

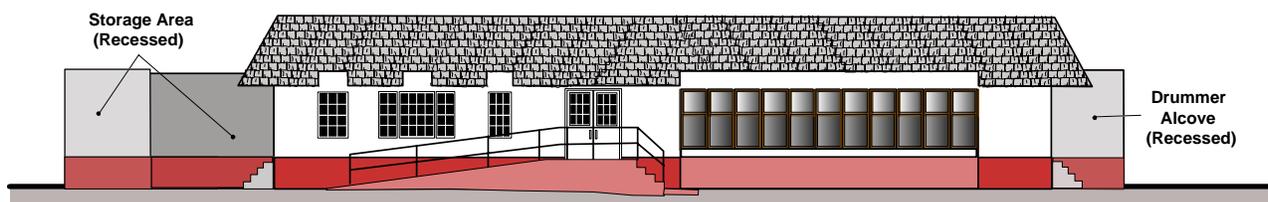
# Report of the Technical Investigation of The Station Nightclub Fire: Appendices

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Nelson Bryner

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**NIST NCSTAR 2: Vol. II**

# **Report of the Technical Investigation of The Station Nightclub Fire: Appendices**

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June 2005



U.S. Department of Commerce  
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Technology Administration  
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National Institute of Standards and Technology  
*Hratch Semerjian, Acting Director*

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#### Disclaimer

The policy of NIST is to use the International System of Units (metric units) in all publications. In this document, however, units are presented in metric units or the inch-pound system, whichever is prevalent to the discipline. Conversion tables are provided in this report.

#### Disclaimer

The NIST-led investigation of The Station Nightclub fire was conducted during the same time period as civil and criminal legal actions involving the same incident, which limited the Team's access to physical evidence and limited the ability to interview many witnesses.

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## ABSTRACT

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A fire occurred on the night of Feb. 20, 2003, in The Station nightclub at 211 Cowesett Avenue, West Warwick, Rhode Island. A band that was on the platform that night, during its performance, used pyrotechnics that ignited polyurethane foam insulation lining the walls and ceiling of the platform. The fire spread quickly along the walls and ceiling area over the dance floor. Smoke was visible in the exit doorways in a little more than one minute, and flames were observed breaking through a portion of the roof in less than five minutes. Egress from the nightclub, which was not equipped with sprinklers, was hampered by crowding at the main entrance to the building. One hundred people lost their lives in the fire. On Feb. 27, 2003, under the authority of the National Construction Safety Team (NCST) Act, the National Institute of Standards and Technology (NIST) established a National Construction Safety Team to determine the likely technical cause or causes of the building failure that led to the high number of casualties in that fire. This report documents the procedures, findings, and issues that were raised by the investigation. Volume I contains the main report and Volume II contains appendix material.

The investigation concluded that strict adherence to 2003 model codes available at the time of the fire would go a long way to preventing similar tragedies in the future. Changes to the codes subsequent to the fire made them stronger. By making some additional changes – and state and local agencies adopting and enforcing them – we can strengthen occupant safety even further.

Ten recommendations to improve model building and fire codes, standards and practices (as they existed in February 2003) resulted from the investigation, including (i) urging state and local jurisdictions to (a) adopt and update building and fire codes covering nightclubs based on one of the model codes and (b) enforce those codes aggressively; (ii) strengthening the requirements for the installation of automatic fire sprinklers; (iii) increasing the factor of safety on the time for occupants to egress; (iv) tightening the restriction on the use of flexible polyurethane foam -- and other materials that ignite as easily and propagate flames as rapidly as non-fire retarded foam -- as an interior finish product; (v) further limiting the use of pyrotechnics; and (vi) conducting research in specific areas to underpin the recommended changes.

Keywords: fire investigation, NCST, nightclub fire, sprinklers, egress, fire spread, polyurethane foam, fire modeling, pyrotechnics



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# LIST OF ACRONYMS, ABBREVIATIONS, UNITS, AND CONVERSION FACTORS

---

AC	alternating current
AG	Attorney General
AHJ	Authority Having Jurisdiction
AIA	American Insurance Association
ALS	Advanced Life Support
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATF	Bureau of Alcohol, Tobacco and Firearms
BBC	Basic Building Code
BCMC	Board for the Coordination of Model Codes
BFPC	Basic Fire Prevention Code
BLS	Basic Life Safety
BOCA	Building Officials and Code Administrators (previously Building Officials Conference of America)
BST	barium strontium titanate
CFD	computational fluid dynamics, and Coventry Fire Department
CF	carpet flooring
CT	ceiling tile
DC	direct current
DHS	Department of Homeland Security
DSC	Differential Scanning Calorimetry
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EMT-C	Emergency Medical Technician - Cardiac
EST	Eastern Standard Time
FDS	Fire Dynamics Simulator
FEMA	Federal Emergency Management Agency

FIT	Flash Ignition Temperature
FPC	Fire Prevention Code
FR	fire retarded
HRR	heat release rate
IBC	International Building Code
IC	Incident Command
ICC	International Code Council
IEBC	International Existing Building Code
IFC	International Fire Code
IR	infrared
ISO	International Organization for Standardization
LCL <sub>0</sub>	lethal concentration, low
LSF	life safety feature
MCI	Mass casualty incident
NCST	National Construction Safety Team
NBC	National Building Code
NFC	National Fire Code
NFPA	National Fire Protection Association
NFR	non-fire retarded
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
ODP	Office of Domestic Preparedness
OSHA	U.S. Occupational Safety and Health Administration
PUF	polyurethane foam
RI	Rhode Island
RTI	response time index
SBC	Standard Building Code
SIT	Spontaneous Ignition Temperature
SNEFEAP	Southern New England Fire Emergency Assistance Plan
t	time
TC	thermocouple
TGA	Thermal Gravimetric Analysis

TIA	Tentative Interim Amendment
UFC	Uniform Fire Code
UL	Underwriters Laboratories
USC	United States Code
USFA	United States Fire Administration
WFD	Warwick Fire Department
WP	wood paneling
WPD	Warwick Police Department
WWFD	West Warwick Fire Department
WWPD	West Warwick Police Department

### **Units**

°C	degrees Centigrade
°F	degrees Fahrenheit
ft	feet
gpm	gallons/minute
in	inch
kg	kilogram
kPa	kilopascal
kW	kilowatt
L	liter
m	meter
mm	millimeter
min	minute
MW	megawatt
psi	pounds/in <sup>2</sup>
s	second
W	Watt
µm	micrometer

## Conversion Factors

$$^{\circ}\text{F} = 1.8 \times ^{\circ}\text{C} + 32$$

$$1 \text{ m} = 3.281 \text{ ft}$$

$$1 \text{ mm} = 0.03937 \text{ in}$$

$$1 \text{ L} = 0.2642 \text{ gal}$$

$$1 \text{ kg} = 2.204 \text{ lb (mass)}$$

$$1 \text{ kg/m}^3 = 0.06243 \text{ lb/ft}^3$$

$$1 \text{ kPa} = 0.1450 \text{ psi}$$

$$1 \text{ kJ} = 0.9479 \text{ Btu}$$

$$1 \text{ kJ/kg} = 0.4301 \text{ Btu/lb}$$

$$1 \text{ kJ/kg-}^{\circ}\text{C} = 0.2389 \text{ Btu/lb-}^{\circ}\text{F}$$

$$1 \text{ kW} = 3413 \text{ Btu/hr}$$

$$1 \text{ kW/m}^2 = 317.1 \text{ Btu/hr/ft}^2$$

$$1 \text{ kW/m}^2\text{-}^{\circ}\text{C} = 176.1 \text{ Btu/hr-ft}^2\text{-}^{\circ}\text{F}$$

$$1 \text{ W/m-}^{\circ}\text{C} = 0.5778 \text{ Btu/hr-ft-}^{\circ}\text{F}$$

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ m} = 1000 \text{ mm}$$

$$1 \text{ }\mu\text{m} = 0.001 \text{ mm}$$

$$1 \text{ MW} = 1,000,000 \text{ W}$$

## PREFACE

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On Feb. 27, 2003, under the authority of the National Construction Safety Team (NCST) Act, the National Institute of Standards and Technology (NIST) established a Team to determine the likely technical cause or causes of the building failure that led to a high number of casualties in The Station nightclub fire in West Warwick, Rhode Island on the night of Feb. 20, 2003. The investigation consisted of the following tasks:

- identification of technical issues and hypotheses requiring investigation through consultations with experts in fire protection engineering, and emergency evacuation, and members of other teams investigating The Station fire;
- data collection from local authorities, contractors and suppliers, building and fire protection design documents, records, plans, and specifications, video and photographic data, telephone and radio transmissions, field data, a limited number of interviews and other oral and written accounts from building occupants and emergency responders, and other witnesses as reported by the news media;
- analysis and comparison of model building and fire codes and practices, as well as review and analysis of practices used in operation of the building;
- simulation and analysis of phenomena (with associated uncertainties), including fire spread, smoke movement, tenability, occupant behavior and response, evacuation issues, and operation of active and passive fire protection systems;
- testing to provide additional data and support computer predictions; and
- preparation of the final report, following established NIST Editorial Review Board procedures, augmented by the NCST Advisory Committee.

As required by the NCST Act and its implementing regulations, priority in the investigation was ceded to the local criminal investigation. No physical evidence was obtained from the scene and access to witnesses and local authorities was limited due to the criminal investigations and civil litigation.

**It is important to note that state and local building regulations -- rather than model codes -- govern building design, construction and operation.** Comparisons of the building design and operation to provisions within model codes were done to assess possible improvements in public safety through revision of model codes, standards and practices. Many of the recommendations are directed toward the current national model codes maintained by the National Fire Protection Association (NFPA) and the International Code Council (ICC), the standards within those codes and elsewhere (e.g., ASTM International, and Underwriters Laboratories (UL)), and the practices associated with their adoption and implementation. Other recommendations are aimed at nightclub owners and managers, occupants, and state and local regulatory authorities and first responders.

The NCST Act requires that at least one member of the Team be an employee of NIST, and that experts who are not employees of NIST shall also be appointed to the Team by the NIST Director. The members of the Team included the following:

- William Grosshandler (Lead Investigator), NIST Building and Fire Research Laboratory

- Nelson Bryner, NIST Building and Fire Research Laboratory
- Daniel Madrzykowski, NIST Building and Fire Research Laboratory
- Kenneth Kuntz, DHS/FEMA, US Fire Administration

Koffel Associates, Inc., provided a review of model building and fire codes; Ove Arup & Partners Massachusetts, Inc., assisted with the analysis of the evacuation process. Portions of both contractor reports have been integrated into this final report.

# APPENDIX A. LARGE FORMAT EVACUATION TIMELINE STILLS

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## A.1 LARGE FORMAT EVACUATION TIMELINE STILLS

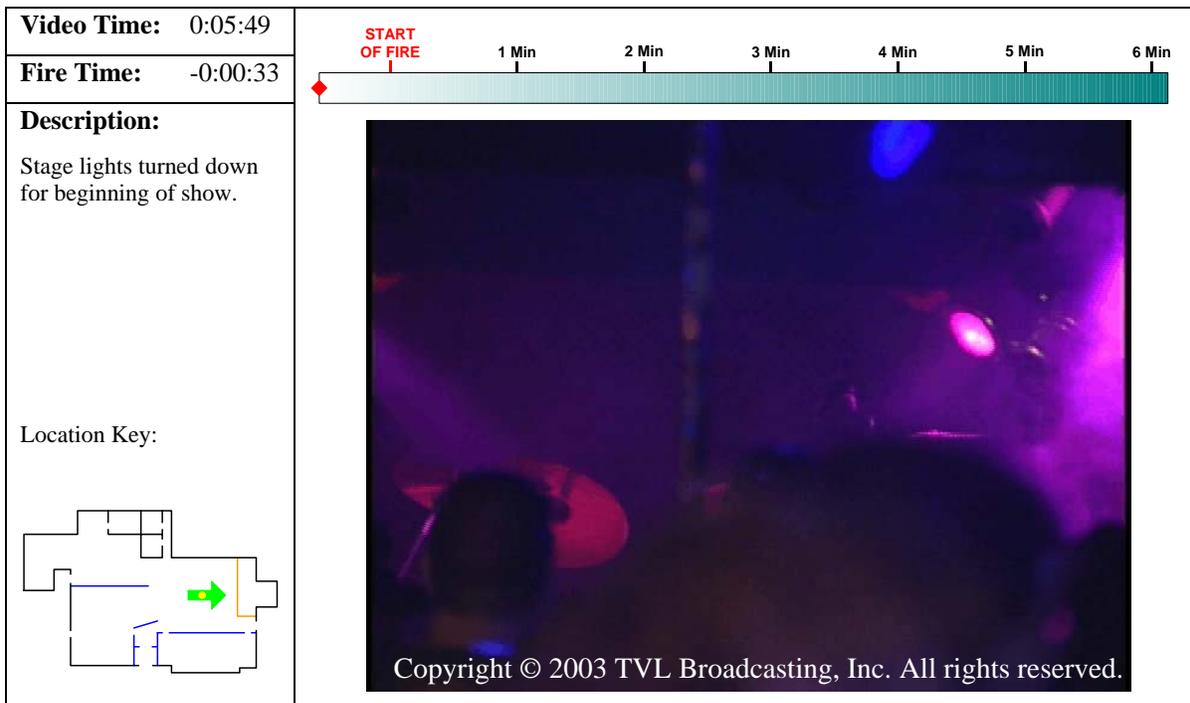
This Appendix, compiled by Arup [1] presents the still frame pictures taken from the WPRI-TV video of the incident at the Station nightclub on February 20, 2003 [2]. The events comprising the incident timeline (see Chapter 2) were identified through these still frames.

Each video frame includes a time bar representing the incident duration considered here with an indication of where the given event occurred in this time span. The analysis focused upon the time period beginning when the lights in the club were turned down in preparation for the show until the camera operator, in the parking lot, places the camera on the ground and significant flames are seen emanating from the front of the building. Beyond this time, the building is heavily engulfed by the fire and no additional events specifically significant to this analysis are shown on the video.

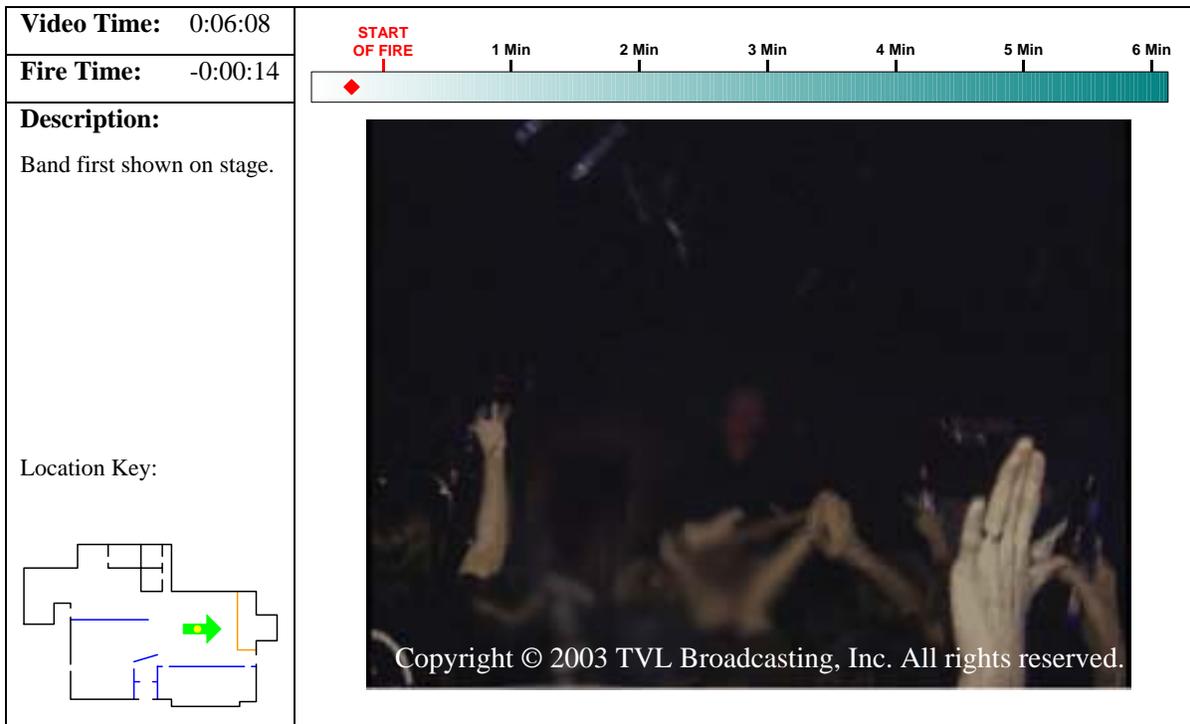
The time bar provided above each still frame corresponds to the comprehensive timeline given in the main report. Note that “Video Time” refers to the absolute videotape counter time associated with the events as captured on the television crew video, while “Fire Time” refers to the time of events relative to the start of the fire.

