

Organization Your Organization

Date The Date

Time The Time

File The File

Next Screen Exit Help

Ready NUM

FIGURE 9.3.1(b) Typical help screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

ANALYSIS INFORMATION

Analyst

Organization

General Help Dialog

The Analysis Information Screen

The Analysis Information is all optional. Some of the default information is automatically obtained from the computer clock. This information is printed on the output sheets for user identification. When this screen is complete select the NEXT SCREEN button.

Next Screen OK

Ready NUM

FIGURE 9.3.1(c) General building data screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES
GENERAL BUILDING DATA

Building Name: Glass Tower East

Building Address: 123 Main Street
Capitol City, GA 345543

Building ID: Case 00-248

Notes: 17 year old, 8 floor office tower. Fully sprinklered,
renovated 2 yrs ago. Fully occupied.

Next Screen Back Screen Exit Help

Ready NUM

The “General Building Characteristics - Sheet 1” screen is next. The number of floors is selected on this screen by clicking on the radio button next to the correct floor value for the evaluated building. Information explaining how to determine the number of floors to comply with NFPA 101A is shown in a window box in the center of the screen. This screen is shown in Figure 9.3.1(d). The “General Building Characteristics - Sheet 2” is the final background information screen [Figure 9.3.1(e)]. The building height, the building age (old or new), and the gross floor area are entered here. The gross floor area is the aggregate floor area of each building level. It is used to estimate the cost of upgrading the fire protection systems in

the facility. After this screen has been evaluated and the “Next Screen” button selected, the user cannot return to the background information screens without deleting all parameter selections and Option information that is set in the following screens. A warning screen is displayed at this point to remind the user of this. Another feature to note is that when the program file is saved and closed before entering this screen, then later recalled, the user begins at the “Analysis Information” screen. If the “Next Screen” button is selected in the “General Building Characteristics - Sheet 2” screen, the project file later saved, closed, and then later recalled, then the user will begin at the “Parameter Worksheet” screen.

FIGURE 9.3.1(d) General building characteristics sheet 1 screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

GENERAL BUILDING CHARACTERISTICS - SHEET 1

This screen is used to determine the building height. The building height is either the number of occupied stories above the lowest level of exit discharge or the number of occupied stories above the lowest level that is at least fifty percent above grade.

Number of Stories:

☐ 1 ☐ 2 ☐ 3 ☐ 4-5 ☒ Over 5

Next Screen Back Screen Exit Help

Ready NUM

FIGURE 9.3.1(e) General building characteristics sheet 2 screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

GENERAL BUILDING CHARACTERISTICS - SHEET 2

An existing building is defined in NFPA 101 (2000) as a building erected of officially authorized prior to the effective dated of the adoption of this edition of the Code by the agency or jurisdiction.

Building Height (Feet):

☐ Less than 75 ☒ 75 to 150 ☐ Greater than 150

Building is Classified as:

☒ Existing ☐ New

Gross Floor Area (Square Feet):

Enter Gross Building Floor Area: 80000.

Next Screen Back Screen Exit Help

Ready NUM

9.3.2 Setting the Base Case. The Base Case is the evaluated building as it currently exists or is planned to be constructed. The Base Case can be assessed using either the “Main Parameter” screen [Figure 9.3.2(a)] or the “Individual Parameter

Evaluation - Worksheet (Base Case)” screen [Figure 9.3.2(b)]. The “Main Parameter” screen will be discussed here. The worksheet screen functions in the same way as the Option worksheet screens, which are discussed in 9.3.3.

FIGURE 9.3.2(a) Main parameter screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

MAIN PARAMETER SCREEN

PARAMETERS

- ☐ CONSTRUCTION
- ☐ SEGREGATION OF HAZARDS
- ☐ VERTICAL OPENINGS
- ☐ SPRINKLERS
- ☐ FIRE ALARM SYSTEM
- ☐ SMOKE DETECTION
- ☐ INTERIOR FINISH
- ☐ SMOKE CONTROL
- ☐ EXIT ACCESS
- ☐ EXIT SYSTEMS
- ☐ CORRIDOR/ROOM SEPARATION
- ☐ OCCUPANT EMERGENCY PROGRAM

Next Screen Back Screen

SCORE

Egr. L.S. Gen.

MANDATORY REQUIREMENT

7.5 5. 6.

Egr. L.S. Gen.

Help Exit

Ready NUM

FIGURE 9.3.2(b) Individual parameter evaluation screen.

CFSES Windows Application - Version 1.2.03 - Untitled

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

INDIVIDUAL PARAMETER EVALUATION - WORKSHEET (BASE CASE)

PARAMETER	FIRE CONTROL	EGRESS	GENERAL
CONSTRUCTION	NOT SCORED		NOT SCORED
SEGREGATION	NOT SCORED	NOT SCORED	NOT SCORED
V. OPENINGS	NOT SCORED	NOT SCORED	NOT SCORED
SPRINKLERS	NOT SCORED	NOT SCORED	NOT SCORED
FIRE ALARM	NOT SCORED	NOT SCORED	NOT SCORED
SMOKE DET.	NOT SCORED	NOT SCORED	NOT SCORED
INT. FINISH	NOT SCORED		NOT SCORED
SMOKE CONT.		NOT SCORED	NOT SCORED
EXIT ACCESS		NOT SCORED	NOT SCORED
EXIT SYSTEM		NOT SCORED	NOT SCORED
CORRIDOR SEP.	NOT SCORED	NOT SCORED	NOT SCORED
OCC. EMER. PR.		NOT SCORED	NOT SCORED
TOTAL	N/A	N/A	N/A
REQUIRED	7.5	5.	6.

Options

OPTION 1 Cost/Risk

OPTION 2 Cost/Risk

OPTION 3 Cost/Risk

OPTION 4 Cost/Risk

OPTION 5 Cost/Risk

Actions

Set Base Case Not Available Refinements Not Available

Base Case Not Available Considerations Not Evaluated

Back Screen Exit Help

Ready NUM

9.3.2.1 Main Parameter Screen. The “Main Parameter” screen allows access to each of the twelve NFPA 101A fire safety parameters. This is the first screen after the background screens. The parameter worksheet screen, which is in a format similar to Worksheet 8.6.2 (from Figure 8.6) in NFPA 101A, is accessed by clicking the “Next Screen” button in the “Main Parameter” screen. The twelve safety parameters are accessed in the “Main Parameter” screen by clicking the small button square just to the left of the parameter name. After a parameter has been evaluated, the user will be returned to this screen. A small checkmark appears next to the parameter button and some descriptive text summarizing the parameter status is displayed. Figure 9.3.2.1(a) shows the “Main Parameter” screen with the construction parameter evaluated. At the bottom of the screen, the minimum required score for the building is shown. The scores at the bottom of the screen correspond to the three NFPA 101A safety categories: Egress, Life Safety, and

General. When all of the parameters have been evaluated, the actual building score will be shown. Figure 9.3.2.1(b) shows a completed “Main Parameter” screen. For this case, the evaluated building received a score of -5.5 in Egress, -12.0 in Life Safety, and -14.0 in General. The mandatory scores for this type of building are 7.5 in Egress, 5.0 in Life Safety, and 6.0 in General. Consequently, the structure failed in each of the three safety categories.

9.3.2.2 Safety Parameter 1: Construction. The first safety parameter is Construction. Figure 9.3.2.2(a) shows the “1. Construction Parameter” screen for a five or more story structure between 75 ft and 150 ft tall. Only the portion of the NFPA 101A worksheet table that corresponds to the building height and the number of stories selected in the background screens is shown.

FIGURE 9.3.2.1(a) Main parameter screen with construction parameter evaluated.

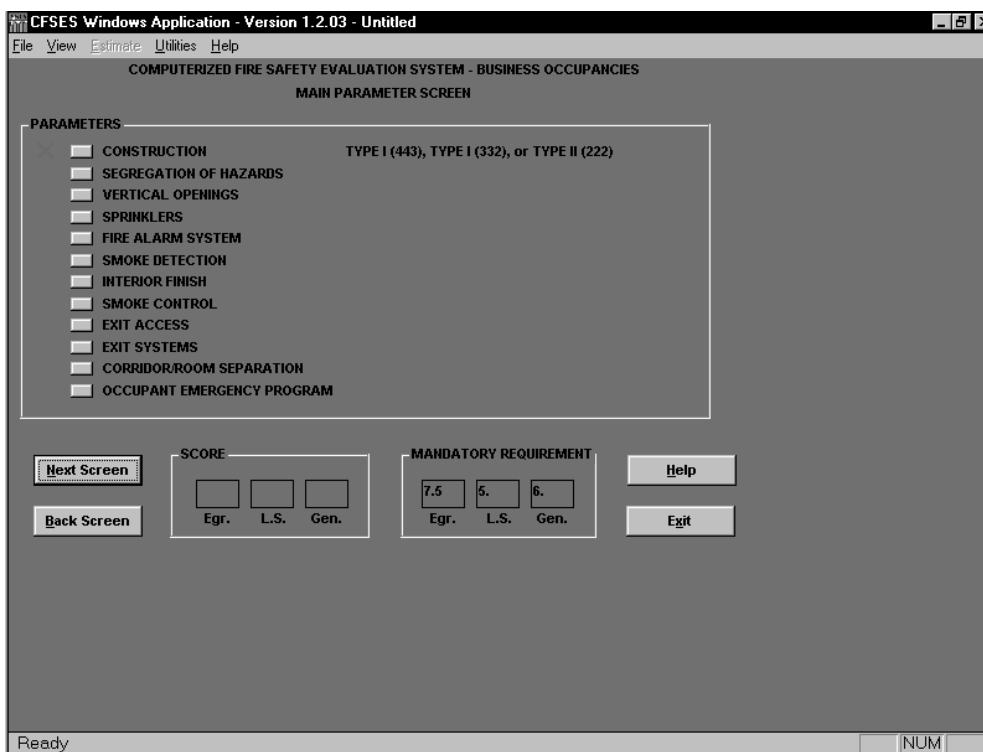


FIGURE 9.3.2.1(b) Main parameter screen with all parameters evaluated.

CFSES Windows Application - Version 1.2.03 - MAY31.PRJ

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

MAIN PARAMETER SCREEN

PARAMETERS

☐ CONSTRUCTION	TYPE I (443), TYPE I (332), or TYPE II (222)
☐ SEGREGATION OF HAZARDS	Exposed exit system; Single deficiency
☐ VERTICAL OPENINGS	Open/incomplete; Connects 4 or more floors
☐ SPRINKLERS	Corridors only
☐ FIRE ALARM SYSTEM	w/o FD notification; with voice communication
☐ SMOKE DETECTION	Corridor
☐ INTERIOR FINISH	Exit: >75 to <=200; rms/stes: >75 to <=200
☐ SMOKE CONTROL	None
☐ EXIT ACCESS	Dead end <=50 ft; Travel is >200 ft
☐ EXIT SYSTEMS	Multiple; Deficient
☐ CORRIDOR/ROOM SEPARATION	Separation; Smoke resistive; w/o door closer
☐ OCCUPANT EMERGENCY PROGRAM	No fire drill conducted

Next Screen Back Screen

SCORE

-5.5	-13.	-14.
Egr.	L.S.	Gen.