Each frame also includes a location key showing where the camera was located (yellow dot) and in which direction it was pointing (green arrow) when the frame was recorded. The faces of occupants have been blurred to preserve anonymity.

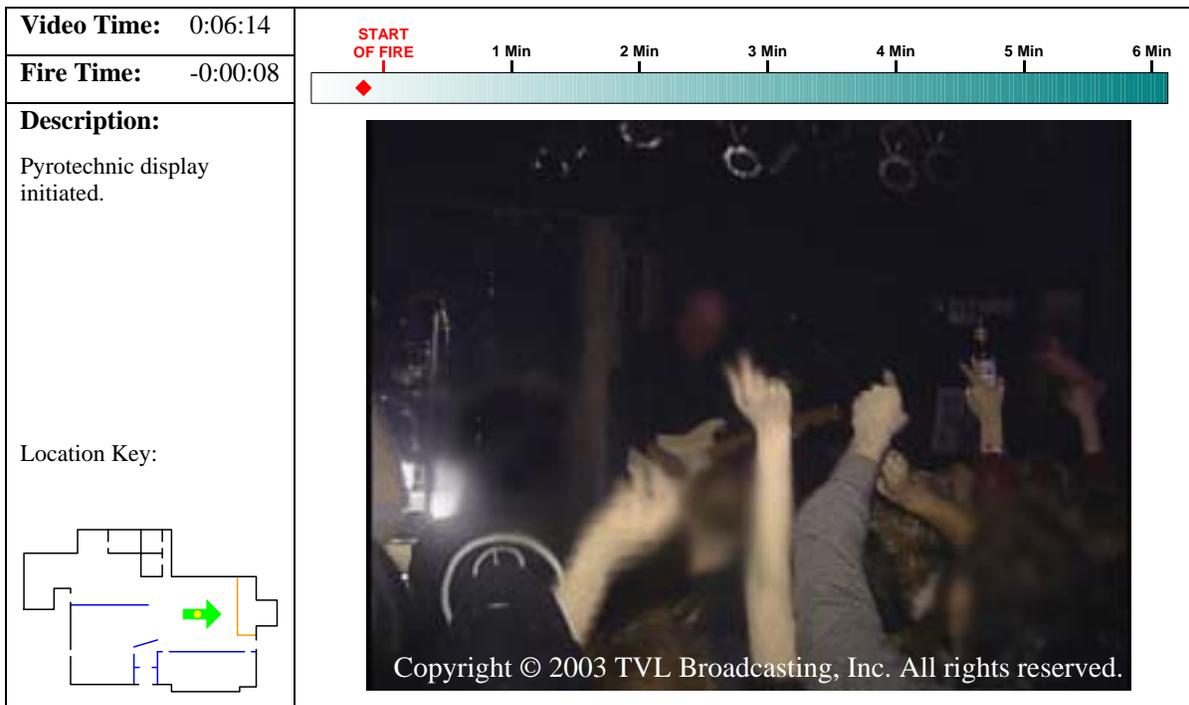
**Figure A.1 Timeline Event 1**



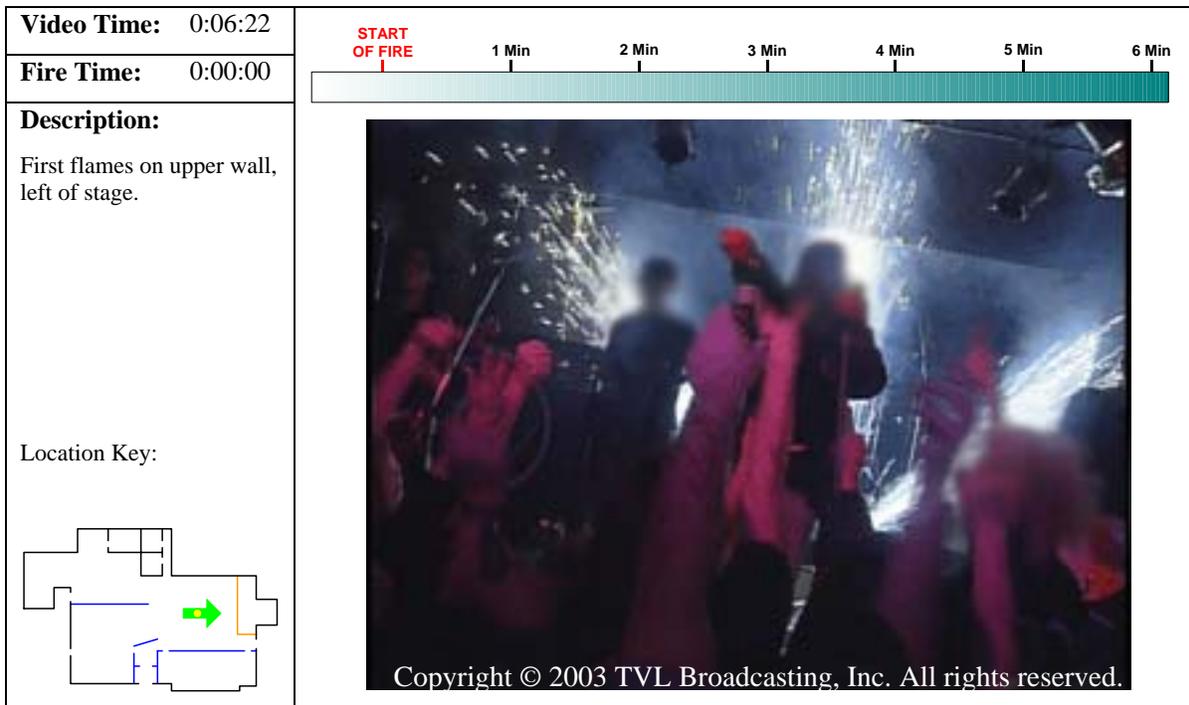
**Figure A.2 Timeline Event 2**



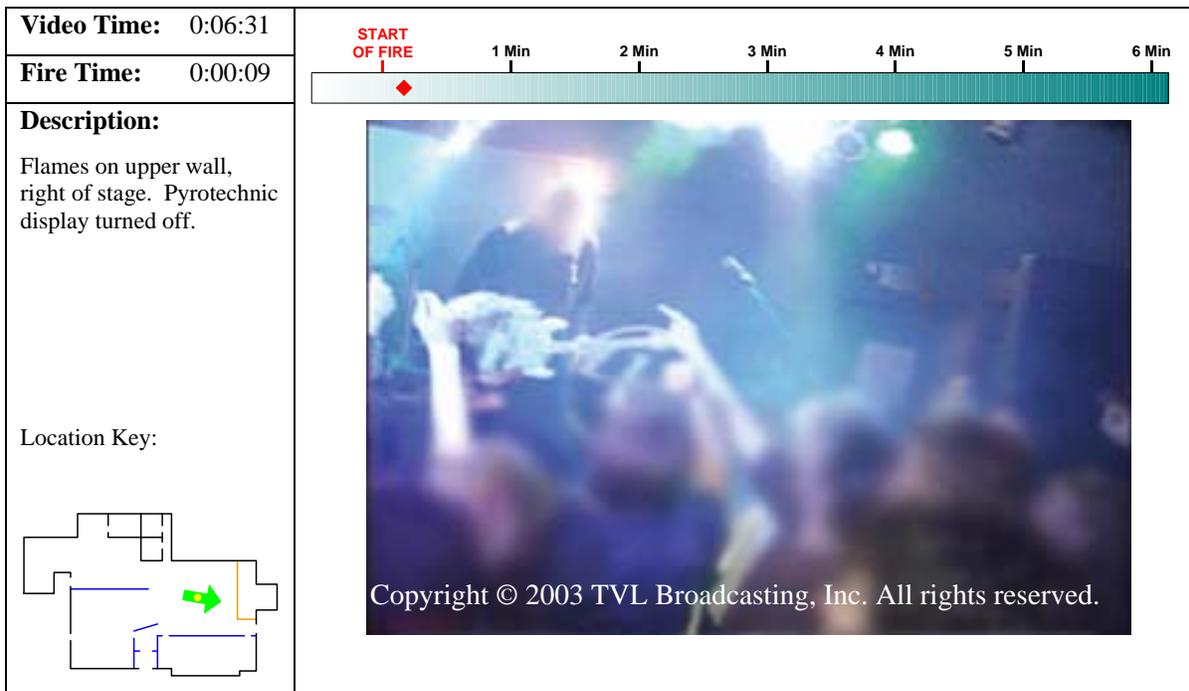
**Figure A.3 Timeline Event 3**



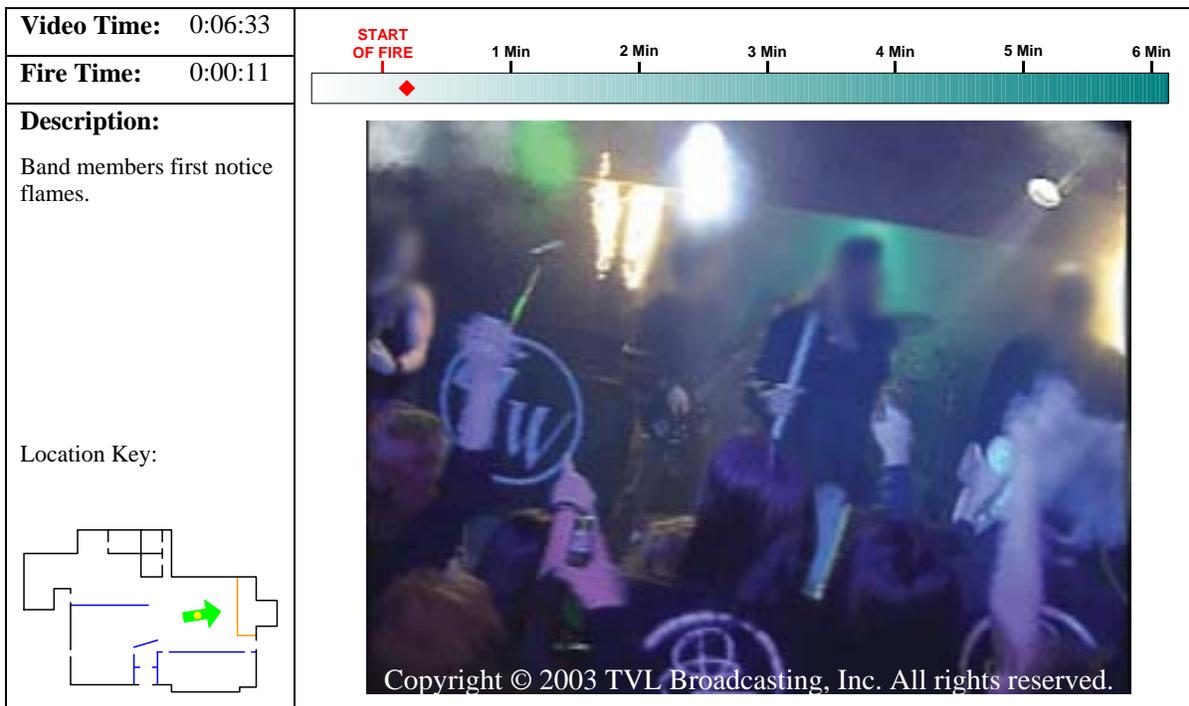
**Figure A.4 Timeline Event 4**



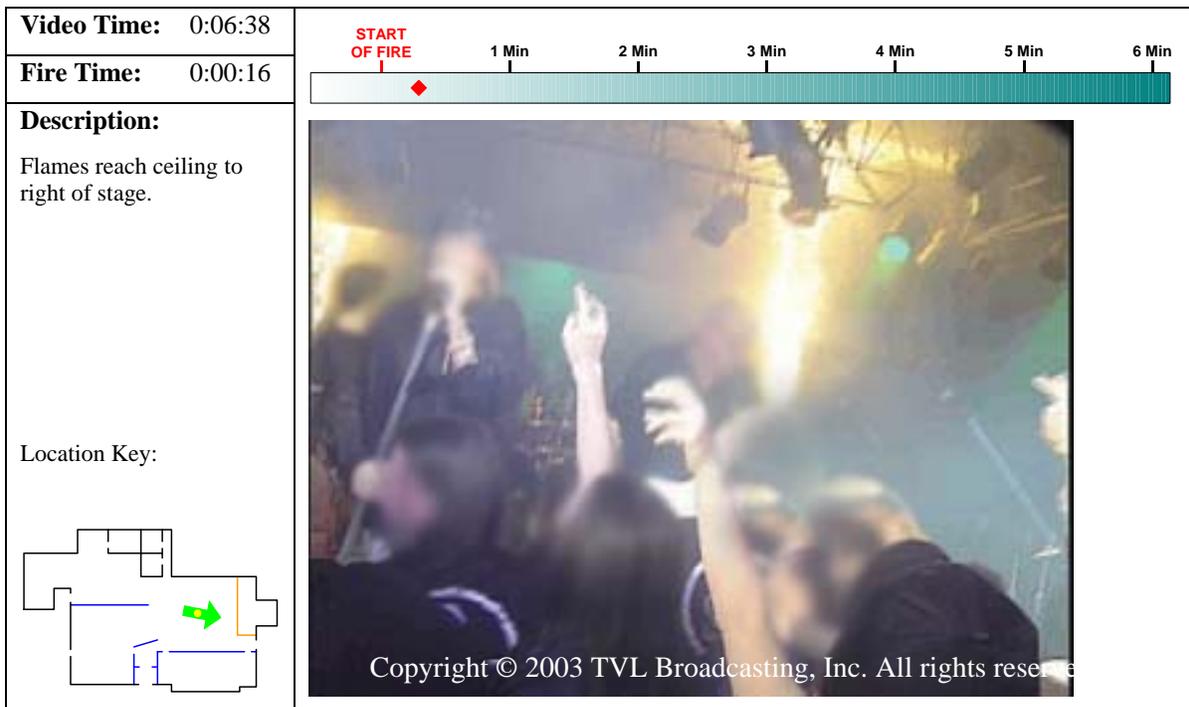
**Figure A.5 Timeline Event 5**



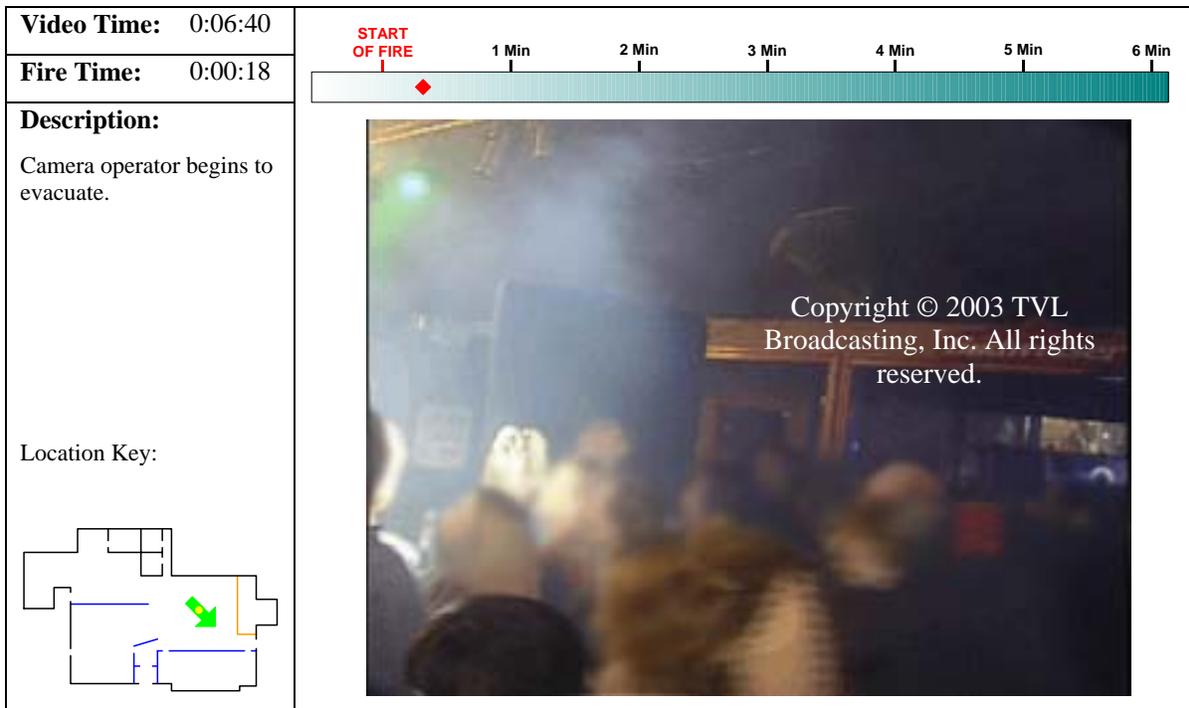
**Figure A.6 Timeline Event 6**



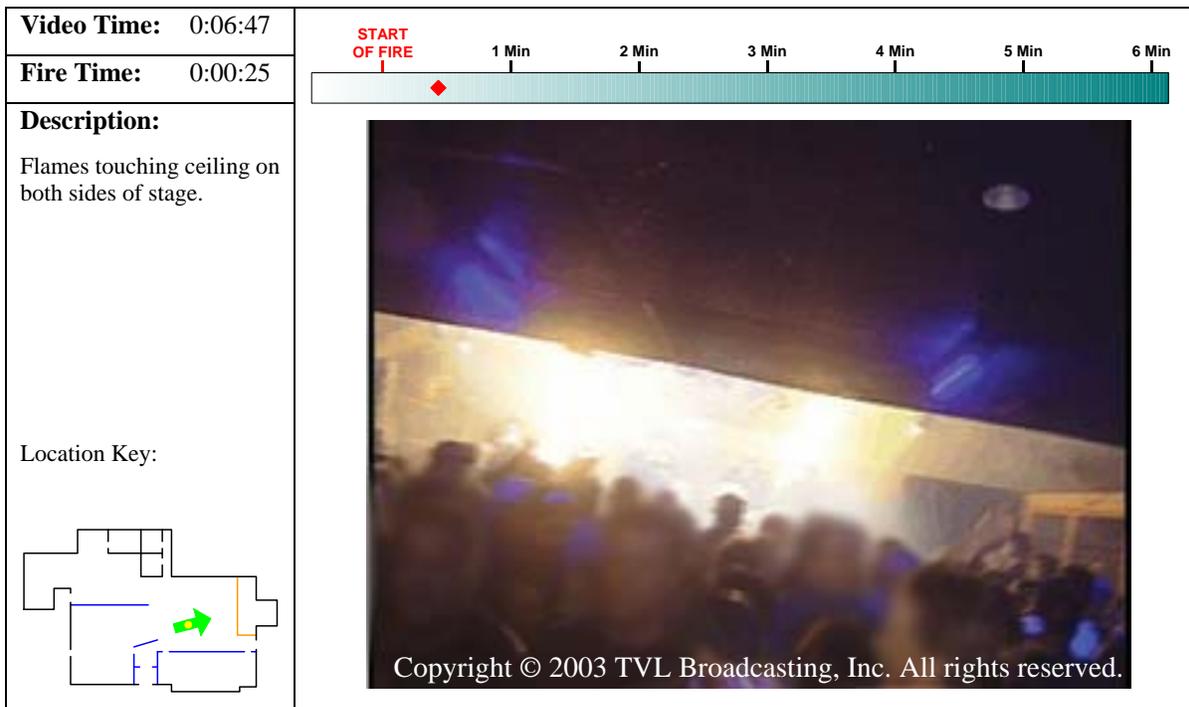
**Figure A.7 Timeline Event 7**



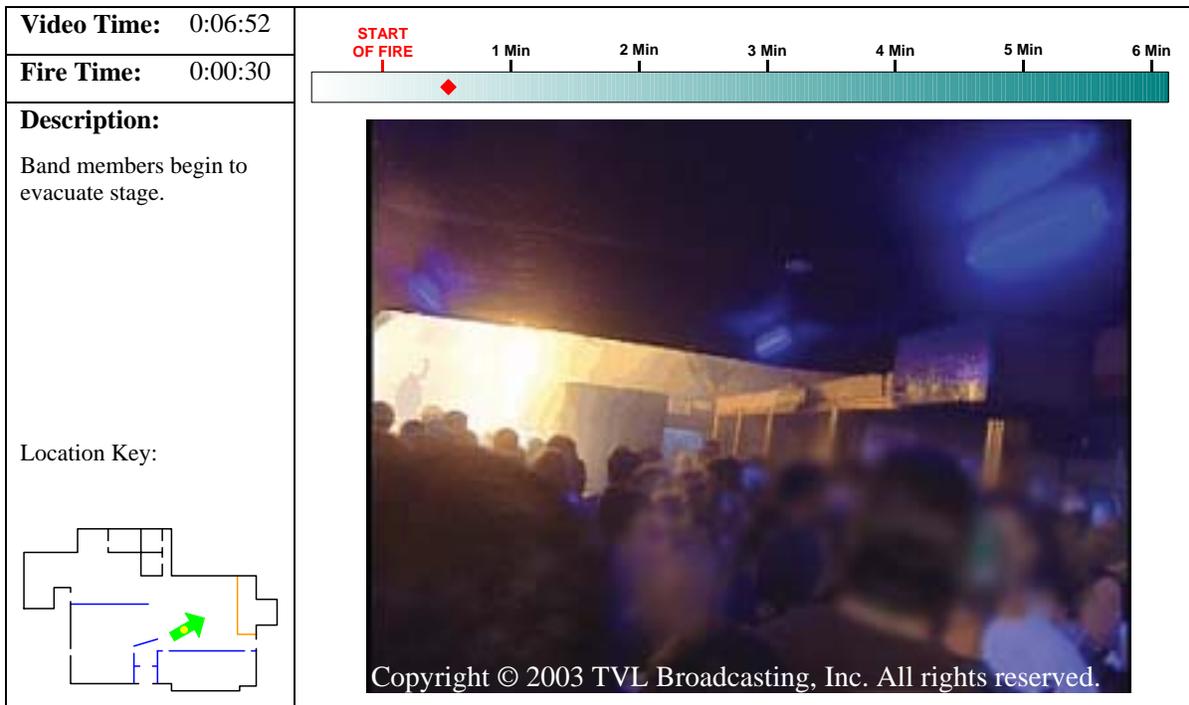
**Figure A.8 Timeline Event 8**



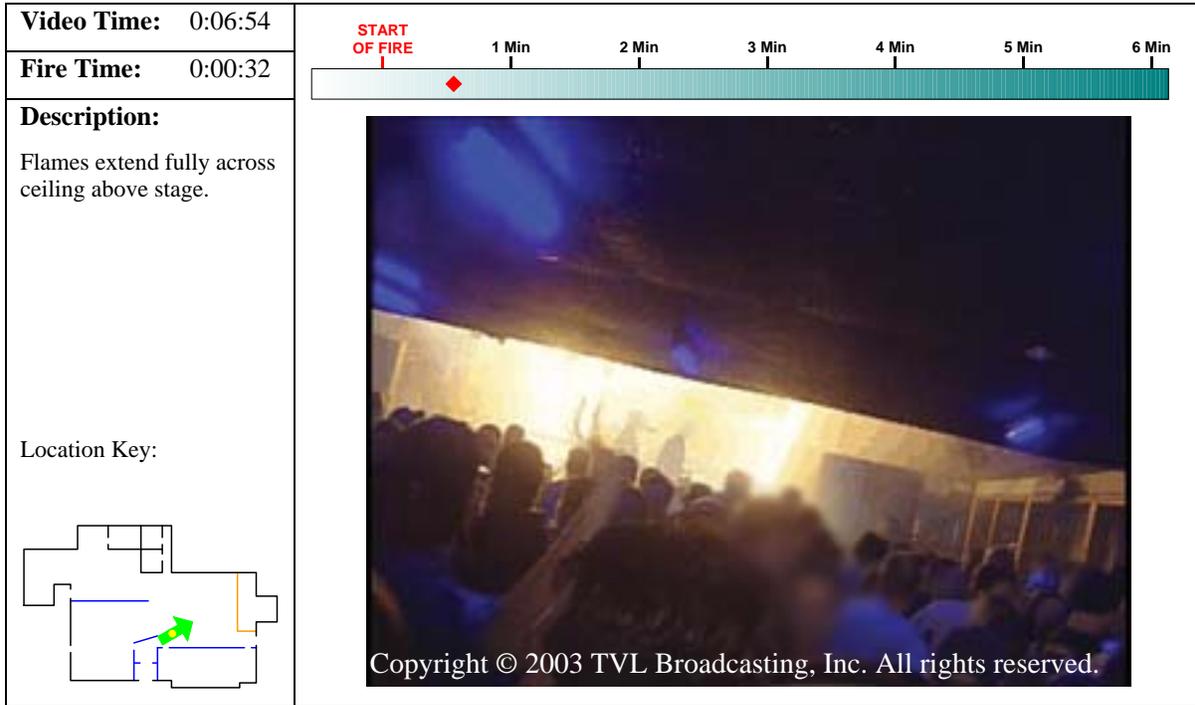
**Figure A.9 Timeline Event 9**



**Figure A.10 Timeline Event 10**



**Figure A.11 Timeline Event 11**



**Figure A.12 Timeline Event 12**

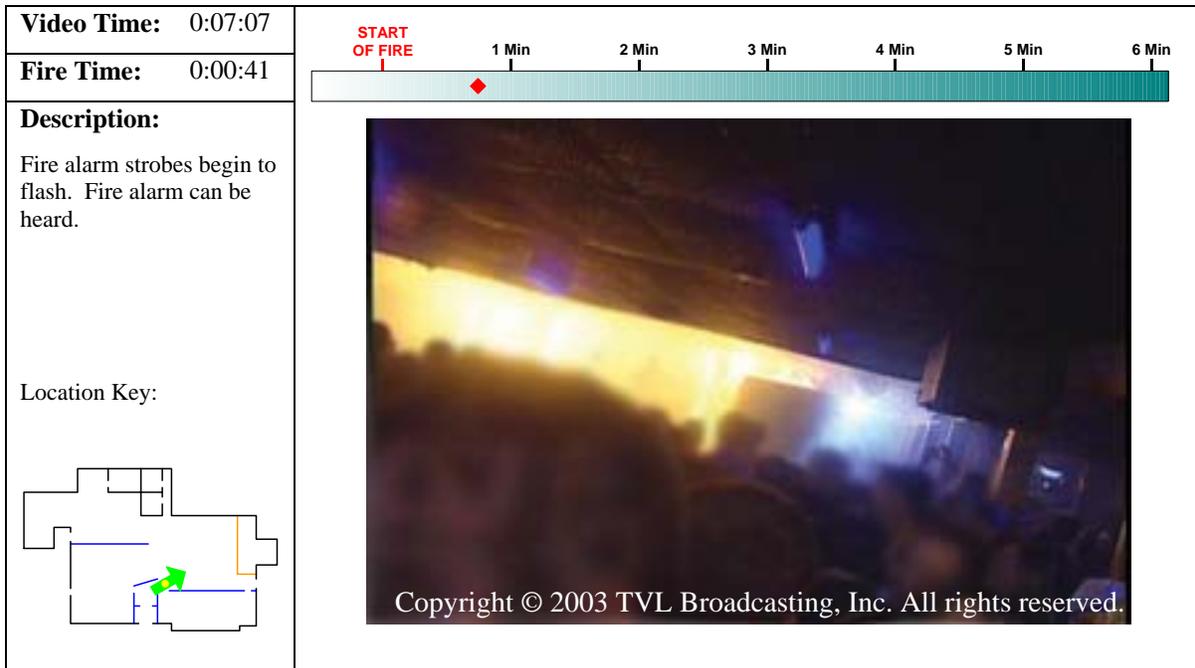


Figure A.13 Timeline Event 13

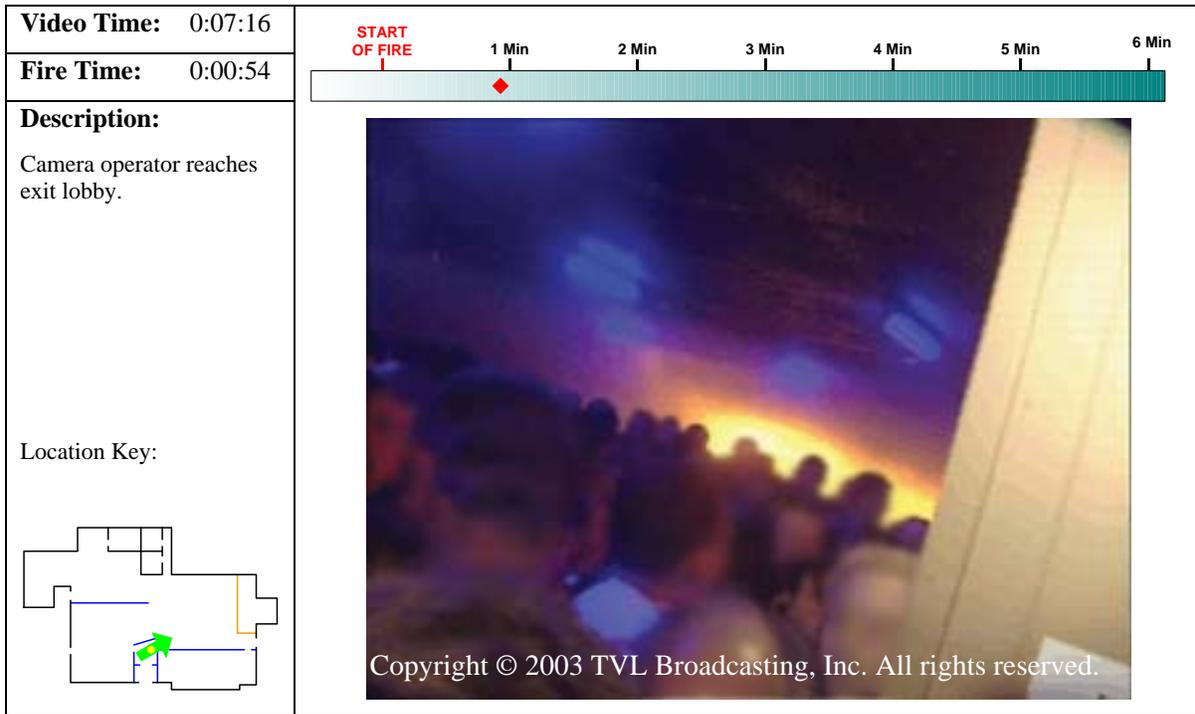
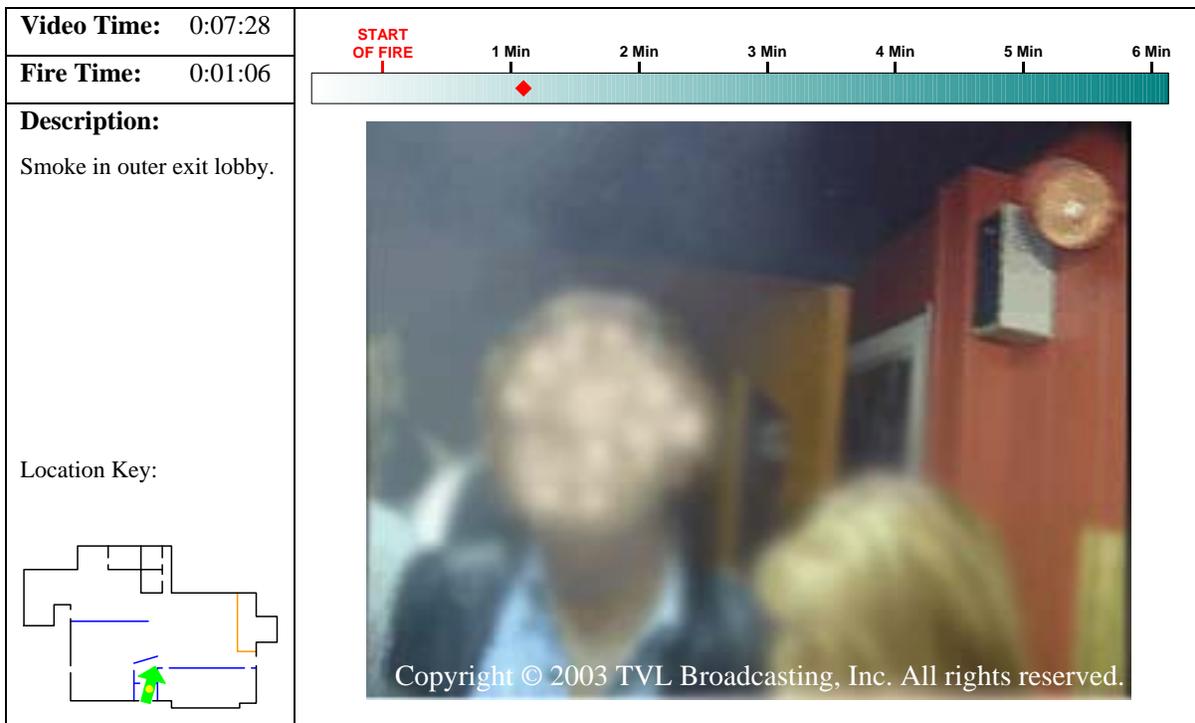
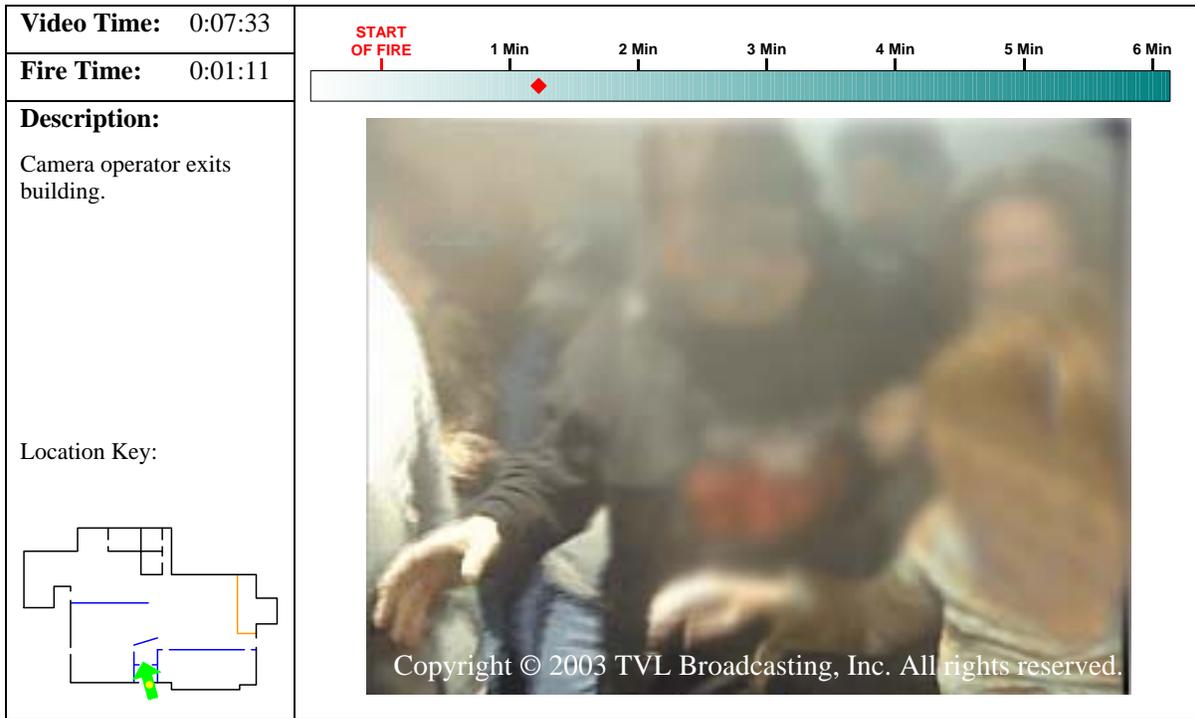