MANDATORY REQUIREMENT

7.5	5.	6.
Egr.	L.S.	Gen.

Help Exit

Ready NUM

FIGURE 9.3.2.2(a) Construction parameter screen.

CFSES Windows Application - Version 1.2.03 - MAY31.PRJ

File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

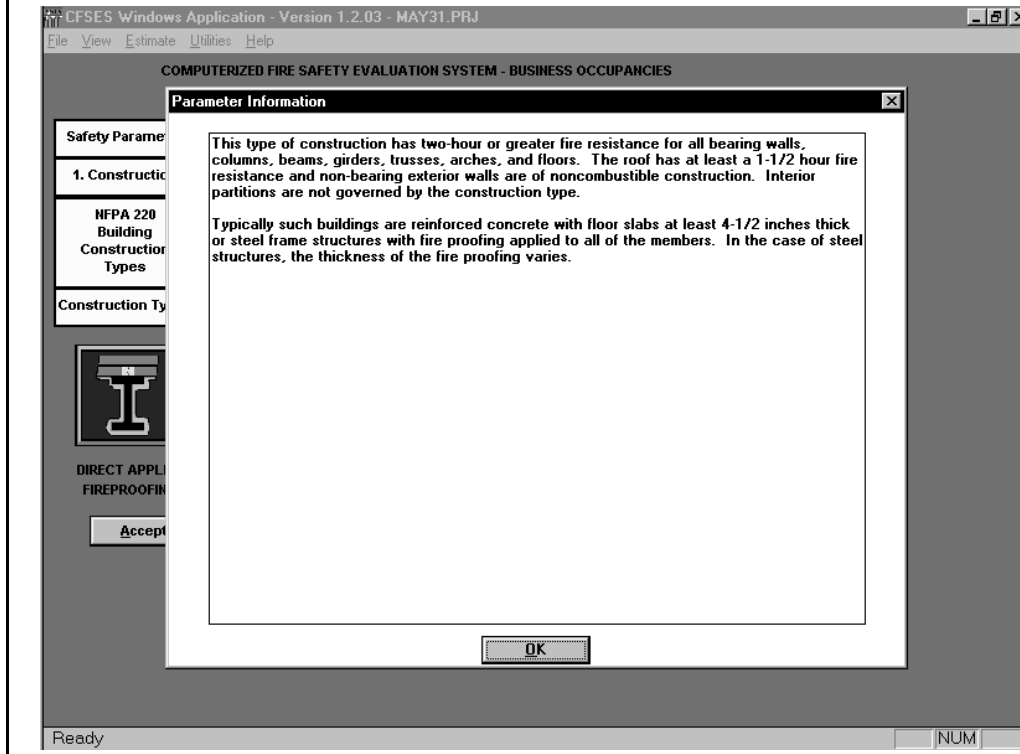
1. CONSTRUCTION PARAMETER

Safety Parameter	PARAMETER VALUE						
1. Construction	Noncombustible			Combustible			
NFPA 220 Building Construction Types	Type I (433) Type I (332) Type II (222)	Type II (111)	Type II (000)	Type III (211)	Type IV (200)	Type V (2HH)	Type V (111) (000)
Construction Types	2	-1	NV	0	NV	0	NV NV

 DIRECT APPLIED FIREPROOFING
  CONCRETE
  MEMBRANE CEILING

Accept Cancel Help Information Judgement

Ready NUM

FIGURE 9.3.2.2(b) Construction parameter information screen.

The user has several options when the Construction parameter screen is shown. The construction type may be examined by clicking on the desired box above the score boxes or by using the “Tab” keyboard button. This will not cause the program to select that construction type. Several examples of the construction type will be shown below the score boxes as icons. Figure 9.3.2.2(a) shows three examples of Type I construction: concrete, membrane ceiling, and direct applied fire proofing. Clicking on one of these icons will bring up an information screen about that particular construction type. The user may also select the “Information” button. This will bring up additional information about the Construction parameter that will help to identify the construction type for the evaluation building. An example of this type of information is shown in Figure 9.3.2.2(b).

The construction type for this building may be selected either by double clicking on the score box below the type of construction identified for the structure or by single clicking on the construction score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Construction parameter. The text “NV” may appear in some of the Construction score boxes for certain types of buildings. This means that the building construction

type is not valid and the NFPA 101A methodology should not be used. A building can be rated “NV” in CFSES, but no scoring will be available and the user will not be able to set Options.

The “Help” button will display an information screen that describes what some of navigation the options available to the user are. The “Cancel” button will make no changes and will return the user to the screen that accessed the Construction parameter. The “Judgement” button allows the user to override the NFPA 101A Table 7.1 parameter score options with a score value based on experience or personal judgement. This feature will be explained in 9.3.2.16.

9.3.2.3 Safety Parameter 2: Segregation of Hazards. The next parameter is Segregation of Hazards. An example of this screen is shown in Figure 9.3.2.3. The user options for this screen are nearly the same as for the Construction parameter screen. One important difference is that the “Estimate” menu file heading is active for this parameter. The estimate feature allows the user to calculate the parameter status and is a special Refinement condition. Subsection 9.3.2.14 explains the Refinements that are available in CFSES, including those for the Segregation of Hazards parameter.

FIGURE 9.3.2.3 Segregation of hazards parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

2. SEGREGATION OF HAZARDS PARAMETER

Safety Parameter	PARAMETER STATUS				
	Exposed Exit System		Segregated from Exit Routes		None or No Deficiencies
	Double Def	Single Def	Double Def	Single Def	
2. Segregation of Hazards	-7	-4	-4	0	0

DOUBLE DEFICIENCY

	NO PROT.	SPRINK. PROT.	FIRE RESIST. ENCL.	SPRINK'D & FIRE RESIST. ENCL.
NOT STRUCT. ENDANG.	SINGLE DEFIC.	NO DEFIC.		
STRUCT. ENDANG.	DOUBLE DEFIC.			

Accept Cancel Help Information Judgement

Ready NUM

An example of the exit system is displayed below the parameter score box if the “Exposed Exit System” or “Segregated Exit System” boxes are selected. A box is selected by single clicking the mouse on the box or by using the “Tab” keyboard button. The Segregation of Hazards parameter is evaluated either by double clicking on the score box below that which has been identified in the evaluation building or by single clicking on the Segregation of Hazards parameter score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Segregation of Hazards parameter screen. Figure 9.3.2.3 shows an exposed exit system with a single deficiency selected. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.4 Safety Parameter 3: Vertical Openings. The next parameter is Vertical Openings, shown in Figure 9.3.2.4. Vertical openings include the exit stairways, ramps, and any other vertical exits, pipes, shafts, ventilation ducts, duct penetrations, laundry chutes, and incinerator chutes. The vertical opening that connects the greatest number of floors must be used as the evaluation basis for this parameter. Unlike the previous two safety parameter screens, the information text is displayed below the score boxes. If the facility is a single story structure, then the Vertical Opening score will be zero, no matter what selection is made. This is a special condition

for this parameter listed in NFPA 101A. The Vertical Openings parameter is evaluated either by double clicking on the score box below the type of vertical openings identified for the structure or by single clicking on the vertical openings score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Vertical Openings parameter screen. Figure 9.3.2.4 shows an open/incomplete exposure vertical opening that connects four floors selected. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.5 Safety Parameter 4: Sprinklers. The “4. Sprinklers Parameter” screen, shown in Figure 9.3.2.5, allows the user to select the level of sprinkler protection. The user can select one of the following: none, corridors only, all but corridors and lobbies, or total building. In some cases, the user may indicate standard or fast response sprinklers. In all cases, the sprinklers must be installed in accordance with NFPA 13, *Standard for Installation of Sprinkler Systems* [NFPA 13, 1999]. Furthermore, to receive credit for sprinkler protection, the sprinkler system must be equipped with an automatic alarm initiating device that activates the building manual fire alarm system or otherwise sounds an alarm sufficiently audible to be heard in all occupied areas.

FIGURE 9.3.2.4 Vertical openings parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

3. VERTICAL OPENINGS PARAMETER

Safety Parameter	PARAMETER STATUS						
	Open (or Incomplete Enclosure)				Enclosed		
	Connects 5 or More Floors	Connects 4 Floors	Connect 3 Floors	Connects 2 Floors	< 30 min	30 min to 1 hr	> 1 hr
3. Vertical Openings	-10	-7	-4	-2	-1	0	1

VERTICAL OPENINGS

There is either a series of unenclosed floor openings through 3 consecutive floor slabs that from a smoke flow standpoint line up with one another

or

There is a shaft of 4 or more floors in vertical length that has unprotected openings to 4 floors. There must be 4 floors exposed to make this charge though the floors need not be consecutive in shafts that extend over 4 floors.

Accept Cancel Help Judgement

Ready NUM

FIGURE 9.3.2.5 Sprinklers parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

4. SPRINKLERS PARAMETER

Safety Parameter	PARAMETER					
	None	Corridors Only	All but Corr. and Lobbies		Total Building	
			Standard	Quick Resp.	Standard	Quick Resp.
4. Sprinklers	0	0	4	6	10	12

SPRINKLERS

All corridors in the building are sprinkler protected and there are at least some unsprinklered spaces that prevents qualifying the building as totally sprinklered.

Accept Cancel Help Discussion Judgement

Ready NUM

Two parameters, Smoke Control and Corridor/Room Separation, have scores that may depend on the Sprinkler parameter selection. Because the twelve safety parameters can be evaluated in any order, the Smoke Control and Corridor/Room Separation parameters could be evaluated before the Sprinklers parameter. If this occurs, the worst case Sprinklers parameter selection is assumed. When the Sprinklers parameter is evaluated, the program will automatically check to see if the Smoke Control Parameter or the Corridor/Room Separation parameter scores have changed. If they have, CFSES will automatically adjust the scores and notify the user of any changes.

The Sprinklers parameter is evaluated either by double clicking on the score box below the type of sprinklers identified for the structure or by single clicking on the Sprinklers parameter score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Sprinklers parameter screen. Figure 9.3.2.5 shows a corridors only Sprinklers parameter selection. The “Cancel,” “Help,” and “Judgement” buttons function the same way as they do in the Construction parameter screen. The “Discussion” button displays an additional information on sprinklers and the

requirements for selecting different sprinkler coverage. This button is analogous to the “Information” button in the Construction parameter screen.

9.3.2.6 Safety Parameter 5: Fire Alarm System. The “5. Fire Alarm System Parameter” screen is shown in Figure 9.3.2.6(a). If a fire alarm exists or is planned, the user must indicate how the signal is transmitted. The user must also indicate if the system includes voice communication for occupant notification and instruction. Text assisting the user in making the proper Fire Alarm System parameter selection is displayed below the score boxes. Some of the scores contain two values: one inside parentheses and one outside of the parentheses. This means that additional information is required to evaluate the score. If one of these boxes is selected, then a window will be displayed that contains additional questions to address. Figure 9.3.2.6(b) shows an example of this type of screen when the “None” score box is selected for the Fire Alarm System Parameter. If the answer to all three questions in the Figure 9.3.2.6(b) is “No” then the score for the “None” box will be 0. Otherwise, the score will be -2, as is shown in Figure 9.3.2.6(a).

FIGURE 9.3.2.6(a) Fire alarm system parameter screen.

Safety Parameter	PARAMETER				
5. Fire Alarm System	None	Without Fire Department Notification		With fire Department Notification	
		Without Voice Communication	With Voice Communication	Without Voice Communication	With Voice Communication
	-2	1(0)	2	2(1)	4

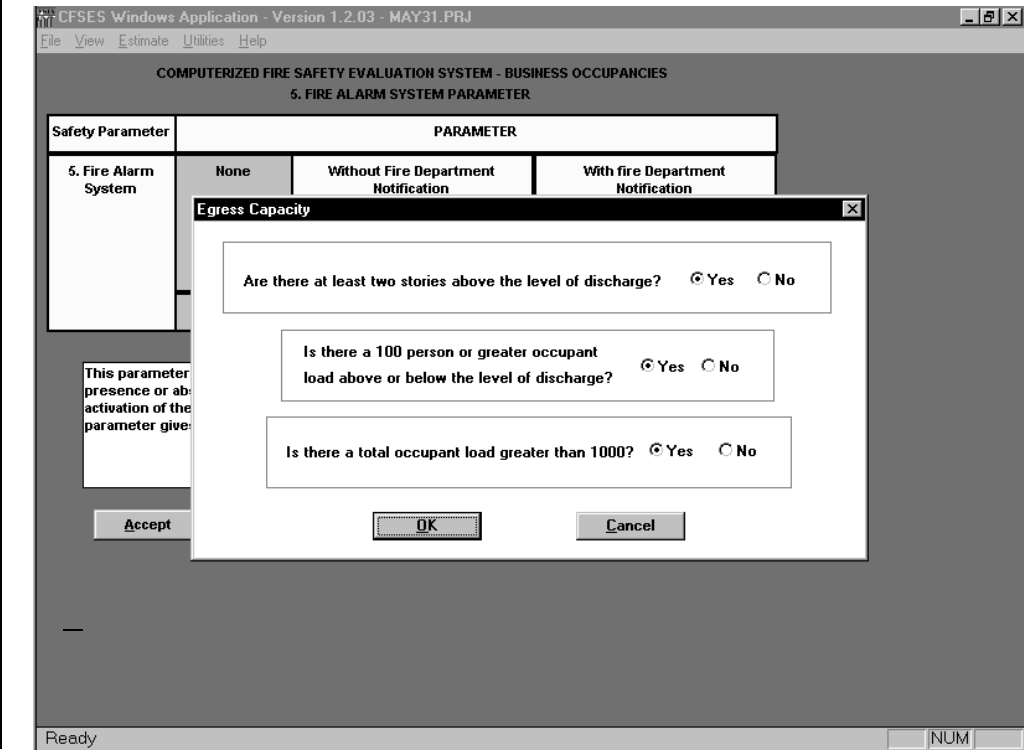
FIRE ALARM SYSTEM

This parameter addresses the manual and/or automatic fire alarm system. It considers both the presence or absence of a fire alarm system for notifying building occupants and whether or not the activation of the fire alarm system (by manual or automatic means) will call the fire department. The parameter gives special credit to systems that include voice communication and alarms.

Accept Cancel Help Judgement

Ready NUM

FIGURE 9.3.2.6(b) Fire alarm system additional information screen.



The Fire Alarm System parameter is evaluated either by double clicking on the score box below the type of fire alarm system for the structure or by single clicking on the Fire Alarm System parameter score then clicking the “Accept” button. If a score box with two scores is double clicked, then an additional information window like that shown in Figure 9.3.2.6(b) will be automatically displayed. In both cases the user will be returned to the screen that accessed the Fire Alarm System parameter screen. Figure 9.3.2.6(a) shows a no fire alarm system selection. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.7 Safety Parameter 6: Smoke Detection. The “6. Smoke Detection Parameter” screen, shown in Figure 9.3.2.7, allows the user to specify the type of smoke detection system in the building. The Smoke Detection parameter choices are none; corridor only; rooms only; and total building. In all cases, smoke detectors must be installed in accordance with NFPA 72, *National Fire Alarm Code*® [NFPA 72, 1999]. It is important to note that no credit is given for heat detectors in habitable spaces. Furthermore, only those detectors that will sound an alarm throughout the building upon activation are to be considered. In order to receive credit for either corridor or room smoke detectors, all of the corridors or all of the rooms must be equipped with smoke detectors.

FIGURE 9.3.2.7 Smoke detection parameter screen.

Safety Parameter	PARAMETER STATUS			
6. Smoke Detection	None	Corridor	Rooms	Total Building (Zone)
	0	1	2	4

SMOKE DETECTION

This parameter addresses the extent of automatic smoke detection coverage in the building. The smoke detectors can alert occupants to the potential danger of fire before the situation become serious.

Accept Cancel Help Judgement

Ready NUM

The Smoke Detection parameter is evaluated either by double clicking on the score box below the type of Smoke Detection System parameter for the structure or by single clicking on the smoke detection score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Smoke Detection parameter screen. Figure 9.3.2.7 shows a corridors only selection. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.8 Safety Parameter 7: Interior Finish. The “7. Interior Finish (Exit Routes, Rooms, and Suites) Parameter” screen is shown in Figure 9.3.2.8. The flame spread rating of the ceiling and wall materials is evaluated here. The flame spread ratings are based on NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials* [NFPA 255, 2000]. The CFSES does not include provisions for materials with flame spread ratings greater than 200 or for finish materials not measured in accordance to NFPA 255. Materials that cannot be evaluated include foamed plastics, asphalt-impregnated paper, materials that melt, drip, or delaminate, and those capable of inducing extreme rates of fire growth and rapid compartment flashover. If these materials are encountered, the CFSES program should not be used.

The flame spread ratings used to obtain a particular score may be reduced for buildings with sprinkler protection. Interior finish with a flame spread rating of 75 that is protected with automatic sprinklers can be evaluated as though it had a flame spread rating of 25. Interior finish that has a flame spread between 75 and 200 that is protected by automatic sprinklers can be evaluated as though it had a flame spread rating of 75.

These reductions are performed automatically by the computer program. The actual flame spread ratings should always be used when making selections. If the Sprinklers parameter has not been evaluated, it is assumed that there are no sprinklers. If the Sprinklers parameter is later evaluated and this causes the score for this parameter to change, then the program will make the changes and alert the user.

The Interior Finish parameter is evaluated either by double clicking on the score box below the type of interior finish for the structure or by single clicking on the Interior Finish parameter score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Interior Finish parameter screen. Figure 9.3.2.8 shows the rooms and corridors both having interior finish with a flame spread rating between 75 and 200. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.9 Safety Parameter 8: Smoke Control. The “8. Smoke Control Parameter” screen is shown in Figure 9.3.2.9. This screen allows the user to evaluate the smoke control system used in the facility. The available options for this parameter are none; passive; or active. If there are no smoke barriers or horizontal exits to a separated fire/smoke zone on the floor and there is no mechanically assisted smoke control system serving the floor, then the user should select “none.” A passive smoke control system consists of continuous vertical membranes designed to restrict the movement of smoke. An active smoke control system has a tested and accepted smoke control design that prevents the leakage of smoke between components or zones.

FIGURE 9.3.2.8 Interior finish parameter screen.

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7. INTERIOR FINISH (EXIT ROUTES, ROOMS, AND SUITES) PARAMETER

Safety Parameter	PARAMETER STATUS						
7. Interior Finish	Flame Spread Ratings						
	Exit Routes	>75 to <=200		>25 to <=75		<=25	
	Rooms/Suites	>75 to <=200	<=75	>75 to <=200	<=75	>25 to <=200	<=25
		-3	-1	0	1	1	2

INTERIOR FINISH

Interior finish is judged on the likelihood that the fire will spread and contribute to fire growth. It considers the finish in the exit routes separate from that in the rooms (or suites). The grading considers that the interior finish in the exit routes is more critical than that in the rooms. The individual flame spread ratings of the material involved determine the assigned charge.

Accept Cancel Help Judgement

Ready NUM

FIGURE 9.3.2.9 Smoke control parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

8. SMOKE CONTROL PARAMETER

Safety Parameter	PARAMETER STATUS		
8. Smoke Control	None	Passive	Active
	0	3	3

SMOKE CONTROL

This parameter considers the ability of the building arrangement and any specific pressurization systems to prevent the movement of smoke from one portion of a building to another. It separately evaluates passive systems based solely on doors and barriers and those that reinforce the doors and barriers with an active (air pressurization) system.

The design and installation of an active system involves significant engineering and acceptance testing. The credit for active smoke control should be given only in cases where an engineered and tested smoke control system is present.

Accept Cancel Help Judgement

Ready NUM

The Smoke Control parameter is evaluated either by double clicking on the score box below the type of smoke control system for the structure or by single clicking on the Smoke Control parameter score then clicking the “Accept” button. In both cases the user will be returned to the screen that accessed the Smoke Control parameter screen. Figure 9.3.2.9 shows a building with no smoke control selected. The “Cancel,” “Help,” and “Judgement” buttons function the same way as they do in the Construction parameter screen.

9.3.2.10 Safety Parameter 9: Exit Access. The “9. Exit Access Parameter” screen, shown in Figure 9.3.2.10, allows the user to evaluate the dead-end corridor and travel distance. If the maximum dead-end corridor distance is greater than 50 ft, then one of two columns below the “Max. Dead Ends”: heading must be selected. These two columns indicate the maximum length of the dead-end corridor. If the maximum dead-end corridor distance is less than 50 ft, then the parameter selection is based on the maximum travel distance. If the maximum dead-end distance is greater than 100 ft, then a separate analysis must be conducted. This analysis must evaluate the flash-over potential of any space that could block egress from the dead-end corridor and also determine the potential rate of smoke filling of the egress system used by the dead-end corridor. To do this, the “Utilities” file menu functions may be used. Section 9.4 describes each of these functions and explains how they can be applied to this type of analysis. If the calculated safe time is less than the expected egress time, then the analysis should be discontinued until a corrective action is specified. The 50 ft dead-end corridor criterion applies only to existing buildings and new full sprinklered buildings. A 20 ft dead-end corridor criterion is used for all other new buildings. If the building is full sprinklered then the maximum travel distance may be increased from 200 ft to 300 ft. The CFSES program automatically makes these adjustments.