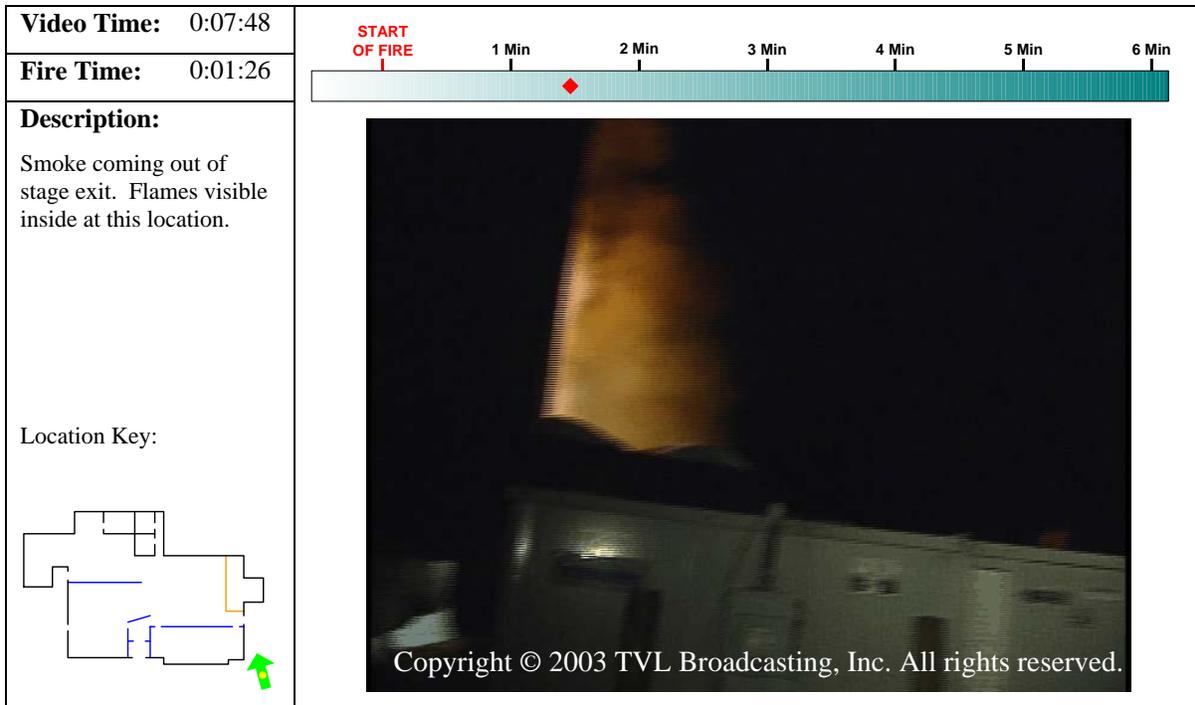
Figure A.14 Timeline Event 14



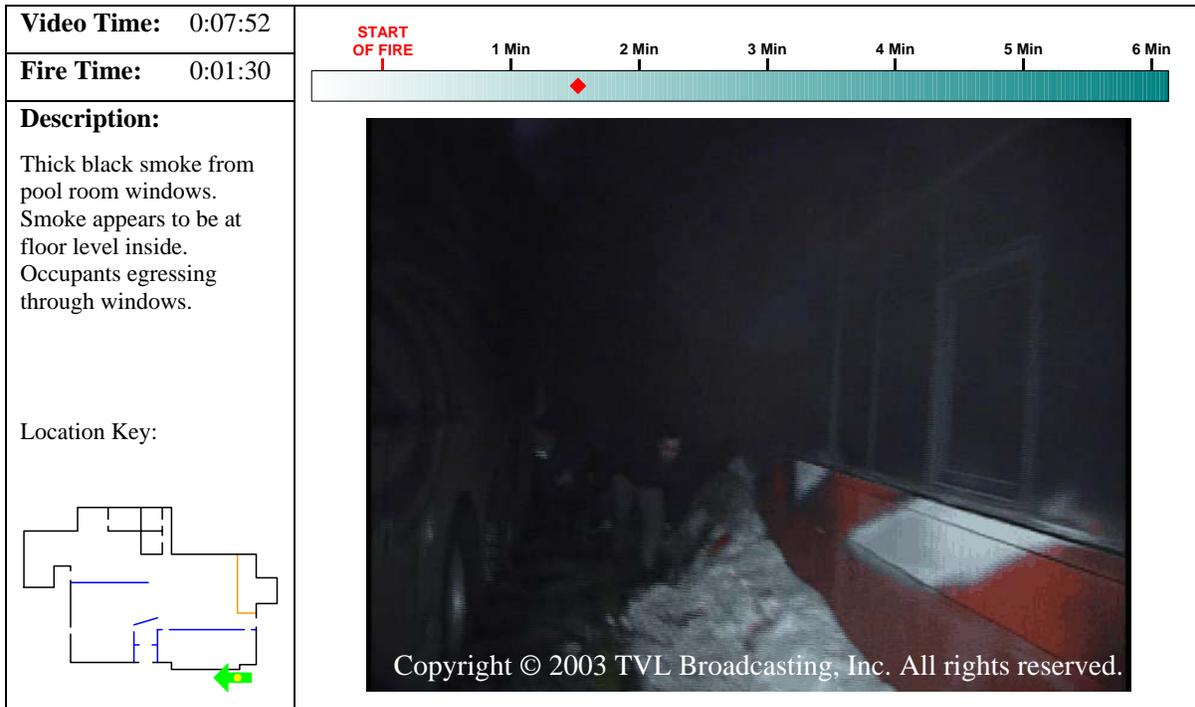
**Figure A.15 Timeline Event 15**



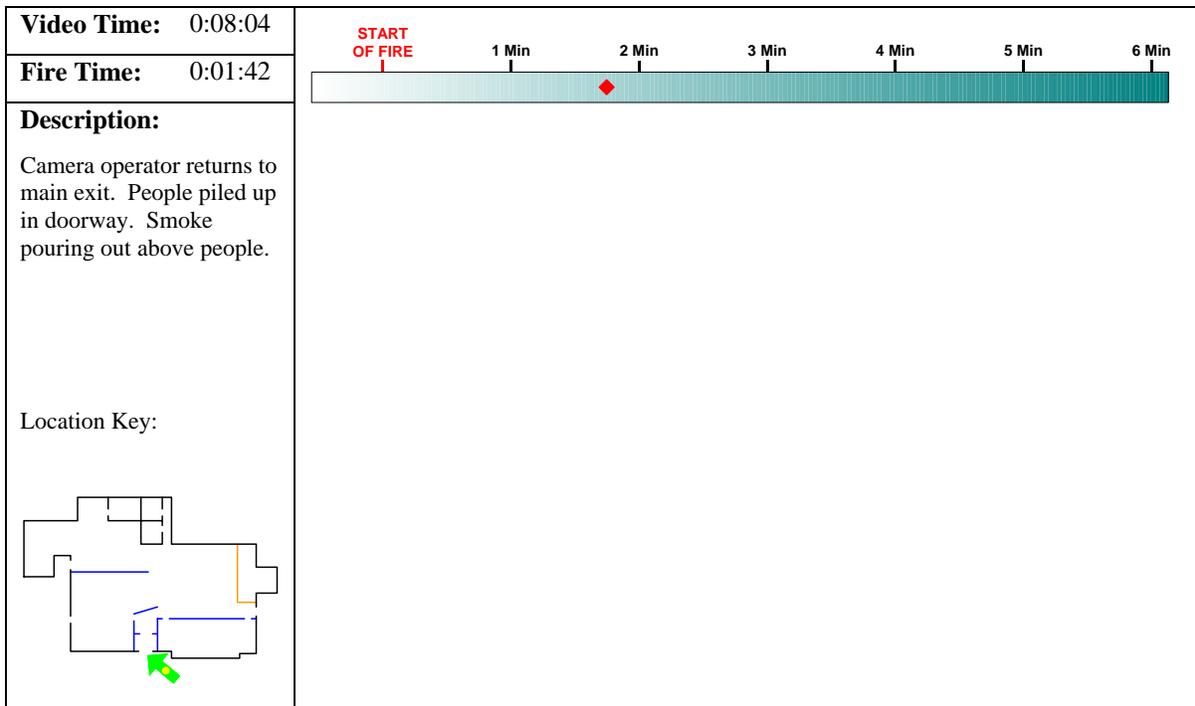
**Figure A.16 Timeline Event 16**



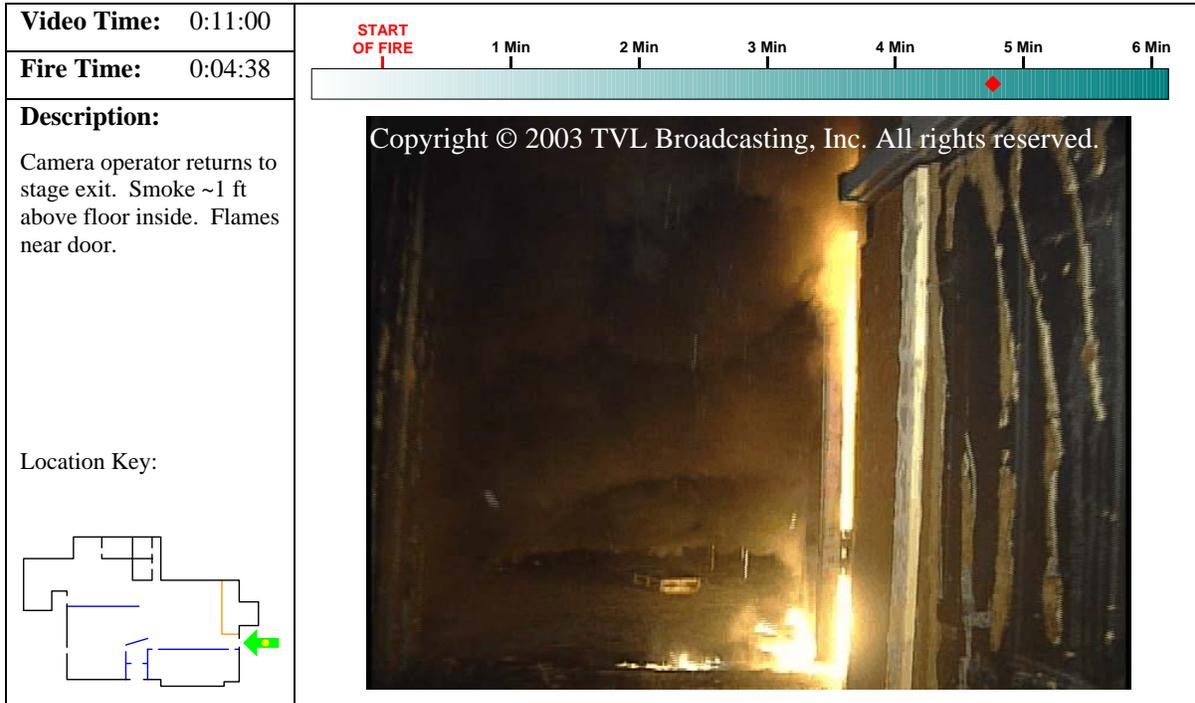
**Figure A.17 Timeline Event 17**



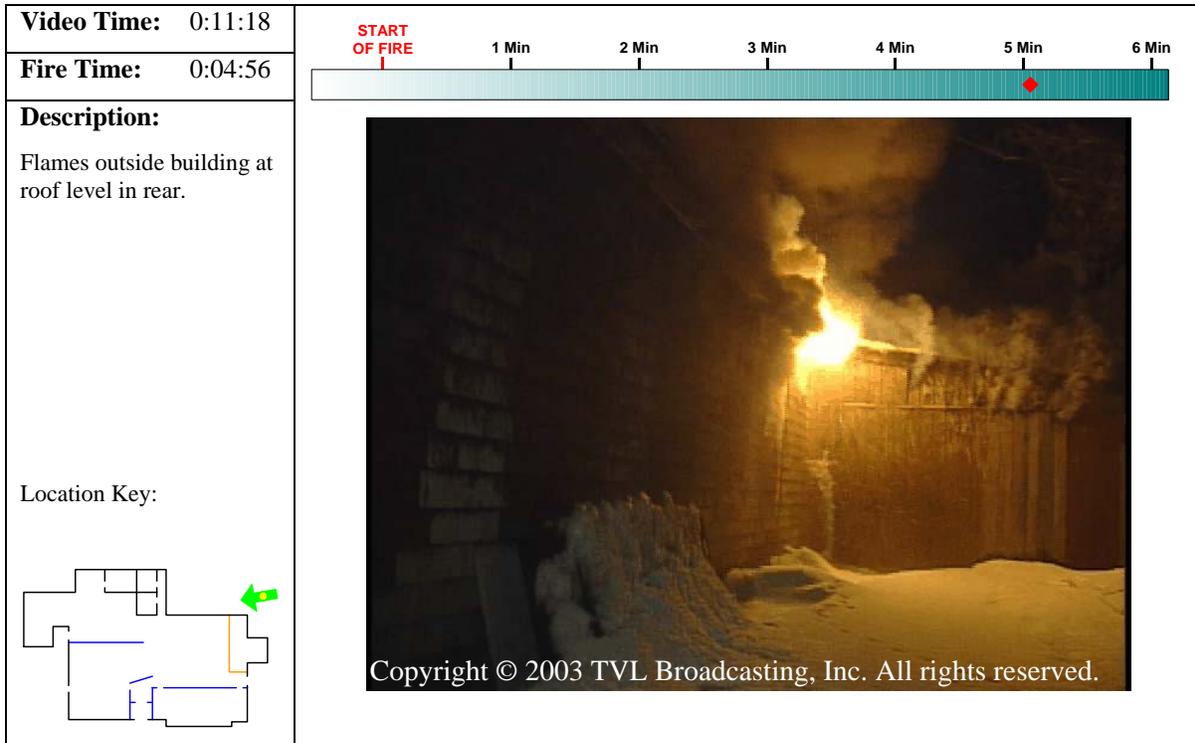
**Figure A.18 Timeline Event 18**



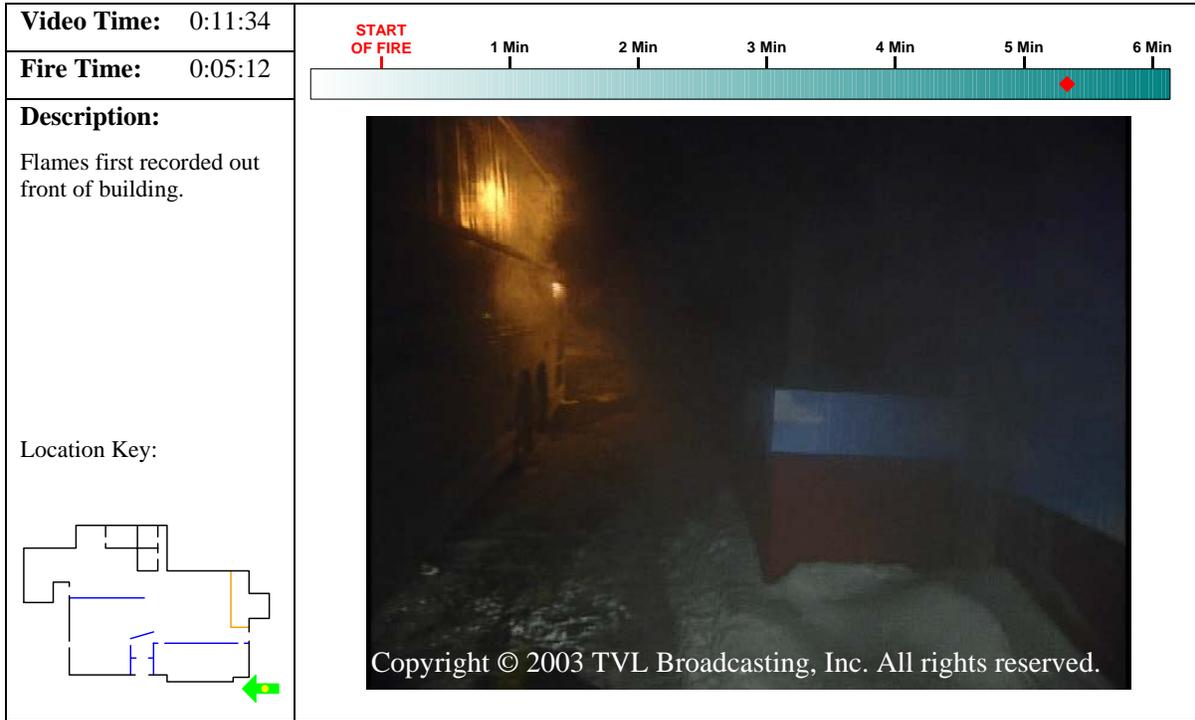
**Figure A.19 Timeline Event 19**



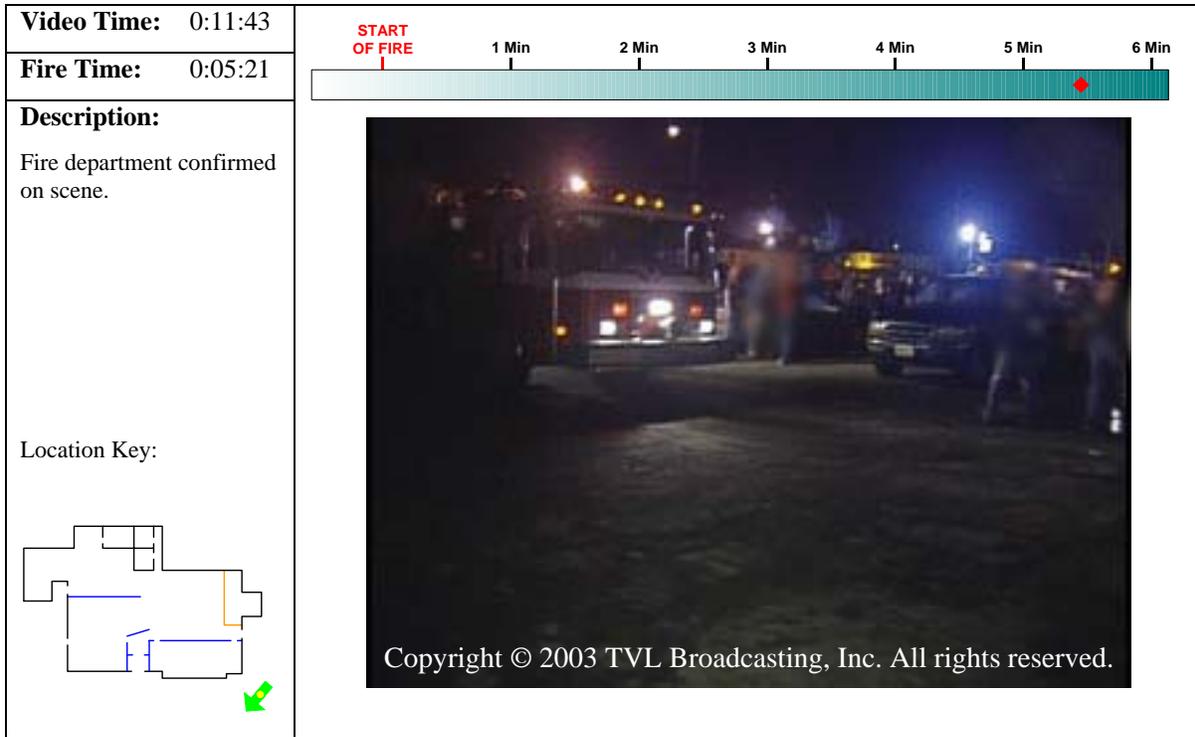
**Figure A.20 Timeline Event 20**



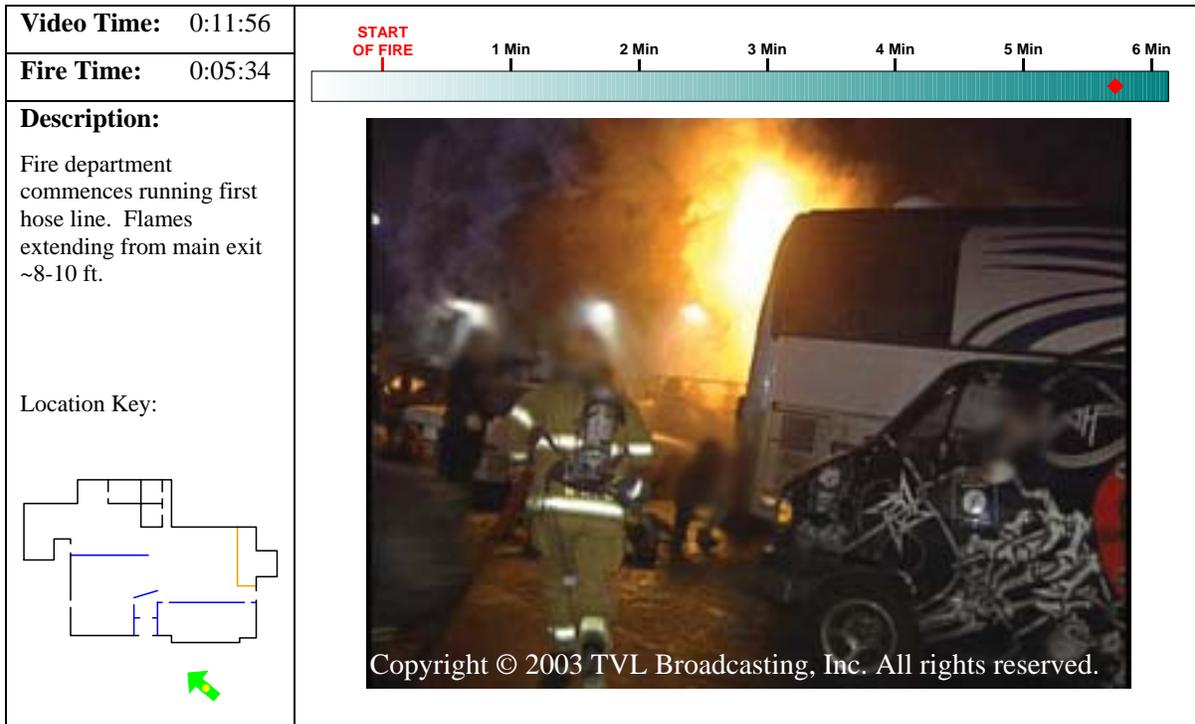
**Figure A.21 Timeline Event 21**



**Figure A.22 Timeline Event 22**



**Figure A.23 Timeline Event 23**



**Figure A.24 Timeline Event 24**



## **A.2 REFERENCES FOR APPENDIX A**

- [1] "Evaluation of Limitations to Egress through Doorways in Emergency Situations," vol. 1, Ove Arup & Partners Massachusetts Inc., Job number 32979, Westborough MA, February 18, 2004.
- [2] Butler, Brian, Video by WPRI-TV, Channel 12, February 20, 2003.

# Appendix B. LARGE FORMAT DEVICE STILLS

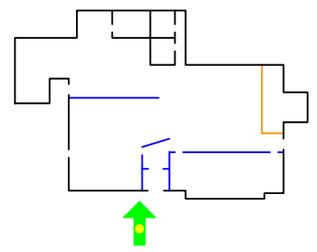
## B.1 INTRODUCTION

This Appendix, compiled by Arup[1], provides large-format versions of the photographs and video still frames [2] used in the review of life safety features (see Chapter 6) in the Station nightclub prior to the fire on February 20, 2003. The photos and still frames are primarily organized based upon the type of life safety feature shown (i.e. exit doors, exit signs, emergency lighting, suppression, and fire alarm and detection). On a secondary level, the pictures are organized based upon their source (i.e. photographic or video evidence). Each picture includes a location key showing where the camera was located (yellow dot) and in which direction it was pointing (green arrow) when the photograph was taken or the video frame was recorded. The ID number provided with each picture can be used to locate the represented life safety feature on the map provided in Figure 6-10 of the main report. The faces of occupants have been blurred to preserve anonymity.

## B.2 EXIT DOORS

### B.2.1 Photograph Evidence: Exit Doors

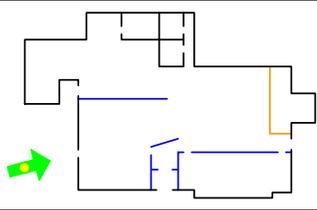
**Figure B.1 Life Safety Feature 1 [3]**

<b>Life Safety Feature ID:</b>	LSF 1	
<b>Type:</b>	Exit door / exterior stairs and ramp	
<b>Description:</b>	Main double doors with ramp and stairs	



courtesy of Anthony Baldino, III

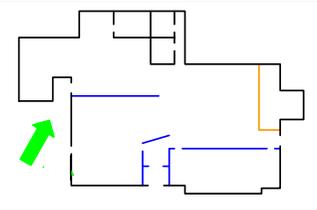