The Exit Access parameter is evaluated either by double clicking on the score box below the type of exit access found in the structure or by single clicking on the Exit Access parameter score then clicking the “Accept” button. In both cases the user will be returned to the screen that invoked the Exit Access parameter screen. Figure 9.3.2.10 shows an exit access that does not have dead ends greater than 50 ft and horizontal travel distances greater than 200 ft selected. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.11 Safety Parameter 10: Exit System. The “10. Exit System Parameter” screen, shown in Figure 9.3.2.11, allows the user to evaluate the travel paths from the building rooms to the building exterior. One of five options are available: single exit route, multiple exit routes with deficiencies, multiple exit routes without deficiencies, multiple exit routes in smoke proof enclosures, and multiple direct exit routes.

A single exit route exists where occupants on any floor do not have either a direct exit or multiple exit routes available. Multiple exit routes exist where occupants on a floor have a choice of two separate means of egress to the building exterior. An exit route is considered deficient if it fails to meet any of the applicable criteria listed in NFPA 101, *Life Safety Code* [NFPA 101, 2000], including the capacity of the exit routes. Any system with a common path of travel in excess of that permitted by NFPA 101 should also be considered deficient. To receive credit for smoke proof enclosures, all exit stairs must meet the requirements for smoke proof enclosures. These requirements are listed in the NFPA 101 [2000]. To be credited for direct exits, each room must contain a door that either opens to the building exterior at grade level or to an exterior balcony with direct access to an exterior exit.

The Exit System parameter is evaluated either by double clicking on the score box below the type of exit system found in the structure or by single clicking on the exit system score then clicking the “Accept” button. In both cases the user will be returned to the screen that invoked the Exit System screen. Figure 9.3.2.11 shows an exit system with multiple routes that are not deficient selected. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.12 Safety Parameter 11: Corridor/Room Separation. The “11. Corridor/Room Separation (Compartmentation) Parameter” screen is shown in Figure 9.3.2.12(a). This parameter screen allows the user to evaluate the quality of the separations between the rooms and the corridors. The separation is considered incomplete if the wall has any unprotected openings between the floor and ceiling. If there are openings above the ceiling level, then the separation is considered complete provided the ceiling is a complete membrane. If the separation meets the criteria cited above, then it is considered to be complete. The complete separations are subdivided based on the fire resistance and the presence/absence of automatically closing doors.

FIGURE 9.3.2.10 Exit access parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

9. EXIT ACCESS PARAMETER

Safety Parameter	PARAMETER STATUS					
9. Exit Access	Max. Dead Ends:		No Dead End > 50 ft and Travel Is:			
	>75 ft to <=100 ft	>50 <=75 ft	>200 ft	>100 ft <= 200 ft	>50 ft to <=100 ft	<=50 ft
	-2	-1	-1	0	1	3

EXIT ACCESS

This parameter addresses the distance that persons evacuating the building in an emergency will have to travel to reach the safety of an exit and whether that route can be easily blocked by a single fire.

Accept Cancel Help Judgement

Ready NUM

FIGURE 9.3.2.11 Exit system parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

10. EXIT SYSTEM PARAMETER

Safety Parameter	PARAMETER STATUS				
10. Exit System	Single	Multiple Routes			
		Deficient	Not Deficient	Smokeproof Enclosures	Direct Exits
	-6(0)	-2	0	3	5

EXIT SYSTEM

This parameter evaluates the individual elements of the actual exit system. Consideration is given to the number of exit options and their quality. To evaluate a Building with a single direct exit, use the Direct Exits selection under the Multiple Exits category.

Accept Cancel Help Judgement

Ready NUM

FIGURE 9.3.2.12(a) Corridor/room separation parameter screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

11. CORRIDOR/ROOM SEPARATION (COMPARTMENTATION) PARAMETER

Safety Parameter	PARAMETER STATUS						
11. Corridor/room separation (compartmentation)	Separation exists and level of protection is:					No Separation	
	In-complete	Smoke resistive		>= 20 min			>=1 hr
		w/o door closer	w/ door closer	w/o door closer	w/ door closer		w/ door closer
	-2	0	1(2)	1	2(3)	3(4)	3

COMPARTMENTATION

This parameter addresses the separation of the actual occupant spaces from the exit corridor system. This measures both the protection of the corridor from fires in a room and the ability to confine the fire and/or smoke to that room.

Accept Cancel Help Judgement

Ready NUM

The Corridor/Room Separation parameter is evaluated either by double clicking on the score box below the type of Compartmentation in the structure or by single clicking on the Corridor/Room Separation parameter score then clicking the "Accept" button. In both cases the user will be returned to the screen that invoked this parameter screen. Figure 9.3.2.12(a) shows a space with incomplete separation selected. The "Cancel," "Help," and "Judgement" buttons work the same way as they do in the Construction parameter screen.

If incomplete corridor/room separation is selected, as it is in Figure 9.3.2.12(a), then a screen requesting additional information will be displayed. This screen is shown in Figure 9.3.2.12(b). The user is prompted for the corridor safe

time in increments of two minutes. The score for the Compartmentation parameter is calculated using the corridor safe time value. The corridor safe time is the minimum assumed time that the corridor will remain tenable in the event of a fire. If the corridor safe time is not known, then the user can calculate the value by clicking on the "Calculate" button. The "Calculate" button will cause the screen shown in Figure 9.3.2.12(c) to be displayed. When all of the information in this screen is entered, the corridor safe time will be automatically determined after the "OK" button is clicked. The "View Graph" button in the screen shown in Figure 9.3.2.12(c) displays a graph of the equation used to determine the corridor safe time.

FIGURE 9.3.2.12(b) Compartmentation additional information screen.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

11. CORRIDOR/ROOM SEPARATION (COMPARTMENTATION) PARAMETER

Safety Parameter	PARAMETER STATUS
11. Corridor/room separation (compartmentation)	Separation exists and level of protection is: No Separation

This parameter corridor system and the ability to

Accept

Corridor Safe Time

The corridor safe time is the minimum time that can be relied upon for which the conditions therein will remain tenable

The corridor safe time is:

- ☒ Less than two minutes
- ☐ Greater than or equal to two but less than four minutes
- ☐ Greater than or equal to four but less than eight minutes
- ☐ Greater than or equal to eight but less than sixteen minutes
- ☐ Greater than or equal to sixteen minutes

OK Cancel Calculate

Ready NUM

FIGURE 9.3.2.12(c) Corridor safe time calculation box.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

11. CORRIDOR/ROOM SEPARATION (COMPARTMENTATION) PARAMETER

Safety Parameter	PARAMETER STATUS
11. Corridor/room separation (compartmentation)	Separation exists and level of protection is: No Separation

This parameter corridor system and the ability to

Accept

Corridor Safe Time Calculation Box

FLOW CALCULATION DATA

Enter the leakage area (in²) 500.

Enter fire gas temperature (°F) 1500.

Enter depth of smoke layer below center of opening (ft) 7.

FILL TIME CALCULATION

Enter corridor height (ft) 9.

Enter corridor width (ft) 8.

Enter corridor length (ft) 500.

Calculate Cancel View Graph

Ready NUM

FIGURE 9.3.2.13 Occupancy emergency program parameter screen.

Safety Parameter	PARAMETER STATUS		
12. Occupant Emergency Program	Number of Fire Drills Conducted per Year		
	0	1 to 2	over 2
	-2	0(1)	1(2)

OCCUPANCY EMERGENCY PROGRAM

This parameter gives a measure to the emergency preparedness of the building occupants. It measures that preparedness in terms of the number of fire drills held each year.

Accept Cancel Help Judgement

Ready NUM

9.3.2.13 Safety Parameter 12: Occupant Emergency Program. The last parameter screen is “12. Occupant Emergency Program Parameter”. The Occupant Emergency Program parameter is evaluated either by double clicking on the score box below the type of Occupancy Emergency Program in the structure or by single clicking on the Occupancy Emergency Program score then clicking the “Accept” button. In both cases the user will be returned to the screen that invoked this parameter screen. Figure 9.3.2.13 shows a building with no occupancy emergency program selected. The “Cancel,” “Help,” and “Judgement” buttons work the same way as they do in the Construction parameter screen.

9.3.2.14 Refinements. The Refinements refer to calculations that can be performed which may result in improved parameter scores. Only six parameters have Refinement calculations available at this time: Construction, Segregation of Hazards, Smoke Control, Exit Access, Exit System, and Corridor/Room Separation. The Refinements calculations for two of the parameters can be performed in the respective safety parameter screen by using the “Estimate” function in the main menu. Accessing the main menu functions is described in Section 9.4. The two parameters that have this feature are Segregation of Hazards and Smoke Control. The Refinement calculations for the other four parameters can

only be done by using the “Refinements” button in the “Parameter Worksheet” screen. A completed “Parameter Worksheet” is shown in Figure 9.3.2.14(a) with the “Refinements” buttons displaying a “not evaluated” status. The Refinement calculations using the “Refinements” button can only be done after all twelve of the safety parameters have been evaluated. When this is done and the “Refinements” button clicked, the screen in Figure 9.3.2.14(b) will be displayed. This is the “Parameter Refinement” screen. Only parameters that are eligible for Refinement calculations have buttons that can be clicked. If a parameter cannot be Refined, then the button will be gray and inactive, and the text “Unavailable” will be shown beside the button. The screen in Figure 9.3.2.14(b) shows that six parameters are eligible for Refinement calculations. In some cases, less than six may be available, depending on the parameter selections. Also, if the Segregation of Hazards and Smoke Control parameters were refined in the safety parameter screens, they will be shown as being “Done” here. The refinements are optional. The “Skip” button will bypass all of the refinements. Individual parameter refinements may also be skipped. The text adjacent to a skipped parameter refinement will read “Skip.”

FIGURE 9.3.2.14(a) Individual parameter evaluation sheet — all parameters evaluated.

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COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES
INDIVIDUAL PARAMETER EVALUATION - WORKSHEET (BASE CASE)

PARAMETER	FIRE CONTROL	EGRESS	GENERAL
CONSTRUCTION	-1		-1
SEGREGATION	-4	-4	-4
V. OPENINGS	-7/2 = -3.5	-7	-7
SPRINKLERS	0	0/2 = 0.	0
FIRE ALARM	2/2 = 1.	2	2
SMOKE DET.	1/2 = 0.5	1	1
INT. FINISH	-3/2 = -1.5		-3
SMOKE CONT.		0/2 = 0.	0
EXIT ACCESS		-1	-1
EXIT SYSTEM		-2	-2
CORRIDOR SEP.	1/2 = 0.5	1/2 = 0.5	1
OCC. EMER. PR.		-2	-2
TOTAL	-8.	-12.5	-16.
REQUIRED	7.5	5.	6.

Options

OPTION 1 Cost/Risk

OPTION 2 Cost/Risk

OPTION 3 Cost/Risk

OPTION 4 Cost/Risk

OPTION 5 Cost/Risk

Actions

Set Base Case Not Available

Refinements Not Evaluated

Base Case Not Available

Considerations Not Evaluated

Back Screen Exit Help

Ready NUM

FIGURE 9.3.2.14(b) Parameter refinement screen.

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File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

Parameter	Status
1. Construction	Refine
2. Seg. of Hazards	Refine
3. V. Openings	Unavailable
4. Sprinklers	Unavailable
5. Fire Alarm Systems	Unavailable
6. Smoke Detection	Unavailable
7. Interior Finish	Unavailable
8. Smoke Control	Refine
9. Exit Access	Refine
10. Exit Systems	Refine
11. Corr./Room Sep.	Refine
12. Occ. Emer. Prog	Unavailable

Done Skip Cancel Help

Ready NUM

The first safety parameter that can be Refined is the Construction parameter. Only certain Construction parameter selections will lead to a Refinement calculation. Table 9.3.2.14(a) summarizes the Refinement calculation status for each Construction parameter selection available in the CFSES program.

If the Construction parameter can be Refined, then the text “Refine” will appear beside the Construction parameter Refinement button. If the parameter cannot be Refined, then the text “Unavailable” will appear beside the button. If the parameter has been skipped, then the text “Skip” will appear beside the button. If the parameter has already been Refined, then the text “Done” will appear next to the button. If the Construction parameter can be Refined, then clicking the Construction parameter Refinement button will display the “Construction Refinement Calculation” screen, which is shown in Figure 9.3.2.14(c). The compartment dimensions, opening dimensions, and fuel load are all required for this

calculation. When this information has been entered, the “Calculate” button will initiate the calculation. The Refinement Calculation uses Law’s Fire Severity Correlation to calculate the fire duration in the worst case space in the building. Figure 9.3.2.14(d) shows the next screen in this process. The calculated fire duration is shown at the top of the screen, 65 minutes in this case. If this duration is less than the fire resistance of all structural elements listed at the bottom of the screen shown in Figure 9.3.2.14(d), then the parameter score can be increased. If not, then the score will remain the same. If the fire resistance of each member is not known, the user should consult NFPA 220, *Standard on Types of Building Construction* [NFPA 220, 1999]. When the user has properly compared the fire resistance of each member to the calculated fire duration, the “Calculate” button should be clicked. An information box will be displayed informing the user if the score was increased or if it is still the same.

Table 9.3.2.14(a) Refinement Calculation Status for Each Construction Parameter Selection

Stories	Height	Construction Type							
		Type I	Type II (111)	Type II (000)	Type III (211)	Type III (200)	Type IV	Type V (111)	Type V (000)
1	< 75 ft	No	Yes	Yes	No	Yes	No	No	Yes
2	< 75 ft	No	Yes	Yes	No	Yes	No	No	Yes
3	< 75 ft	No	Yes	Yes	No	Yes	No	No	Yes
4 – 5	< 75 ft	No	Yes	Yes	No	Yes	No	No	Yes
5+	< 75 ft	No	Yes	No	No	No	No	No	No
5+	75 ft – 150 ft	No	Yes	No	No	No	No	No	No
5+	> 150 ft	No	No	No	No	No	No	No	No

FIGURE 9.3.2.14(c) Construction refinement calculation — screen 1.

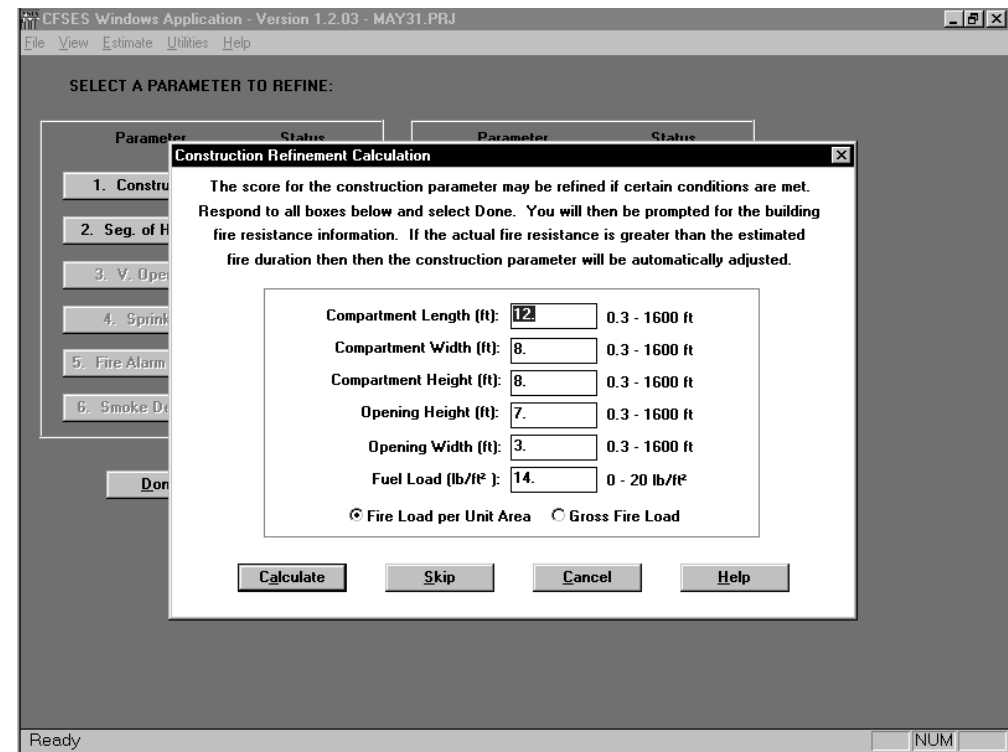
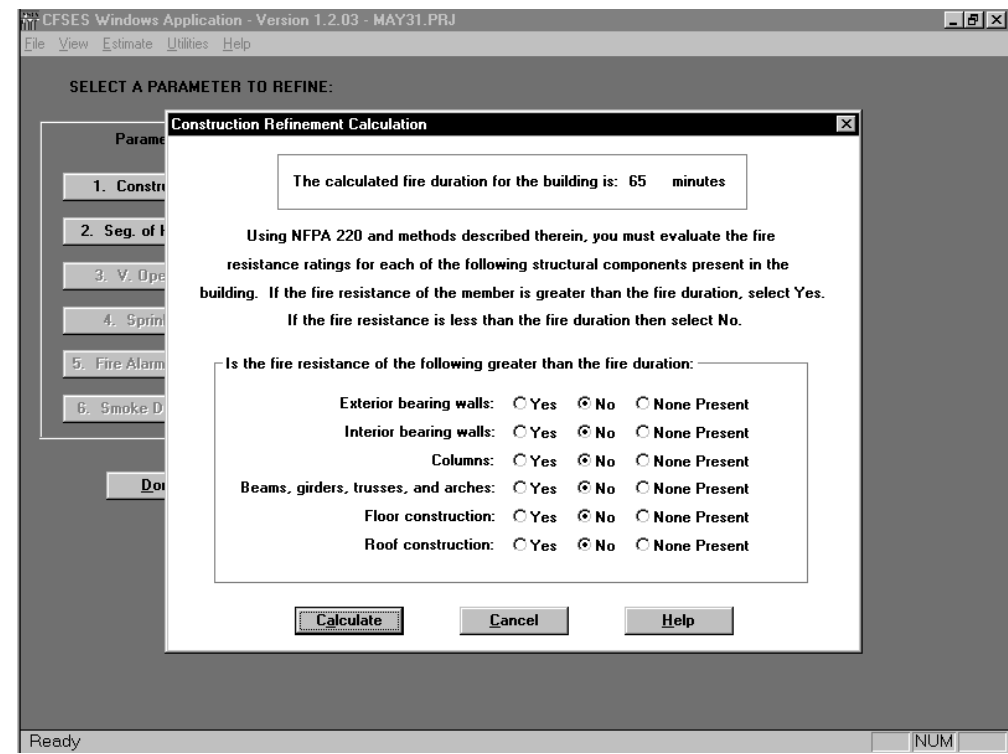


FIGURE 9.3.2.14(d) Construction refinement calculation — screen 2.



Law's Fire Severity Correlation calculates the effective fire duration using the following equation [Portier et al., 1996]:

$$t_f = \frac{4.89 m_{\text{fuel}}}{(A_V A_R)^{0.5}} \quad (1)$$

where t_f is the effective fire duration (s), m_{fuel} is the total mass of fuel (lb), A_V is the equivalent total area of openings (ft²), and A_R is the total internal surface area of the compartment floors, walls, and ceiling (ft²). The total fuel mass may be entered either as the fuel load per unit area or the gross fuel load. The gross fuel load is the fuel load multiplied by the compartment floor area. The program will automatically toggle between the two ways to enter the fuel load by using the specified compartment dimensions.

If there is more than one opening, then the equivalent opening area must be determined using the following equation:

$$A_V = H_V W_V \quad (2)$$

where H_V is the equivalent opening height (ft) and W_V is the equivalent opening width (ft). The equivalent opening height, H_V , is the difference between the maximum opening elevation among all openings and the minimum opening elevation among all openings. The equivalent opening width is determined using the following equation:

$$W_V = \frac{1}{H_V^{1.5}} \cdot \sum_{i=1}^n (A_{V,i} H_{V,i}^{1.5}) \quad (3)$$

where i is the i th opening and n is the total number of openings.

If the Construction parameter score can be increased, then the program automatically adjusts the score and notifies the

user. The new score will depend on what type of construction was originally selected for this parameter. Table 9.3.2.14(b) summarizes how the CFSES program will increase the Construction parameter score.

Table 9.3.2.14(b) Construction Parameter Refinement Calculation Actions

Original Construction Type	Equivalent Construction Type of Refined Construction Parameter with Increased Score
Type II (111)	Type II (222)
Type II (000)	Type II (222)
Type V (000)	Type V (111)

The next parameter that can be Refined is Segregation of Hazards. Only certain parameter selections will lead to the Refinement calculation. Table 9.3.2.14(c) summarizes the Refinement status of the Segregation of Hazards parameter selections.

Figure 9.3.2.14(e) shows the first screen in this calculation process. Thomas's Flashover Correlation is first used to determine if flashover can occur in the worst case hazardous space. The "7-5.2.1" and "7-5.2.4.3" buttons in Figure 9.3.2.14(e) display sections of the NFPA 101A code that can assist identifying a hazardous area. The "Burn Rates" button shows the heat release rates of common fuel packages to help with entering the values in the calculation screen. The "View Graph" button graphically displays Thomas's Flashover Correlation. When the information is complete in this window, the "Calculate" button should be selected. The program will automatically prompt the user for the dimensions of each opening. When this is finished, the calculation will be performed and a message displaying the results will be shown. If flashover cannot occur, then the parameter score can be increased and the Refinement calculation is done.

Table 9.3.2.14(c) Refinement Calculation Status for Each Segregation of Hazards Parameter Selection

Exposed Exit System		Segregation from Exit Routes		No Hazardous Areas/ No Deficiencies
Double Deficiency	Single Deficiency	Double Deficiency	Single Deficiency	
Yes	Yes	Yes	No	No

FIGURE 9.3.2.14(e) Segregation of hazards refinement calculation — screen 1.