**Figure B.2 Life Safety Feature 2**

<b>Life Safety Feature ID:</b>	LSF 2	
<b>Type:</b>	Exit door / exterior stairs	
<b>Description:</b>	Exterior stairs from Left-side front bar exit	

NIST photo



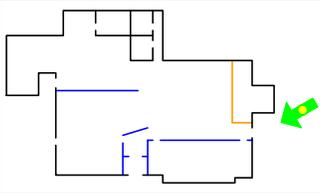
**Figure B.3 Life Safety Feature 3**

<b>Life Safety Feature ID:</b>	LSF 3	
<b>Type:</b>	Exit door / exterior stairs	
<b>Description:</b>	Exterior stairs from kitchen	

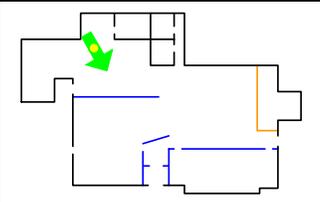
NIST photo



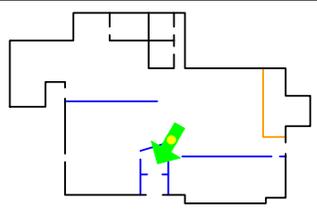
**Figure B.4 Life Safety Feature 4**

<b>Life Safety Feature ID:</b>	LSF 4	
<b>Type:</b>	Exit door / exterior stairs	
<b>Description:</b>	Exterior stairs from stage area	
<p>NIST photo</p> 		

**Figure B.5 Life Safety Feature 5**

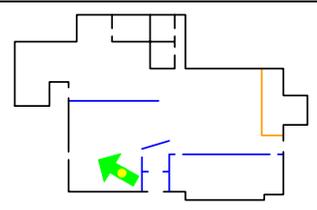
<b>Life Safety Feature ID:</b>	LSF 5	
<b>Type:</b>	Exit Sign	
<b>Description:</b>	Exit sign above door out to front vestibule	
<p>NIST photo</p> 		

**Figure B.6 Life Safety Feature 6 [4]**

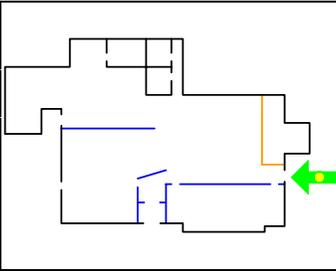
<b>Life Safety Feature ID:</b>	LSF 6	
<b>Type:</b>	Interior Door	
<b>Description:</b>	Door leading from the interior ticket area towards the outer vestibule	
<p>photo courtesy of K. Corbin</p> 		

**B.2.2 Video Evidence: Exit Doors**

**Figure B.7 Life Safety Feature 7 [2]**

<b>Life Safety Feature ID:</b>	LSF 7	
<b>Device Type:</b>	Exit door with panic hardware	
<b>Description:</b>	Exit door from left side of main bar to exterior concrete stairs. Panic hardware was provided on this door.	
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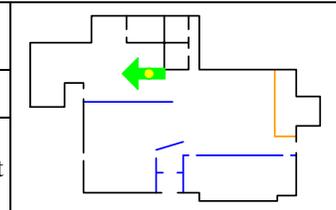
**Figure B.8 Life Safety Feature 8 [2]**

<b>Life Safety Feature ID:</b>	LSF 8	
<b>Device Type:</b>	Exit door with panic hardware	
<b>Description:</b>	Exit door adjacent to stage to exterior concrete stairs. Panic hardware was provided on this door. Note that it appears there was foam attached to this door and that there was an additional interior door that swung against the egress direction.	
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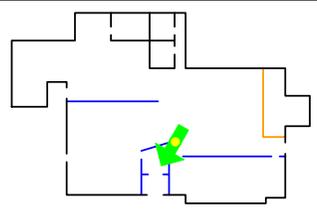
**B.3 EXIT SIGNS**

**B.3.1 Photograph Evidence: Exit Signs**

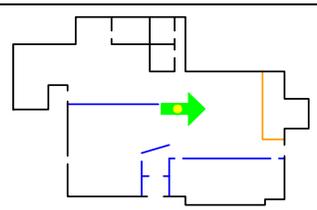
**Figure B.9 Life Safety Feature 9 [4]**

<b>Life Safety Feature ID:</b>	LSF 9	
<b>Device Type:</b>	Exit Sign	
<b>Description:</b>	Located near the rear bar. The exit sign is pointing toward the kitchen exit door.	
 <p>photo courtesy of K. Corbin</p>		