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File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

1. Con
2. Seg.
3. V.
4. S
5. Fire A
6. Smok

Segregation of Hazards Refinement Calculation

This screen assumes that a hazardous area in accordance with NFPA 101A 7-5.2.1 or 7-5.2.4.3 has been identified.

What is the burning rate per square foot of floor area for the largest fuel package (Btu/s-ft²) ? 200.

What is the total floor area occupied by this fuel package (ft²) ? 10.

Enter the number of openings 1

What is the total surface area of the walls, ceiling, and floor (ft²) ? 500.

Help View Graph 7-5.2.1 7-5.2.4.3

Calculate Skip Cancel Burn Rates

Ready NUM

FIGURE 9.3.2.14(f) Segregation of hazards refinement calculation — screen 2.

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File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

1. Con
2. Seg.
3. V.
4. S
5. Fire A
6. Smok

Segregation of Hazards Refinement Calculation

Flashover was predicted in the hazardous area. Before this parameter can be Refined, the fire duration in the area must be calculated.

Enter the total wood equivalent fire load (lbs): 2300.

Enter the total area of the openings (ft²): 21.

Enter the total surface area of the walls, ceiling, and floor (ft²): 500.

Is the space sprinklered? ☐ Yes ☒ No

Is the exit route exposed to the hazardous area? ☒ Yes ☐ No

Enter the minimum level of fire resistance of any floor members or structural bearing elements that would be exposed by fire in the hazardous area. 60.

Enter the minimum level of fire resistance of walls or partitions and doors enclosing the area. Use zero if there are any unprotected openings. 60.

Calculate Cancel View Graph

Ready NUM

If flashover can occur, then Law's Fire Severity Correlation will be used to estimate the fire duration for comparison with the fire resistance of the hazardous area enclosure. This screen is shown in Figure 9.3.2.14(f). In order to perform this Refinement calculation, it is necessary to know if the space has sprinklers and if the exit routes are exposed. When all of the information in the screen shown in Figure 9.3.2.14(f) has been entered, the user should select "Calculate." The calculation will be performed and the user will be notified of the results. If the parameter score could be increased, then it will be scored as if there were no deficiencies.

Thomas's Flashover Correlation estimates energy release from a fire needed to cause flashover in a compartment. The following equation is used in the CFSES model to estimate the flashover energy [Portier et al., 1996]:

$$\dot{Q}_{fo} = 0.69A_R + 18.4(A_V H_V^{0.5}) \quad (4)$$

where $\dot{Q}_{fo}$ is the minimum flashover heat release rate (Btu/s).

The next parameter that can be Refined is Smoke Control. Only buildings that do not have a smoke control system or that have a passive smoke control system can be Refined. Figure 9.3.2.14(g) shows the screen used for this calculation. The Smoke Control parameter score can be increased if it can be shown that the sprinkler system would prevent a moderate growth rate fire from reaching 284 Btu/s. If there is no sprinkler system in the worst case space, then the parameter score will remain the same. If there is a sprinkler system, then the sprinkler information must be entered. A sprinkler actuation calculation will next be initiated. If the calculated fire size at

sprinkler actuation is less than 284 Btu/s, then the parameter score is increased to the same level as if there were an active smoke control system.

A moderate growth fire has a time dependent heat release rate given by the following equation [NFPA 72, 1999]:

$$\dot{Q}(t) = 0.0111t^2 \quad (5)$$

where $\dot{Q}(t)$ is the heat fire heat release rate (Btu/s) at time t (s). The equations used to calculate the sprinkler actuation time are based on the sprinkler response time index (RTI) and the sprinkler actuation temperature. These equations are summarized by Stroup and Evans [1988] and Alpert [1972] and are used by the computer program DETACT.

The next parameter that can be Refined is Exit Access. The only parameter selections that can be Refined are those where the dead-end corridor distance is less than 50 ft and the horizontal travel distance is between 50 ft and 400 ft. The Refinement calculation uses a single level egress equation to estimate the expected escape time from the worst case level in a building. Figure 9.3.2.14(h) shows the screen used for this calculation. As a minimum, the horizontal travel speed and the maximum travel distance must be entered. If there are disabled persons, the travel speed of a disabled person, as a percent of an able person, must also be entered. When the information in the calculation screen has been entered, the user should select the "Calculate" button. The calculation will then be performed and if the parameter score can be increased, then the CFSES program will automatically make the score changes. The user will be notified of the calculation results.

FIGURE 9.3.2.14(g) Smoke control refinement calculation.

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File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

Smoke Control Refinement Calculation

The Smoke Control parameter can be Refined if the sprinkler system can prevent a moderate growth fire from reaching 284 Btu/s. Enter the sprinkler information and this routine will automatically update the smoke control parameter score if applicable.

General Input Parameters for Worst Case Area

☐ No sprinklers in worst case area

☒ Sprinklers in worst case area

Height of ceiling (ft): 8. 0 - 1600 ft

Radial distance (ft): 7.7 0 - 1600 ft

Ambient temperature (°F): 77. -29 - 210 °F

RTI value ((ft-s)^{0.5}): 250. 1.8 - 720 (ft-s)^{0.5}

Activation Temperature (°F): 160. 100 - 400 °F

Calculate Skip Cancel Help

Ready NUM

FIGURE 9.3.2.14(h) Exit access refinement calculation.

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File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

Parameter	Status
1. Construction	Done
2. Seg. 4	
3. V. D	
4. Sp	
5. Fire Ale	
6. Smoke	
7. Interior Finish	Unavailable

Exit Access Refinement Calculation

This Refinement calculates the time needed for a person or group of people to reach exit access. An exit access is considered as any enclosed stair or corridor leading to an Exterior exit. This enhancement applies to the worst case floor level within a multi-story structure.

Speed on level routes (0.33 - 39 ft/s): Distance over floor (0 - 6600 ft):

☒ Disabled persons Slowest disabled person as percent of abled (1 - 100 %):

Calculate Skip Cancel Help

Ready NUM

The Refinement calculation compares the maximum horizontal travel time on the level being considered to a baseline value. If the calculated travel time is less than the baseline value, then the Exit Access score will be increased. The baseline value is calculated using the approach given in NFPA 101 [2000]. If the parameter score can be changed, the following parametric equations are used to determine the score value:

$$S = 3.74 - 2.96 t_{hor} \quad (\text{Sprinklers not present})$$

$$S = 3.70 - 2.35 t_{hor} \quad (\text{Sprinklers present}) \quad (6)$$

where S is the new Exit Access parameter score and t_{hor} is the calculated horizontal travel time (min). A constraint on the calculated parameter score is that it must be between the minimum and maximum score values for this parameter given in NFPA 101A. The minimum Exit Access score is -1.0 and the maximum Exit Access score is 3.0. If the Exit Access score changes as a result of using Equation 6, then it will be a Judgement value. Judgement value scoring is explained in 9.3.2.16. The horizontal travel time on a single level is calculated using the following equation [Portier et al., 1996]:

$$t_{hor} = \frac{x_{hor}}{v_{able} \chi} \cdot \frac{1}{60} \quad (7)$$

where x_{hor} is the horizontal travel distance (ft), v_{able} is the horizontal travel speed for an able person (ft/s), and χ is the disabled person travel speed fraction.

The Exit System Refinement calculation is based on the calculated egress time for an entire building. Only exit systems with deficient multiple routes can be Refined. If the calculation demonstrates that the egress time is within an acceptable limit, then the deficiency will be removed. The acceptable egress limits are defined as three minutes per floor. Figure 9.3.2.14(i) shows the screen used for this calculation. The user is required to enter the number of floors, the total number of occupants, the number of exit doors, the horizontal travel speed, and the flow rate through a single exit. In addition, if disabled persons are present the "Disabled Persons" checkbox should be selected. If there are multiple floors in the building then the "Stairs" checkbox should be checked. If there are stairs, then the number of stairways, the total vertical travel distance, the average or total width of the stairs, the height of the stair risers, the depth of the stair tread, the flow rate of persons on the stairs, and the speed down the stairs need to be entered. The program will automatically toggle between the average and total stair width, depending on the user selection.

When all of the information has been entered, the user should select the "Calculate" button. The program will perform the calculation and if the egress time is less than the baseline value of three minutes per floor, the parameter will be increased. The calculation results will be displayed in an information screen.

FIGURE 9.3.2.14(i) Exit system refinement calculation.

The total building egress time is calculated using the following equation [Portier, 1996]:

$$t_{tot} = t_{ver} + t_{ex} + t_{st} \quad (8)$$

where t_{tot} is the total egress time (min), t_{ver} is the vertical exit time (min), t_{ex} is the total horizontal and door exit time (min), and t_{st} is the stair exit time (min). The vertical exit time is given by the following equation:

$$t_{ver} = \frac{z_{ver}}{v_{st}} \cdot \sqrt{\frac{11z_{ris}}{7x_{tr}}} \cdot \frac{1}{60} \quad (9)$$

where z_{ver} is the vertical travel distance (ft), v_{st} is the travel speed on the stairs (ft/s), z_{ris} is the height of the riser (ft), and x_{tr} is the depth of the tread (ft). If there are no stairs, then t_{ver} is zero. The total horizontal and door exit time is given by the following equation:

$$t_{ex} = t_{hor} + t_{op} \quad (10)$$

where t_{op} is the discharge time through the exits (min) and t_{hor} is the horizontal travel time (min). The horizontal travel time

is determined by using Equation 7. The discharge time through the exits is given by:

$$t_{op} = \frac{N_p}{N_{ex}Q_{ex}} \cdot \frac{1}{60} \quad (11)$$

where N_p is the maximum number of occupants on a level, N_{ex} is the number of exits on the level with the maximum number of occupants, and Q_{ex} is the exit discharge rate (persons per exit per second). The stair exit time is calculated using:

$$t_{st} = \frac{N_p}{W_{eff}Q_{st}} \cdot \frac{1}{60} \quad (12)$$

where W_{eff} is the effective total stair width (ft) and Q_{st} is the person flow through the stairs (persons/ft/s). A correction is made to the stair width entered in the calculation screen for railings and other obstacles, as specified in NFPA 101 [NFPA 101, 2000].

The final parameter that can be refined is the Corridor/Room Separation parameter. Only certain parameter selections can be refined. Table 9.3.2.14(d) summarizes the Refinement status for each parameter selection.

Table 9.3.2.14(d) Corridor/Room Separation Refinement Status

Separation Exits and Protection Level is:						No Separation/ Single Tenant
Incomplete	Smoke Resistive		Over 1/2 hr		Over 1 hr	
	Without Door Closer	With Door Closer	Without Door Closer	With Door Closer	With Door Closer	
No	No	Yes	No	Yes	Yes	No

The Refinement calculation for this parameter is similar to the Refinement calculation for the Segregation of Hazards parameter. The first part of the calculation determines if flashover can occur in the worst case room using Thomas's Flashover Correlation. If flashover is not predicted, then the parameter is treated as if there were no separation and the score increased accordingly. Figure 9.3.2.14(j) shows the flashover calculation screen for this parameter. Thomas's Flashover is used for this calculation. The "Burn Rate" button in Figure 9.3.2.14(j) displays some common fuel package burn-

ing rates. If flashover is not predicted, then Law's Fire Severity Correlation is used to estimate the fire duration. This screen is shown in Figure 9.3.2.14(k). The user must enter the fire resistance of the compartment for comparison with the calculated fire duration. If the fire duration is less than the compartment fire resistance, then the score for this parameter can be increased such that it corresponds to a parameter selection of no separation. An information screen is displayed summarizing the results of the calculation when complete.

FIGURE 9.3.2.14(j) Corridor/room separation refinement calculation — screen 1.

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File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

Parameter Status Parameter Status

1. Corridor/Room Separation Refinement Calculation

2. Segregation of Hazards

3. Ventilation

4. Smoke

5. Fire Alarm

6. Smoke Detector

The Corridor/Room Separation parameter may be Refined if the fire severity can be shown to be less than the fire rating of the most severe room space.

What is the burning rate per square foot of floor area for the largest fuel package (Btu/s-ft²)? 200.

What is the total floor area occupied by this fuel package (ft²)? 10.

Enter the number of openings 1

What is the total surface area of the walls, ceiling, and floor (ft²)? 500.

Calculate Skip Cancel Burn Rates Help

Ready NUM

FIGURE 9.3.2.14(k) Corridor/room separation refinement calculation — screen 2.

CFSES Windows Application - Version 1.2.03 - MAY31.PRJ

File View Estimate Utilities Help

SELECT A PARAMETER TO REFINE:

Parameter Status Parameter Status

1. Corridor

2. Seg.

3. V.

4. S.

5. Fire A.

6. Smok

Corridor/Room Separation Refinement Calculation

Flashover was predicted in the worst case room. To be Refined, the fire duration in this space must be evaluated and compared to te fire resistance rating

Enter the total wood equivalent fire load (lbs): 2300

Enter the total area of the openings (ft²): 21

Enter the total surface area of the walls, ceiling, and floor (ft²): 500

Enter the fire resistance of the enclosure in minutes: 60

Calculate Cancel Help

Ready NUM

When the user is finished with the parameter Refinement calculations, the “Done” button should be selected. If there are still unfinished parameter Refinement calculations, this button will not work and an error message will be displayed. The user can either finish the Refinement calculations or select the “Cancel” button. The “Cancel” button will exit the screen without deleting any of the Refinements, but the Refinement process will still be unfinished. The “Individual Parameter Evaluation” sheet will return and the text below the “Refinements” button will indicate the Refinement status, either “Done” or “Not Evaluated.”

9.3.2.15 Additional Considerations. The last section of NFPA 101A, Chapter 7 that needs to be evaluated is the Additional Considerations, listed in NFPA 101A, Worksheet 8.6.6 (in Figure 8.6). There are six considerations listed in the table

that are beyond the scope of the code, but need to be evaluated. The Additional Considerations are accessed in the CFSES program by selecting the “Considerations” button on the “Individual Parameter Evaluation” sheet [Figure 9.3.2(b)]. The Additional Considerations are an optional part of the analysis because they are not included in the score and do not affect the pass/fail status of a building. When the user clicks the “Considerations” button, two screens will be displayed in sequence. The first screen, shown in Figure 9.3.2.15(a), contains Additional Considerations A through C. The second screen, shown in Figure 9.3.2.15(b), contains Additional Considerations D through F. Consideration F, which addresses standpipes in new high rise buildings, can be evaluated only if the building is a new high rise structure greater than 75 ft, which is not the case in Figure 9.3.2.15(b).

FIGURE 9.3.2.15(a) Additional considerations — screen 1.

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File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES
INDIVIDUAL PARAMETER EVALUATION - WORKSHEET (BASE CASE)

PARAMETER	FIRE CONTROL	EGRESS	GENERAL	Options
CONSTRUCTION				
SEGREGATION				
V. OPENINGS				
SPRINKLERS				
FIRE ALARM				
SMOKE DET.				
INT. FINISH				
SMOKE CONT.				
EXIT ACCESS				
EXIT SYSTEM				
CORRIDOR SEF.				
OCC. EMER. PR.				
TOTAL				
REQUIRED				

Back

Ready NUM

Facility Fire Safety Requirements - Screen 1 (Additional Considerations)

The following six considerations should be addressed but do not impact the level of fire safety as determined in NFPA 101A.

A. Building utilities conform to the requirements of Section 7-1 in NFPA 101. ☐ Yes ☒ No

B. The air conditioning, heating, and ventilation systems conform to Section 7-2 in NFPA 101, except for enclosure of vertical openings, which have been considered in Safety Parameter 3. ☐ Yes ☒ No

C. Elevator installations are made in accordance with the requirements of Section 7-2 in NFPA 101. ☐ Yes ☒ No ☐ Not Applicable

OK Cancel

FIGURE 9.3.2.15(b) Additional considerations — screen 2.

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File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES
INDIVIDUAL PARAMETER EVALUATION - WORKSHEET (BASE CASE)

PARAMETER	FIRE CONTROL	EGRESS	GENERAL	Options
CONSTRUCTION				
SEGREGATION				
V. OPENINGS				
SPRINKLERS				
FIRE ALARM				
SMOKE DET.				
INT. FINISH				
SMOKE CONT.				
EXIT ACCESS				
EXIT SYSTEM				
CORRIDOR SEF.				
OCC. EMER. PR.				
TOTAL				
REQUIRED				

Back Sc

Ready NUM

Facility Fire Safety Requirements - Screen 2 (Additional Considerations)

The following six considerations should be addressed but do not impact the level of fire safety as determined in NFPA 101A.

D. Rubbish chutes, incinerators, and laundry chutes are installed in accordance with Section 7-5 of NFPA 101. ☐ Yes ☒ No ☐ Not Applicable

E. Portable fire extinguishers are installed and maintained in accordance with the requirements of NFPA 101 26-3.5/27-3.5, and 7-7.4.1. ☐ Yes ☒ No

F. Standpipes are provided in all new high rise buildings a required by NFPA 101 26-4.2. ☒ Yes ☐ No ☐ Not Applicable

OK Cancel

9.3.2.16 Overriding Parameter Scores: Judgement Values. In some instances, the safety parameter score boxes that are available within each of the twelve parameter evaluation screens will not adequately characterize the actual risk status for that parameter. CFSES provides a means of overriding the available scores for a parameter through the use of Judgement Values. As was noted earlier, each safety parameter evaluation screen has a “Judgement” button. Clicking this button will invoke a “Judgement Score” screen, like the one shown in Figure 9.3.2.16. The Judgement screen in Figure 9.3.2.16 is for the Vertical Openings parameter. All parameter judgement screens are identical except for the title.

The user is required to enter two items: the score and the reason for using a Judgement Score. The score can be any value between the maximum and minimum NFPA 101A scores for the parameter at hand. For instance, the range of acceptable scores listed in NFPA 101A for the Vertical Openings parameter is -10 through 1. The acceptable range of scores for the Smoke Detection parameter is 0 through 4. When the Judgement Score and reason have been entered, the user should select the “Accept” button. The “Cancel” button makes no changes to the parameter status. The “Clear” button deletes a Judgement Score and restores the parameter to the unevaluated state.

9.3.2.17 Setting the Base Case. The Base Case can be set when all of the parameters have been evaluated and the Refinements, if any, have been completed. The Base Case is set when the “Set Base Case” button is clicked. A window will be displayed informing the user that the Base Case is set, and the “Set Base Case” button will become the “Delete Base C.”

button. The program will not permit changes to the Base Case once it is set. The user cannot use the “Back Screen” button or access a safety parameter unless the Base Case is deleted with the “Delete Base C.” button. Deleting the Base Case will also delete all Options that are set. Before deleting the Base Case, a window will be displayed warning the user that all set Options will also be deleted. The user can abort the delete process at this point.

When the Base Case is set, all five of the Option buttons become active if the Base Case does not meet the minimum requirements in each of the three safety categories. Subsection 9.3.3 discusses how to set the Options. The safety categories at the top of each column turn red if the Base Case fails to meet the minimum acceptable score in that particular category. If the Base Case passes in all three categories, then the analysis is done. The user can print the status of the twelve safety parameters for the Base Case and the Additional Considerations information, then save the building file and terminate the analysis.

9.3.3 Setting the Options. If the Base Case does not meet the minimum required score in any of the three safety categories (Egress, Life Safety, or General), then the failing safety category(s) will turn red and the Option buttons will become activated. The Option buttons allow the user to modify the safety parameters until the building receives a passing score in each safety category. When this is done, the Option is automatically set. Up to five Options can be set per project file. Because all Options have a passing score, the user can compare the incremental changes in risk and cost offered by them.

FIGURE 9.3.2.16 Typical judgement value screen.

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File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES

JUDGEMENT SCORE FOR THE VERTICAL OPENINGS PARAMETER

This screen allows one to enter any score value between the range of values for a particular parameter. This is to allow selection of scores that fall in between the available scores on a typical work sheet

Enter the desired score: 0.5

Enter the reason for score selection: Enclosed vertical openings with a 1 hour fire rating. Appears to be some degrading fire stopping, score of 1 reduced to 0.5.

Accept Clear Cancel Help

ENTER JUDGEMENT DATA REMOVES JUDGEMENT DATA MAKES NO CHANGES BRIEF TEXT HELP

Ready NUM

FIGURE 9.3.3 Typical cost/risk summary screen.

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File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES
INDIVIDUAL PARAMETER EVALUATION - OPTION 1

PARAMETER - Options

Option 1 Cost and Risk Breakdown

PARAMETER	Score
CONSTRUCTION	
SEGREGATION	
V. OPENING	
SPRINKLER	
FIRE ALARM	
SMOKE DETECTOR	
INT. FINISH	
SMOKE CONTROL	
EXIT ACCESS	
EXIT SYSTEM	
CORRIDOR	
OCC. EMERGENCY	
TOTAL	
REQUIRED	

Back

OK

Ready

NUM

Fire Control Risk

Best Possible Score: 21.5
Option 1 Score: 14.
Required Score: 7.5
Base Case Score: -10.
Worst Possible Score: -18.5

Egress Risk

Best Possible Score: 29.
Option 1 Score: 13.17
Required Score: 5.
Base Case Score: -11.83
Worst Possible Score: -31.

General Risk

Best Possible Score: 43.
Option 1 Score: 18.67
Required Score: 6.
Base Case Score: -14.33
Worst Possible Score: -38.