**Figure B.10 Life Safety Feature 10 [4]**

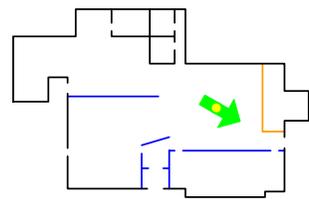
<b>Life Safety Feature ID:</b>	LSF 10	
<b>Device Type:</b>	Exit Sign	
<b>Description:</b>	Exit sign above door from ticket area to front vestibule	
 <p>photo courtesy of K. Corbin</p>		

**Figure B.11 Life Safety Feature 11 [4]**

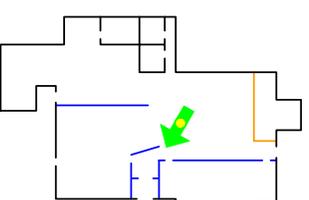
<b>Life Safety Feature ID:</b>	LSF 11	
<b>Device Type:</b>	Exit Sign	
<b>Description:</b>	Exit sign above door to the right of the stage. Note that sign is clearly illuminated.	
 <p>photo courtesy of K. Corbin</p>		

### B.3.2 Video Evidence: Exit Signs

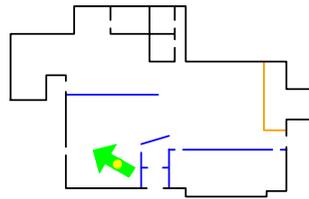
**Figure B.12 Life Safety Feature 12 [2]**

<b>Life Safety Feature ID:</b>	LSF 12	
<b>Device Type:</b>	Exit Sign	
<b>Description:</b>	Exit sign above door to the right of the stage. Note that sign does not appear to be illuminated.	
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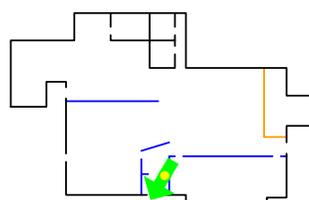
**Figure B.13 Life Safety Feature 13 [2]**

<b>Life Safety Feature ID:</b>	LSF 13	
<b>Device Type:</b>	Exit Signs	
<b>Description:</b>	Two visible. One located in the main floor area with an arrow towards the ticket area. One above the ticket area doors leading to the front vestibule.	
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**Figure B.14 Life Safety Feature 14 [2]**

<b>Life Safety Feature ID:</b>	LSF 14	
<b>Device Type:</b>	Exit Sign	
<b>Description:</b>	Exit sign over left side main bar area door.	
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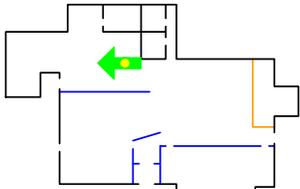
**Figure B.15 Life Safety Feature 15 [2]**

<b>Life Safety Feature ID:</b>	LSF 15	
<b>Device Type:</b>	Exit Sign	
<b>Description:</b>	Located in front vestibule above main double exit doors. This location is based upon similar wall and ceiling features observed in the WPRI video.	
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## B.4 EMERGENCY LIGHTING

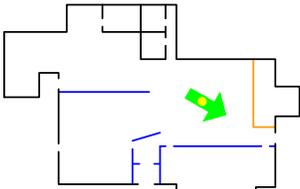
### B.4.1 Photograph Evidence: Emergency Lighting

Figure B.16 Life Safety Feature 16 [4]

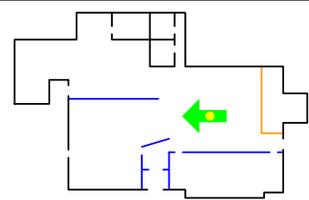
<b>Life Safety Feature ID:</b>	LSF 16	
<b>Device Type:</b>	Emergency Light	
<b>Description:</b>	Located near the rear bar adjacent to exit sign.	
 <p>photo courtesy of K. Corbin</p>		

### B.4.2 Video Evidence: Emergency Lighting

Figure B.17 Life Safety Feature 17 [2]

<b>Life Safety Feature ID:</b>	LSF 17	
<b>Device Type:</b>	Emergency Light	
<b>Description:</b>	Emergency light above and to the right of the stage exit door.	
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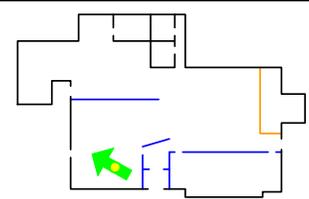
**Figure B.18 Life Safety Feature 18 [2]**

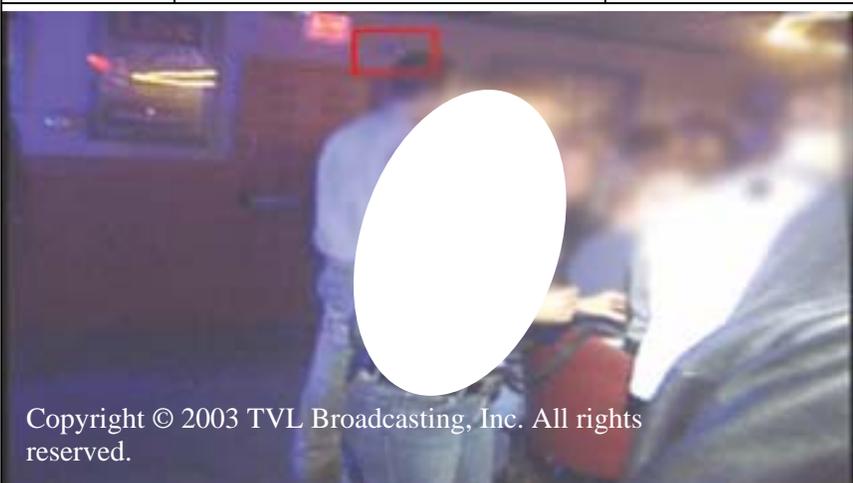
<b>Life Safety Feature ID:</b>	LSF 18	
<b>Device Type:</b>	Emergency Light	
<b>Description:</b>	Location on the wall adjacent to the kitchen by the main bar.	


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**Figure B.19 Life Safety Feature 19 [2]**

<b>Life Safety Feature ID:</b>	LSF 19	
<b>Device Type:</b>	Emergency Light	
<b>Description:</b>	Emergency light above and to the right of the left side exit door in the main bar area.	

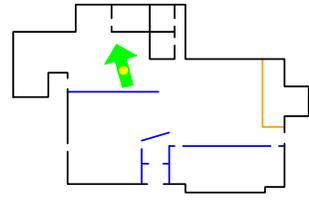
  


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## B.5 SUPPRESSION

### B.5.1 Video Evidence: Suppression

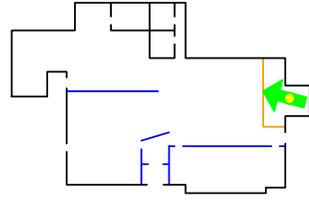
Figure B.20 Life Safety Feature 20 [2]

<b>Life Safety Feature ID:</b>	LSF 20	
<b>Device Type:</b>	Fire Extinguisher	
<b>Description:</b>	Located by the small bar.	
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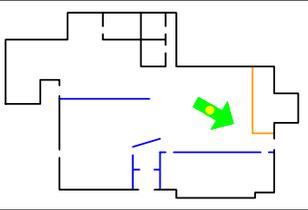
## B.6 FIRE ALARM AND DETECTION

### B.6.1 Video Evidence: Fire Alarm and Detection

Figure B.21 Life Safety Feature 21 [2]

<b>Life Safety Feature ID:</b>	LSF 21	
<b>Device Type:</b>	Detector	
<b>Description:</b>	Located above lighting grid in the vicinity of the stage.	
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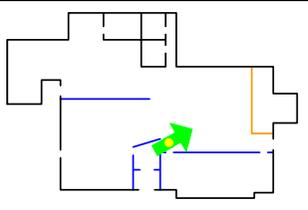
**Figure B.22 Life Safety Feature 22 [2]**

<b>Life Safety Feature ID:</b>	LSF 22	
<b>Device Type:</b>	Fire Alarm Strobe	
<b>Description:</b>	Adjacent to exit sign at stage exit door.	


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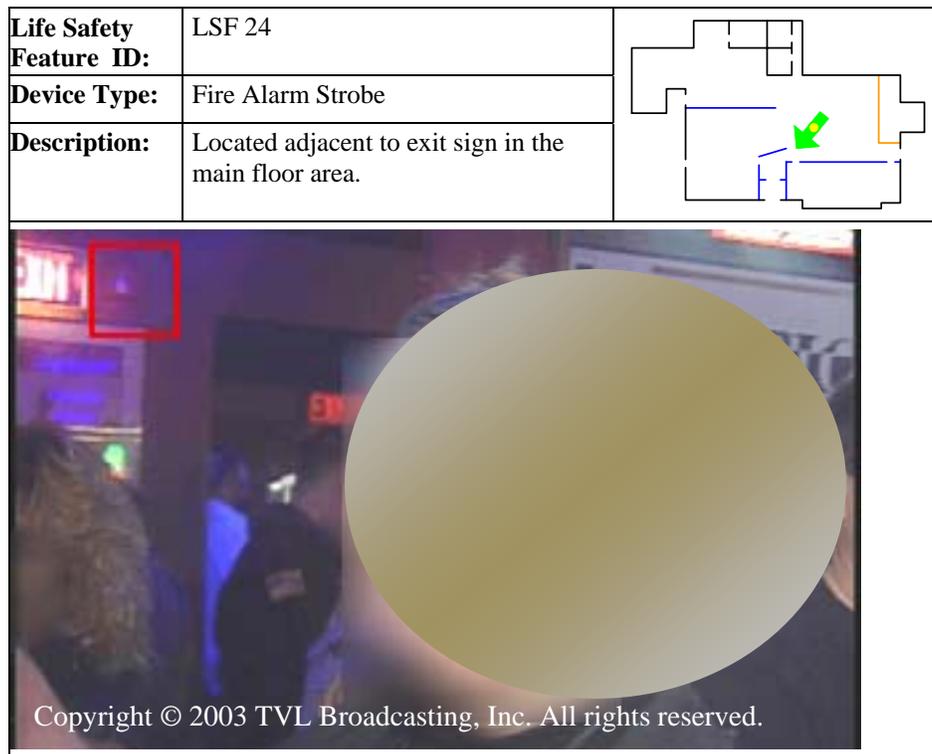
**Figure B.23 Life Safety Feature 23 [2]**

<b>Life Safety Feature ID:</b>	LSF 23	
<b>Device Type:</b>	Fire Alarm Strobe	
<b>Description:</b>	On ceiling to the left and in front of the stage	


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**Figure B.24 Life Safety Feature 24 [2]**



## **B.7 REFERENCES FOR APPENDIX B**

- [1] "Evaluation of Limitations to Egress through Doorways in Emergency Situations," vol. 1, Ove Arup & Partners Massachusetts Inc., Job number 32979, Westborough MA, February 18, 2004.
- [2] Butler, Brian, Video by WPRI, Channel 12, February 20, 2003.
- [3] photograph by Anthony Baldino III (undated)
- [4] courtesy of K. Corbin



# Appendix C.

## PREVIOUS EGRESS INCIDENT ACCOUNTS

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### C.1 INTRODUCTION

In order to identify the different factors that contribute to lives lost during emergency evacuations and how these events may have contributed to historical regulatory changes, a review was conducted of previous fires with significant loss of life that have occurred in the United States and abroad. This review was conducted under a contract to Arup Fire [45] on behalf of the NCST. In addition, past events in which evacuation efforts were successful and lives were not lost were documented.

### C.2 SUMMARY OF PAST EVACUATIONS

The following steps were taken in this review:

- A literature search was conducted to identify significant fires or other incidents, with particular emphasis upon incidents in which exit geometry may have played a significant role. The search included the following sources: standard internet searches, *fire doc* searches, review of significant conference proceedings, review of journal articles and review of various handbooks.
- From the literature search, significant details of incidents were coordinated with specific NFPA 101 and model code requirements.
- Code changes from each cycle of NFPA 101: *Life Safety Code*®, the Board for the Coordination of Model Codes (BCMC), the Uniform Building Code (UBC), the BOCA Basic National Building Code (BOCA), or the Standard Building Code (SBC) were reviewed and specific changes were noted. The monographs were reviewed for each change to determine the reasons for submitting or accepting these code changes. Arup personnel visited NFPA, ICC Alabama, ICC Chicago, and ICC Los Angeles libraries to review historic codes and monographs.
- Code change dates were matched to significant fire dates, and where possible, code changes precipitated by large life loss fires were identified.

#### C.2.1 Unsuccessful Evacuation

Table C-1 provides a summary of the unsuccessful incidents. The contributing factors listed in the table were identified as possible links to code changes that followed the incident. Contributing factors flagged were the following: delayed notification, combustibile interior finishes, some exits blocked or not obvious, incorrect exit door swings, locked exit doors, inadequate exit capacity, barred or boarded windows, and crowd crush at exits.

Delayed notification was considered a contributing factor if the incident reports specifically stated this fact. Combustibile interior finishes were considered a contributing factor if it was mentioned in the sources that combustibile finishes were located on the walls, ceilings, or structure. Combustibile finishes were not considered a contributing factor if a large amount of combustibles were present, but finishes were noncombustibile. Blocked or concealed exits were considered a contributing factor if it was found in

the literature that the exits were blocked by fire, blocked by building contents, or if they were concealed or hidden by building contents, furnishings, or layout.

If the literature stated that the building had incorrect exit door swings, this was considered a contributing factor. Locked exits were considered a factor if it was stated in the reports that doors were locked or were difficult to open to unfamiliar occupants. If the incident reports stated that there was inadequate exit capacity, or this could be inferred by the situation then this was considered a contributing factor. If a building was overcrowded and could otherwise accommodate the number of occupants specified by the building code, inadequate exit capacity was still considered a factor. If the reports stated that the windows were barred or boarded and the windows could otherwise be considered a means of escape, this was considered a contributing factor. If the incident accounts included descriptions of occupants piling-up at the exit doors, and thus hindering evacuation, crowd crush at the exits was considered a contributing factor.

Table C-2 provides additional details regarding these incidents, as well as an overview of any regulatory changes brought about as a result and any efforts to analytically model each incident. Note that the regulatory changes listed in Table C-2 are not necessarily directly related to the specific incident, but rather, the changes listed indicate modifications to the subsequent revision of the particular regulation.

## **C.2.2 Successful Evacuations**

Table C-3 is set up similarly to Table C-1, except that it lists factors that may have contributed to a successful evacuation.

## **C.3 DETAILS OF UNSUCCESSFUL INCIDENTS**

### **C.3.1 Conway's Theater Fire, Brooklyn, NY, 1876**

On December 5, 1876, during the final act of the play *The Two Orphans*, a fire erupted in Conway's Theater [1]. The theater seated 1700, but held 800 at the time of the fire. The rising velvet curtain created a draft that caught a gas jet flame. The flame ignited a flimsy drape and spread quickly. The audience saw the fire spreading out from around the stage before the actors on stage knew what was happening. A member of the company in the wings alerted the actors. Three actors stood at the front of the stage and told the audience to stay calm. Some people even sat back in their seats when they heard this.

The theater construction included a cheap wooden bench gallery; this gallery collapsed, throwing 150 audience members into the fire below. This also led to further fire spread into the theater. Stagehands were trying to put out the fire with canvas, since there was no fire fighting equipment available. The stagehands stopped attempts to extinguish the fire after the collapse of the gallery.

The stage manager ordered everyone on stage to save themselves; some actors escaped through the stage door to an adjoining alley or through the cellars under the stage, which opened through horizontal grates to the street. All of the people in the theater company escaped except for the three actors that stood at the front of the stage to calm the audience during the beginning stages of the fire. Many of the audience members were crushed to death in the obstructed, narrow, winding stairs of the main exit. In addition, many perished in the cellar. However, since the fire department had no way of knowing the occupant load of the theater at the time of the fire, and since a significant number people made it out of the building safely, the firefighters thought that all had been saved and started trying to prevent the fire from spreading to other buildings. In all, 315 lives were lost in the Conway's Theater fire.

**Table C-1. Historical Review of Incidents: Data and Contributing Factors**

Facility Name	INCIDENT DATA							CONTRIBUTING FACTORS									
	Year	Type of Occupancy	Type of Incident	Fatalities	Occupants at Time of Fire	Occupants Allowed by Code	Fire Origin	Alarm System Present	Sprinkler System Present	Delayed Notification	Combustible Interior Finishes	Some Exits Blocked or not Obvious	Incorrect Exit Door Swings	Locked Exit Doors	Inadequate Exit Capacity	Barred or Boarded Windows	Crush at Exits
Conway’s Theater [1]	1876	Assembly	Fire	315	800	1700	Gas Jet Flame				✓	✓			✓		✓
Iroquois Theater [2, 3]	1903	Assembly	Fire	602	~2400		Hot Light			✓	✓	✓		✓	✓		✓
Lakeview Elementary School [4]	1908	Educational	Fire	174	~400		Overheated Steam Pipe	✓			✓	✓					✓
Triangle Shirtwaist [5]	1911	Factory	Fire	147	~500		Rag Bin			✓			✓	✓	✓		✓
Italian Hall [5, 6]	1913	Assembly	False Alarm / Prank	72			No Fire						✓		✓		✓
Clinic [7, 8]	1929	Hospital	Fire	123	~250		X-Ray Film Ignited			✓							✓
Rhythm Club [9]	1940	Assembly	Fire	207	700+		Food Grill				✓	✓	✓		✓	✓	✓
Cocoanut Grove [5, 10]	1942	Assembly	Fire	492	~1000	600	Unknown				✓	✓	✓	✓	✓		✓
Winecoff Hotel [11, 12, 13]	1946	Hotel	Fire	119	280		Accident (suspicious)			✓		✓			✓		
Our Lady of Angels [5]	1958	Education	Fire	93			Unknown	✓		✓	✓	✓			✓		
Upstairs Lounge [14]	1973	Assembly	Fire	32	65	110	Arson				✓	✓		✓	✓	✓	
Gulliver’s Disco [15]	1974	Assembly /Mixed	Fire	24	~500		Arson			✓		✓			✓		
Beverly Hills Supper Club [3, 5, 16]	1977	Assembly	Fire	164	2400-2800	1511	Electrical			✓	✓	✓		✓	✓		✓

Facility Name	INCIDENT DATA										CONTRIBUTING FACTORS						
	Year	Type of Occupancy	Type of Incident	Fatalities	Occupants at Time of Fire	Occupants Allowed by Code	Fire Origin	Sprinkler System Present	Alarm System Present	Delayed Notification	Combustible Interior Finishes	Some Exits Blocked or not Obvious	Incorrect Exit Door Swings	Locked Exit Doors	Inadequate Exit Capacity	Barred or Boarded Windows	Crush at Exits
The Who Concert [3, 17]	1979	Assembly	Crowd Ingress	11	~8000		No Fire						✓	✓			✓
Haunted Castle [18]	1984	Amusement park	Fire	8	~30		Accident			✓	✓						
Happy Land Social Club [20, 21]	1990	Assembly	Fire	87			Arson	✓*		✓	✓		✓	✓			
Private Club [22]	1992	Assembly/Hotel	Fire	3			Accident		✓	✓							
E2 Nightclub [23, 24, 25]	2003	Assembly	Crowd Egress	21	~500	240-300	No Fire				✓		✓	✓			✓
Summerland [26]	1973	Assembly	Fire	51	~3000		Accident			✓	✓		✓	✓			✓
Stardust Cabaret [27]	1981	Assembly	Fire	48	846		Arson				✓						
Gothenburg Dance Hall [28]	1998	Assembly	Fire	63	~400	150	Arson				✓	✓		✓			✓
de Hemel [45]	2000	Assembly	Fire	14			Accident				✓	✓					

\*Sprinkler or alarm covered only a portion of the building, or system was not operational (see Table C-2 for details).

**Table C-2. Historical Review of Incidents: Additional Details, Regulatory Changes, and Modeling**

Facility Name	Year	Deaths	Crowd Crush	Additional Details	Resulting Regulatory Changes	Modeling Information
Conway's Theater [1]	1876	315	✓	No basic fire fighting equip. in bldg. Wooden bench gallery collapse causing fire spread. Narrow, winding exit stairs. Firefighting efforts focused on surrounding exposures.		
Iroquois Theater [2, 3]	1903	602	✓	No fire hoses and extinguishers. Stage fire curtain failed to completely close. Occupants informed to remain seated. Exit doors covered by metal gates. Exits converged in a common stairway.		
Lakeview Element. School [4]	1908	174	✓	Fire under wooden exit prevented stair usage. Floor collapsed into fire below. Non-isolated stairways. Delayed response by fire department.		
Triangle Shirtwaist [5]	1911	147	✓	Combustible construction and interior finishes. High fuel loads of hanging, piled cloth. Exit doors were locked and swung in the opposite direction of travel. Fire escape collapsed.	<b>NFPA 101®</b> : Creation of a Committee on Safety, a Factory Investigating Commission, New York Fire Prevention Bureau and the NFPA Building Exting Code (Life Safety Code).	
Italian Hall [5, 6]	1913	72	✓	No fire, unknown mass evacuation. Single stair for egress. Inward swinging doors.		
Clinic [7, 8]	1929	123	✓	Some X-rays were stored outside of metal cabinets. Two explosions produced poisonous gasses that killed nearly all victims. Toxic gases were spread by the ventilation system and open fire door.		
Rhythm Club [9]	1940	207	✓	Dry moss suspended from ceiling. One available exit, windows were boarded up. No upper windows or skylights to vent heat, smoke.		

Facility Name	Year	Deaths	Crowd Crush	Additional Details	Resulting Regulatory Changes	Modeling Information
Cocoanut Grove [5, 10]	1942	492	✓	Highly overcrowded as compared to codes. Combustible decorations placed throughout. Exits hidden by decorations, many were locked. Narrow hallways and converging exits. Jammed revolving entrance door.	<b>NFPA 101</b> ®: Greater acceptance of Building Exits Code; clarification of exit requirements; limitation noted concerning use of combustible finishes.	CFAST, WPI/Fire used to model fire effects within bldg. FPETool was used to estimate available evacuation time, sprinkler activation if sprinklers had been present.
Wincoff Hotel [11,12,13]	1946	119		No fire escapes or sprinklers. Delayed notification to fire department. Open main central staircase allowed flame and smoke to spread. Fire doors were not used. Transoms were not all air sealed.		
Our Lady of Angels [5]	1958	93		2 of the 5 available stairways were enclosed. Combustible materials were located in the stair. Delayed notification due to teachers evacuating their own classes. Inadequate opening protection.	<b>NFPA 101</b> ®: Improved fire safety procedures; tests were conducted to explore multistory school building with open stairs; requirement of sprinklers in school bldgs of different type. <b>BOCA</b> : Changes were made to the classification of the interior finishes requirements.	
Upstairs Lounge [14]	1973	32		Rapid fire spread in only stair due to combustible interior finishes. Fire door at the top of the stairs was opened and lead to smoke spread. Hidden and obstructed rear exit door. Numerous windows were boarded up or equipped with steel bars.	<b>BOCA</b> : Increases to egress capacity, travel distance; panic hardware was required for >100 occupants; widely requirement of sprinklers and standpipes	
Gulliver's Disco [15]	1974	24		Delayed discovery of the fire. Lack of fire-rated doors and wall separations. Exits were not separated Exits from dance floor were not remote and one stairway was blocked by smoke.	<b>NFPA 101</b> ®: Requirement for fire alarm/notification systems be installed with loads >300. <b>BOCA</b> : Increases to egress capacities of travel distances, doors and stairs; panic hardware for >100 occupants; sprinkler systems and standpipes were more widely required.	

Facility Name	Year	Deaths	Crowd Crush	Additional Details	Resulting Regulatory Changes	Modeling Information
Beverly Hills Supper Club [3, 5, 16]	1977	164	✓	<p>Number of occupants greater than the applicable codes</p> <p>Overcrowded room with tables and additional seating which blocked egress movement</p> <p>Rapid fire spread due to combustible interior finishes</p> <p>Delayed movement time</p> <p>No alarm system was installed in the building</p>	<p><b>NFPA 101</b>®: Although not necessarily directly related to this incident, the 1981 Edition required fire alarm and automatic sprinkler systems in assemblies &gt; 300 persons.</p> <p><b>BOCA</b>: Doors were to be installed with panic hardware and swing in the direction of travel for loads of &gt;50 occupants.</p>	A resistor network diagram and mean flow volume equations showed that opening doors drew the fire into the escape routes.
The Who Concert [3, 17]	1979	11	✓	<p>Poor crowd management plan</p> <p>Only one of two doors were open to allow the 8000 concert goers to enter the building</p>	<p><b>NFPA 101</b>®: Requirements regarding festival type seating were introduced.</p> <p>Crowd Management report that offered 108 safety recommendations was developed.</p>	
Haunted Castle [18]	1984	8		<p>No automatic detection or suppression system installed.</p> <p>Large amounts of combustible materials were present.</p> <p>Foam plastic mounted on walls.</p> <p>Occupants had difficulty escaping.</p>	<p><b>NFPA 101</b>®: Limits placed on use of types of interior finishes.</p> <p><b>BCMC</b>: Size, location and illumination of exit signs.</p> <p><b>UBC</b>: Interior finish requirements were changed</p>	
Happy Land Social Club [20, 21]	1990	87		<p>Building violated code regulations but still in operation.</p> <p>Building was only partially sprinklered.</p> <p>One of the two main exit doors was covered by a roll-down steel security door, swinging doors were locked.</p> <p>Four doors separated the patron areas from an entrance lobby.</p> <p>Exit stairs were not enclosed.</p> <p>Combustible interior finishes in lobby area.</p>	<p><b>UBC</b>: Although not necessarily a direct result of this incident, changes were made to the requirements of exit width and fire alarm/notification system for the subsequent edition.</p>	
Private Club [22]	1992	3		<p>Lack of approved sprinkler and unprotected penetrations in walls, ceiling assemblies contributed to spread.</p> <p>Concealed spaces increased hazard for firefighters.</p> <p>Wood paneling on walls, ceiling tiles left in concealed spaces contributed to fire extent</p>	<p><b>BOCA</b>: Sprinklers were being required in assembly occupancies of various sizes.</p>	

Facility Name	Year	Deaths	Crowd Crush	Additional Details	Resulting Regulatory Changes	Modeling Information
E2 Nightclub [23, 24, 25]	2003	21	✓	Club should have been closed due to numerous building code violations. Pepper spray caused the crowd to rush the main exit. Alternate exits not easily accessible. The club was overcrowded.	Since this fire is so recent there have not been any regulatory changes.	
Summerland [26]	1973	51	✓	Delayed notification to fire service. Combustible exterior and interior finishes aided in fire spread. Emergency doors were padlocked. Turnstiles could not handle numbers.	Isle of Man and the United Kingdom tightened fire regulations on public buildings.	
Stardust Cabaret [27]	1981	48		Adequate exit capacity. Fire spread quickly due of large amount of combustible materials.	Fire investigation lead to significant range of recommendations but unknown if that lead to changes in regs.	
Gothenburg Dance Hall [28]	1998	63	✓	Fire growth and spread was high due to fuel loads. Hall was severely overcrowded. No automatic detection or sprinkler system was installed. Occupant that first discovered fire did not notify others. Numerous people jumped from windows. Crowds of people surrounding the building hampered the fire service.	Discussions concerning the use of multiple “normal” exits would be better than a few wider exits for public halls/auditoria were conducted.	BuildingEXODUS evacuation model used to analyze similar scenario (fire load used in model was main difference). [29]
de Hemel nightclub	2000	14		New Years eve, 2000/2001, Fire spread over Christmas tree boughs suspended from ceiling, ignited accidentally with a sparkler		Fire recreated at TNO laboratory

**Table C-3. Historical Review of Incidents: Successful Evacuations**

Incident	Year	Fire Origin	Manual Alarm	Detection System	Sprinklers	Occupants	Fatalities	Occupant Injuries	Delayed Evacuation	Delayed FD Response	Fire Contained by Construction
School, California [30]	1992	Cooking equipment	✓	✓		1,000	0	0	✓		
Nightclub, Texas [31]	1992	Electrical			✓	100's	0	0			
School, Oregon [32]	1992	Arson	✓		✓ <sup>2</sup>	450	0	0			✓
School, Mass. [33]	1992	Pyrotechnic device					0	0		✓	
School, Oregon [34]	1994	Electrical		✓			0	0			
Restaurant, Indiana [35]	1996	Cooking equipment			✓ <sup>3</sup>		0	0			
Dinner Theater, Florida [36]	1996	Pyrotechnic device	✓	✓	✓	400	0	0			
Restaurant, Michigan [37]	1996	Equipment malfunction					0	0			
Community Cntr, Penn. [38]	1997	Electrical	✓	✓	✓ <sup>2</sup>	100	0	4			
Restaurant, Massachusetts [39]	1997	Cooking equipment			✓ <sup>2,3</sup>	25	0	0			
School, California [40]	1998	Electrical	✓ <sup>1</sup>				0	0	✓	✓	
Casino, Nevada [41]	1998	Unknown		✓	✓		0	1			✓
Restaurant, New Jersey [41]	1998	Smoking materials		✓	✓ <sup>2</sup>		0	2			
Restaurant, Michigan [41]	1998	Cooking equipment			✓ <sup>3</sup>		0	0			
Theater, Nevada [42]	1999	Electrical			✓		0	5			
Fine Line Music Café, Minneapolis [43]	2003	Pyrotechnic device			✓	120	0	0			

<sup>1</sup> Manual alarm system out of service at time of fire.

<sup>2</sup> Sprinkler system covered only part of the building.

<sup>3</sup> Kitchen area protected by dry chemical extinguishment system.

The following details regarding this incident are of note:

- The theater did not have the basic fire fighting equipment, including a hose or any water buckets, because it was believed that a brick building would not burn;
- The wooden bench gallery collapsed, killing many audience members and spreading the fire beyond the stage;
- The main exit was at the bottom of narrow, winding stairs, which were eventually blocked by bodies that had fallen in the evacuation push;
- Fire fighters thought that everyone had made it safely out of the building and concentrated on saving the surrounding buildings.

### **Impact on regulations or practices**

The NFPA Life Safety Code, the Board for the Coordination of Model Codes (BCMC), the Uniform Building Code (UBC), the BOCA Building Code (BOCA), and the Standard Building Code (SBC) had not yet been developed at the time of the fire.

### **C.3.2 Iroquois Theater Fire, Chicago, Illinois, 1903**

Less than one month after its grand opening, the Iroquois Theater in Chicago, Illinois suffered a fast-moving fire during a performance [2,3]. At 3:15 PM, a hot light ignited highly combustible stage scenery items. The fire spread rapidly, and the efforts of the lone on-duty firefighter proved futile. Contrary to standard precautions in theaters at the time, the Iroquois Theater had no fire hoses or extinguishers and the standpipes on the stage were dry because the water supply system was not completed. Confident that the fire could be controlled, an actor urged the audience to remain seated. However, the fire rapidly escalated, and people eventually began moving. Numerous deaths occurred as people from the balcony level, the gallery level, and the main level converged in the exit stairway. Additionally, numerous people jumped from the upper levels as the stairway became blocked.

All 602 deaths occurred within 15 minutes of the start of the fire. Most of the fatalities were in the third floor or gallery area. A draft caused by the stage exit doors being opened caused flames to rush to open vents above the gallery rather than to the stage vents, which were missing counterweights and were nailed shut. Upon arrival, fire department personnel were able to extinguish the fire within 30 minutes. The building was largely undamaged, and reopened within one year.

The following details regarding this incident are of note:

- The theater lacked fire hoses and extinguishers, so the on-duty firefighter was not able to fight the fire above his head;
- The ushers and personnel received no instructions about what to do in the case of a fire;
- The curtain designed to separate the stage area from the audience got caught before it could reach its full down position, and thus was unable to prevent fire spread from the stage. Later testimony revealed that the curtain may have been improperly installed, and also may not have been fireproof;

- After the fire started, the audience was urged to stay in their seats and not to evacuate, and the orchestra continued playing;
- Some exit doors had been covered by metal gates. Some of these were locked, and others had latches that were likely unfamiliar to occupants;
- Exit paths from the balcony area and the main floor met in a single, common stairwell.

### **Impact on Regulation or Practices**

The NFPA Life Safety Code, the Board for the Coordination of Model Codes (BCMC), the Uniform Building Code (UBC), the BOCA Building Code (BOCA), or the Standard Building Code (SBC) had not yet been developed at the time of the fire.