Parameter Change Cost Estimate

Sprinklers: \$100,000 - \$250,000
Other Parameters: Building Specific

The Option evaluation process begins by clicking on an Option button such that it is the current option shown. If the Option is not set, the caption at the top of the screen will indicate that it is an Option worksheet. If the Option is set, then none of the safety categories will be red and the caption at the top of the screen will indicate that the Option is set. If the Option is not set, the user can modify the status of a safety parameter by clicking on the name of the safety parameter. The safety parameter screen will be displayed, with the Base Case selection shown. The user simply makes another selection to change the parameter setting for the Option. Some changes are not advisable even though they are not prevented. Among these are changing a parameter such that the score is reduced and changing the construction type. Some changes are prohibited, including altering the number of stories, the age of the structure, or the building height.

Options that are set can be changed. The user will be asked to verify the Option change. When an Option is set, the user may view the relative cost and risk benefit by clicking on the "Cost/Risk" button beside the current option. Figure 9.3.3 shows an example of the cost/risk screen. When the user is satisfied with the Options that have been set, the project summary can be printed. An Option printout will contain all of the cost and risk information for that Option. Appendix B contains a sample CFSES printout with five Options.

9.4 Main Menu Commands. The Main Menu is the standard Windows™ backdrop that allows the user to perform file input and output, customize settings, print data, and obtain version information. The CFSES Main Menu contains five menu options: "File," "View," "Estimate," "Utilities," and "Help." Above the Main Menu is the System Menu. The System Menu consists of a colored bar, the application title (CFSES Windows Application - Version 1.2.03 - filename), a small CFSES

icon on the left and three small gray squares on the right. The three small gray squares allow the user to switch between applications, exit, minimize the run, and change the size of the window. This section describes the CFSES Main Menu features. The System Menu is standard for all Windows™ applications.

9.4.1 File/View/Help Menus. Three of the CFSES Main Menu items are typical of most Windows™ applications: "File," "View," and "Help." These options may be accessed by depressing the "Alt" key, which activates the default Main Menu item "File." The other items may be selected by using the arrow keys, the "Tab" key, or the letter underlined in the menu item. The "Esc" key returns the user to the CFSES screen.

The "File" menu item contains nine commands, as seen in Figure 9.4.1 (a). The nine commands are "New...," "Open...," "Close," "Save," "Save As," "Print," "Print Preview," "Print Setup," and "Exit." Beside some of the commands are control sequences with the syntax "Ctrl+<letter>." The control sequences are another means of quickly accessing the Main Menu items. There are four file operation commands in the "File" menu. The first is "New..." This will begin a new project. If the current project has not been saved, then a window will be displayed prompting the user to save the current project before creating a new one. This is a standard Windows™ procedure. The "Open..." command allows the user to open a previously saved project. The default project extension is ".PRJ." The open command will list all files with this extension, as shown in Figure 9.4.1 (b). CFSES files may have any extension, but only those with the .PRJ extension will be shown in the open view box. The "Save" and "Save As" sub-menu commands save the current project. The "Save As" command can change the name of a current project file or it can save an unnamed file, whereas the "Save" command saves the current project file or calls "Save As" if it is unnamed.

FIGURE 9.4.1(a) The file menu.

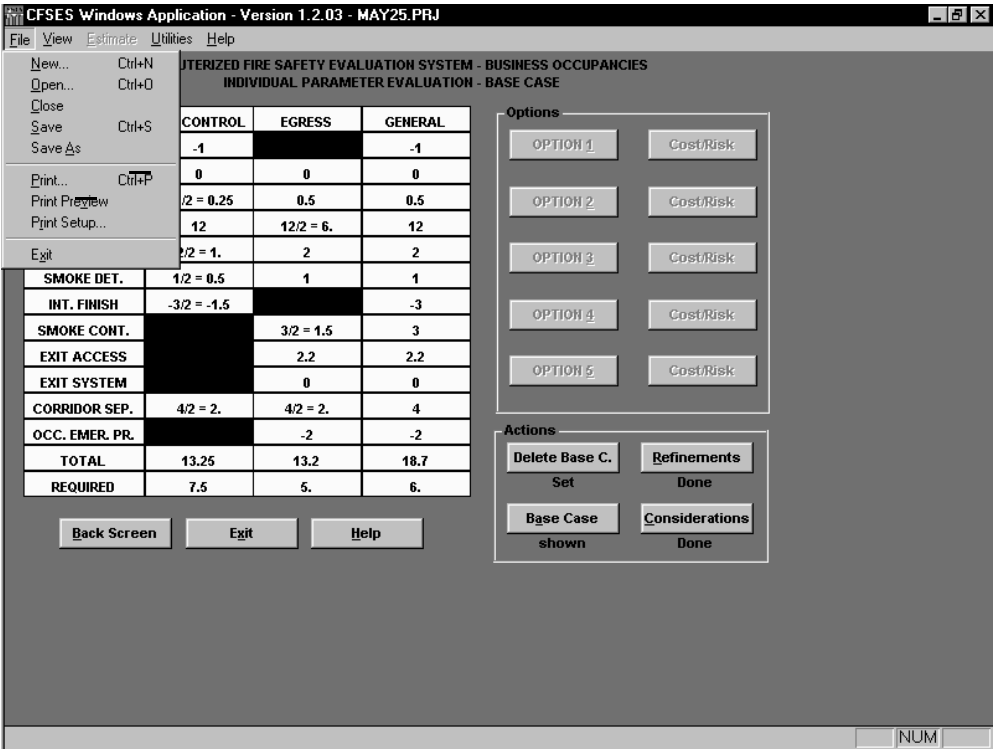
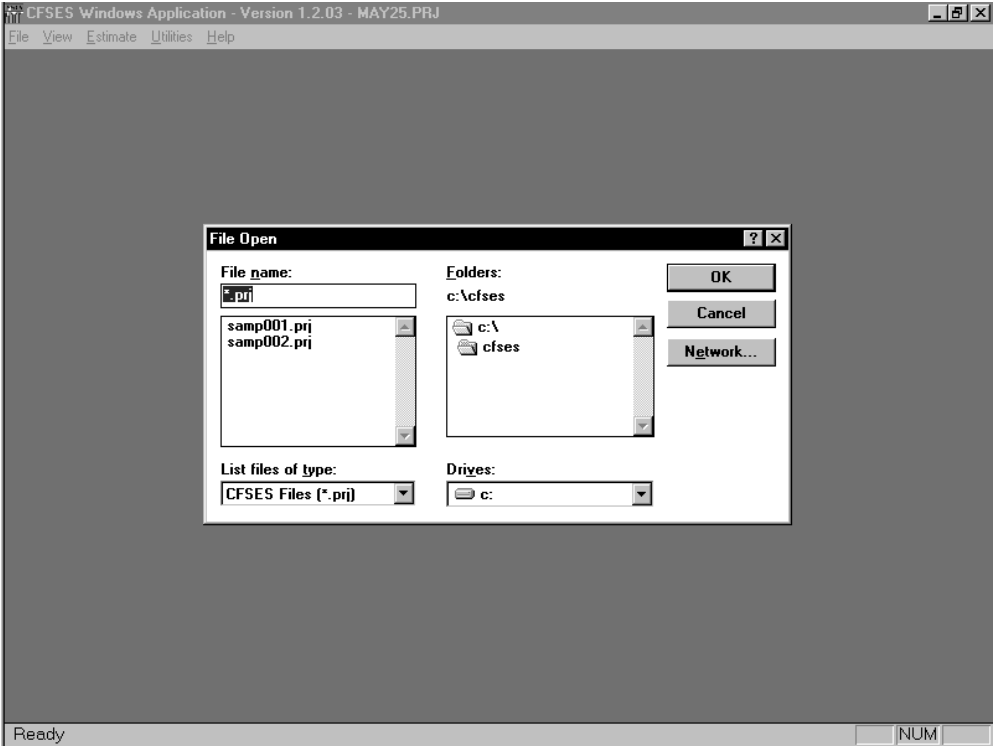


FIGURE 9.4.1(b) The file open command.



The menu commands “Print,” “Print Preview,” and “Print Setup” all involve printing the results of an CFSES analysis. They are only active when the user is in the “Individual Parameter Evaluation” screen. The “Print” command will cause the screen shown in Figure 9.4.1(c) to be displayed. The user should select which elements to print, then choose the “OK” button. Appendix A and B contain sample printouts from the CFSES program. Figure 9.4.1(c) shows that only the Base Case can be printed. This means that none of the Options have been set and the Additional Considerations have not been evaluated. The “Print Preview” command will also cause the screen shown in Figure 9.4.1(c) to be displayed. However, when the “OK” button is selected, a computer image of the printed page or pages is displayed. Figure 9.4.1(d) shows an example of the print preview feature. The user can continue and print, zoom in or out, and scroll between pages when using the print preview function. This is a standard Windows™ application used by many different software packages. The “Print Setup” command allows the user to configure the printer. The screen that is displayed depends on what kind of printer or printers are available to the user and which printer drivers are installed.

The final command in the “File” menu is “Exit.” This will terminate an CFSES project. If the project file has not been saved, then a screen will be displayed warning that the project has not been saved. The “Exit” buttons in all the CFSES screens display this warning before exiting.

The next main menu item is “View.” There is only one command associated with “View”: “Status Bar,” as shown in Figure 9.4.1(e). The status bar command toggles the bar at the base of the screen on and off. This is a typical Windows™ function. The status bar for the CFSES program displays a summary of the menu command function, the capital key lock status, the number lock key status, and the scroll lock key status.

The “Help” menu item contains two commands: “About CFSES...” and “Version,” as shown in Figure 9.4.1(f). The “About CFSES...” command displays the screen shown in Figure 9.4.1(g). It includes the program name, the version number, the issue date, and the organizations involved in the CFSES effort. The “Version” command displays a small window with the version number and issue date, shown in Figure 9.4.1(h).

FIGURE 9.4.1(c) The print selection screen.

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File View Estimate Utilities Help

COMPUTERIZED FIRE SAFETY EVALUATION SYSTEM - BUSINESS OCCUPANCIES
INDIVIDUAL PARAMETER EVALUATION - BASE CASE

PARAMETER	FIRE CONTROL	EGRESS	GENERAL
CONSTRUCTION	.1		.1
SEGREGATION	0		
V. OPENINGS	0.5/2 = 0.25		
SPRINKLERS	12		
FIRE ALARM	2/2 = 1.		
SMOKE DET.	1/2 = 0.5		
INT. FINISH	-3/2 = -1.5		
SMOKE CONT.			
EXIT ACCESS			
EXIT SYSTEM			
CORRIDOR SEP.	4/2 = 2.		
OCC. EMER. PR.			
TOTAL	13.25		
REQUIRED	7.5		

Options: OPTION 1 Cost/Risk

Print Selection

Please select the information you want to print:

- ☒ Base Case
- ☐ Option 1
- ☐ Option 2
- ☐ Option 3
- ☐ Option 4
- ☐ Option 5
- ☒ Additional considerations

Back Screen Exit OK Cancel

Ready NUM