### **C.3.3 Lakeview Elementary School Fire, Collinwood, Ohio, 1908**

The Lakeview Elementary School fire was the worst disaster in Cleveland history with a toll of 172 children and two teachers [4]. The three-story school had a brick exterior, but the interior was all constructed of wood. It was theorized at the time that the fire was caused by an overheated steam pipe that ignited wood joists under the front stairs. The fire was discovered by a child who had gone down to the girls' lavatory in the basement. The student told the janitor who then sounded the alarm and opened the front and rear doors. Students that attempted to escape using the front doors were pushed back by flames and smoke, so they ran to the back entrance. Someone fell at the back entrance and a blockage of people developed as many tried to force their way through. One of the exterior doors had blown shut and children became wedged in the narrow space. The pushing of the students trying to escape and the weakening of the structure by the fire below caused the floor to collapse, which plunged the crowd into the burning basement. Classes on upper floors fled using fire escapes and others jumped out of windows. The team of village horses used by the volunteer fire department was busy dragging a road scraper a mile away, so by the time they arrived little could be done.

The following details regarding this incident are of note:

- Wooden construction ignited under the front stairs, rendering them useless for evacuation;
- The floor at the rear exit collapsed, throwing many occupants into the fire;
- Stairways were not enclosed;
- Exterior rear door blew shut;
- The team of horses that normally pulled the fire engine were not readily available at the time of the fire and arrived late to the scene.

### **Impact on regulations or practices**

The fire in Collinwood brought about laws requiring fire resistant construction, enclosed stairwells, and "panic bars" that trigger door latches when pushed from inside in schools. The NFPA 101 Life Safety Code, the Board for the Coordination of Model Codes (BCMC), the Uniform Building Code (UBC), the BOCA Building Code (BOCA), or the Standard Building Code (SBC) had not yet been developed at the time of the fire.

### **C.3.4 Triangle Shirtwaist Company Fire, New York, New York, 1911**

The fire at the Triangle Shirtwaist Company in New York in 1911 had possibly the greatest impact on modern fire and life safety codes of any historical fire. The business was located on the three topmost floors of a ten-story building. Fire initiated in a bin of rags on the lowest of the three floors, and quickly spread despite the efforts of employees to extinguish it using buckets of water [5]. Large amounts of fabric throughout the space contributed to rapid fire growth and spread.

Initial evacuation was hampered by a locked exit door, which, when eventually unlocked, swung against the direction of egress travel, thus causing a crush of evacuating occupants. Even after the door was opened, some occupants tripped on the exit stairway and caused a further delay in the egress.

Some occupants from the top floor escaped via the roof to an adjacent building. Occupants of the upper and lower floors never notified the middle floor occupants of the fire. Instead, occupants of this floor learned of the fire when flames extended through the windows. During the exiting of occupants from this floor, the fire escape collapsed. Some occupants tried to use the elevators, but they were already packed with occupants from other floors. As a last resort, some occupants jumped from the ninth-floor windows. A total of 147 people died in this incident.

The following details regarding this incident are of note:

- The building had wood floors, window frames, and trim. The New York City building codes of the time allowed this for structures less than 11 stories high;
- Each of the two lower floors, where large numbers of employees worked, included vast amounts of cloth either piled on the floors, in bins or on tables, or hanging from lines. This contributed to rapid fire growth and spread on the floor of origin;
- Numerous exit doors were locked in an effort to monitor employees and prevent theft;
- The exit doors swung opposite the direction of egress travel;
- The building had only two staircases. This violated New York City building codes of the time, which required three staircases per floor where the floor area of each floor exceeded 10,000 ft<sup>2</sup>;
- Elevators placed priority on the topmost floor, and thus were full when they stopped at the lower floors, where the danger was more imminent;
- A lack of communication between the eighth and tenth floors and the ninth floor led to late notification of the occupants of the ninth floor;
- The fire escape, when heated by the fire extending from the windows, could not support the large number of evacuating occupants and collapsed;
- The New York City fire department did not have equipment that could fight fires higher than seven stories up in a given building.

#### **Impact on regulation or practices**

According to information in the Life Safety Code<sup>®</sup> Handbook:

- Immediately after the incident, New York City residents formed the Committee on Safety, which worked to pass laws requiring greater safety in factory buildings;

- The Governor of New York, in response to this incident, created a Factory Investigating Commission within the state;
- Later in the same year, a law was passed creating the New York City Fire Prevention Bureau (the first such bureau in the US).

### ***NFPA 101®: Life Safety Code®***

Again, according to the Life Safety Code Handbook, due to the severity of this incident, NFPA began to broaden its scope to include elements of life safety. The first such publication dealt with exit drills in factories, schools, department stores, and theaters. Two years later, an NFPA committee on Safety to Life, which was to study the current situation regarding life safety in buildings, was formed. This was the beginning of the NFPA Life Safety Code. In 1927, this work also resulted in the NFPA Building Exiting Code.

### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

### ***Uniform Building Code (UBC)***

The first edition of the UBC was not published until 1927.

### ***BOCA Building Code (BOCA)***

The first edition of the BOCA code was not published until 1950.

### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945. Details of proposed changes and committee reports were not available prior to 1977.

## **C.3.5 Italian Hall Disaster, Calumet, Michigan, 1913**

On Christmas Eve of 1913, a party was being held in an upstairs function room in the Italian Hall in Calumet, Michigan. The majority of the attendees were children. At some point during the party, something caused the occupants to initiate a mass evacuation. Reports of the cause of this vary, but no fire was found [5,6]. The evacuating occupants rushed down the main stairway and clogged in the exit doorway. The resulting crush of people in the stairwell led to the deaths of 72 people; all of these were either crushed or suffocated.

Some reports indicate that intoxicated, disgruntled workers may have yelled ‘fire.’ It is unclear if this did occur.

The following details regarding this incident are of note:

- The function room was served by a single main exit stairway;
- The exit doors at the bottom of the main stairwell opened inward; this resulted in a blockage as people rushed down the stairway before the first evacuating occupants could open the doors.

### **Impact on regulation or practices**

#### ***NFPA 101®: Building Exits Code®***

NFPA 101 was not yet published; the incident occurred in 1913 while the first edition of the *Building Exits Code* was released in 1927.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code (UBC)***

The first edition of the UBC was not published until 1927.

#### ***BOCA Building Code (BOCA)***

The first edition of the BOCA code was not published until 1950.

#### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.6 Clinic Fire, Cleveland, Ohio, 1929**

On May 15<sup>th</sup>, 1929 a fire started at 11:25 AM in a basement room where 70,000 X-rays were stored [7,8]. The burning films released poisonous gases that traveled through the building's ventilation system that was also located in the basement. A fire door was left open aiding in the movement of the poison gas. At 11:31 AM, an explosion rocked the building, spreading more poisonous gas and starting fires throughout the building. When the fire department arrived, the building was already shrouded in smoke. Soon after, another explosion shook the building. Patients ran for the exits, and many succumbed to the toxic gases while trapped in stairways and near the elevator. Many of the nurses and doctors died helping the patients. Some patients found their way out, but eyewitness accounts state that many of these perished as a result of their injuries or inhalation of smoke. The fires were extinguished, and the victims were removed from the building within two hours. The incident claimed 123 lives; 43 of these were doctors and nurses. Nearly all of the victims died of inhalation of poison gas.

The following details regarding this incident are of note:

- Contrary to American Hospital Association guidelines, the X-rays were stored in paper folders and some had been left outside the steel cabinets where they were supposed to be kept;
- A fire door was open and allowed the gas to spread throughout the clinic;
- The building was not equipped with a sprinkler system.

#### **Impact on regulation or practices**

The fire resulted in the development of new standards for the storage of hazardous materials, particularly X-ray film. Also, poisonous gases were recognized as a hazard and fire insurance companies began to develop and strictly enforce safety regulations.

The impacts that this incident had on various regulations are discussed below.

#### ***NFPA 101®: Building Exits Code***

While there do not appear to be any changes to NFPA 101 directly associated with this incident, the 1929 edition brought the first introduction of the "Assembly Occupancies" chapter. The 1934 edition expanded upon occupant loading, exit capacities, required number of exits, and travel distances.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

The first edition of the BOCA code was not published until 1950.

#### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.7 Rhythm Club Fire, Natchez, Mississippi, 1940**

The Rhythm Club was a single-story dance hall in Natchez, Mississippi. It was a wood framed building with corrugated steel walls and roof. Several years before the fire, the ceiling joists of the building had been concealed by adding a layer of Spanish moss on top of a netting system. On the night of the fire, the moss was extremely dry; it is suspected that the heat from a grill located near the front of the building caused the moss to ignite. The fire spread rapidly across the dry moss [9].

The building was equipped with only one exit, which was located at the front of the building. When the fire began to grow, several occupants were able to exit through this door. However, the location of the ignition near the front of the building caused most of the occupants to move to the back into the building, where there were no additional exits. The main exit doors opened against the direction of egress travel, but since only a few people were able to reach this exit, it was not expected that this detail significantly contributed to the loss of life, and no fatalities occurred near these doors. The sides of the building were lined with numerous small windows, but all of these in the main open portion of the building had shutters, some of which were latched, but most of which were nailed closed. All of the shutters opened inward. As a last resort, occupants attempted to break through the corrugated steel walls of the building to reach the outside, but were unsuccessful. The majority of the 207 fatalities occurred at the very back of the building, at the opposite end from the only available exit.

The following details regarding this incident are of note:

- The tinder-dry Spanish moss layered below the ceiling joists led to extremely fast fire spread along the length of the building, and contributed to further fire spread by falling and igniting combustible items below;
- The building was equipped with only one available exit door. The location of the fire in the front portion of the building prevented most occupants from accessing this exit;
- None of the windows along the sides of the main portion of the building could be used as a means of escape, since they were very small and most were boarded up. One plain glass window was included in a subdivided portion at the front of the building, but occupants were not able to reach this area due to the location of the fire, and even if they had, the door to this room was locked;
- At the time of the fire, more than 700 people were packed into the 120 ft by 38 ft structure;

- There were no skylights or other windows to vent the heat or smoke, so the metal walls held the heat in like an oven.

### **Impact on Regulation or Practices**

#### ***NFPA 101®: Building Exits Code®***

There do not appear to be any changes to NFPA 101 directly associated with this incident.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

The first edition of the BOCA code was not published until 1950.

#### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.8 Cocoanut Grove Nightclub Fire, Boston, Massachusetts, 1942**

The Cocoanut Grove Nightclub was a single-story building with a finished basement. The basement contained an additional lounge and a kitchen. Technically, the capacity of the club was 600 occupants. On the night of November 28, 1942, when a fire broke out in some combustible decorations in the basement lounge, there were over 1000 occupants in the club [5,10]. From the portion of the building where the fire broke out, there was only one obvious exit, and this was up a set of stairs leading through an approved exit door to a hallway, and eventually to the main exit, which included a revolving door. This hallway also had a door exiting to the street, but this was locked at the time of the fire. Other means of egress existed, but were concealed behind decorations and false walls; some were locked.

The fire spread rapidly across the underside of the false ceiling in the compartment of origin, and eventually went up the exit stairs and into the exit hallway and spread into the main dining room. The patrons in the main dining area knew of only one exit, the main exit with the revolving door. Other exits were not obvious or were hidden with decorations similar to the basement lounge. Some of the patrons stumbled upon these exits and escaped; however, some of the exits on the first floor were also locked trapping occupants.

There was a second lounge area on the first floor down a narrow hallway from the dining area. The smoke spread into this area and people rushed for the only exit door, which opened inward. The push of the crowd jammed the door closed and many of the occupants within this area died.

It is reported that the fire lasted less than an hour from ignition to extinguishment; 492 people died. Many of these deaths resulted from a bottleneck of evacuating occupants in the narrow exit hallway leading from the downstairs lounge. Many more people died when they got trapped behind the revolving door that served as the main exit from the lobby area.

The following details regarding this incident are of note:

- The night of the fire, the club was highly overcrowded (compared to its capacity according to the applicable codes);
- The fire spread rapidly across combustible decorations throughout the club;
- While numerous exits from the lower-floor lounge existed, only one was obvious and unlocked the night of the fire. Others were hidden by decorations or false walls, and many of these were locked. Only employees, and the few people the employees were able to assist, used these exits;
- The main exit from the lower lounge required that occupants traverse a narrow hallway and enter the main lobby, where they would converge with occupants evacuating from other parts of the building. An additional exit door located in the narrow hall was locked;
- Many of the patrons in the dining area only knew of the main exit, since many of the other exits were concealed or unmarked;
- Some of the exits were locked;
- The only exit in the smaller lounge off from the dining area opened inward and trapped patrons in the lounge;
- A large number of people were trapped behind the revolving main entrance door, which became jammed with people early in the evacuation.

### **Impact on Regulation or Practices**

#### ***NFPA 101®: Building Exits Code®***

According to information in the Life Safety Code® Handbook:

- Subsequent to this incident, the NFPA Building Exits Code began to be accepted by more jurisdictions throughout the country;
- At the 1945 NFPA Annual Meeting, the Committee on Safety to Life recommended changes to the prescribed method of egress capacity measurement, clarification of stairway enclosure requirements, changes to requirements regarding moveable chairs in nightclubs, and changes in exit lighting and signage requirements, as a result of this fire;
- A caution was added to the Building Exits Code warning that, where combustible interior finishes exceeding the limitations of the Code were used, the provisions of the Code may not be sufficient to ensure life safety.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code***

The 1943 edition of the UBC did not contain any significant changes from the previous edition; however, a number of changes were made between the 1943 and the 1946 editions. Though it is unclear if this incident had any direct impact, the following were changes incorporated into the 1946 edition of the UBC:

- Required egress width requirements changed to provide one foot of width for every 50 occupants. The previous requirement provide for a varying number of inches of exit width per person based upon the total occupant load;
- A main entrance/exit provision was added such that the main entrance/exit was now required to have a capacity not less than 50% of the design occupant load;
- The number of required exits was changed such that 2 exits were required from 10-499 occupants; 3 exits for 500-999 occupants; and 4 exits for more than 1,000 occupants;
- Panic hardware was now required for doors serving more than 50 occupants in assembly occupancies.

### ***BOCA Building Code (BOCA)***

The first edition of the BOCA code was not published until 1950.

### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945.

## **Modeling Efforts**

In one study, the Cocoon grove fire was the subject of a number of modeling efforts. Both CFAST and WPI/Fire were used to model fire effects within the building. FPETool was also used to estimate the evacuation time from the building and to estimate sprinkler activation time (had sprinklers been present).

### **C.3.9 Winecoff Hotel Fire, Atlanta, Georgia, 1946**

In the early morning hours of December 7, 1946 a fire occurred at the fifteen-story Winecoff Hotel in downtown Atlanta [11,12,13]. At the time the hotel had 280 guests in its 194 rooms and 119 of these guests died in the fire. The hotel was advertised as fireproof because of a brick exterior and concrete and steel construction. It was built in 1913 and did not have fire escapes or a sprinkler system because it was not required by code when it was built. The authorities believed that the fire began on the fourth or fifth floor. The fire was reported to the night auditor and as soon as he verified that there was a fire he sounded the alarm around 3:20am. However, the fire department records indicate that the first alarm came in by telephone at 3:42am. The night auditor then contacted as many rooms as possible before the switchboard stopped working telling the guests to keep their doors closed and to stay calm. However, only the rooms on the third through the sixth floors had heavy wooden doors and tightly sealed transoms. Above the sixth floor, the rooms did not have the thick doors and many of the transoms had been permanently opened allowing for smoke and flame to spread into these rooms. Also, the fire spread quickly because it was aided by the open narrow staircase that acted as a flue. The fire was ruled as an accident, caused by a burning cigarette on a mattress. However, there are some investigations that have pointed toward arson.

The following details regarding this incident are of note:

- There were no fire escapes or sprinklers in the hotel;
- There was a twenty minute delay in reporting the fire to the fire department;
- The main central staircase was open and allowed flame and smoke to spread floor to floor;
- Fire rated doors were not used;

- The transoms were not fire rated or sealed.

### **Impact on Regulation or Practices**

The Wincoff fire led to a number of new fire regulations for Atlanta. The major change was to require the enclosing of stairwells with additional requirements for alarm systems and smoke detectors.

The impacts that this incident had on various regulations are discussed below.

#### ***NFPA 101®: Building Exits Code®***

There do not appear to be any changes to NFPA 101 directly associated with this incident.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

The first edition of the BOCA code was not published until 1950.

#### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.10 Our Lady of Angels School Fire, Chicago, Illinois, 1958**

Inadequate exit components were blamed for the loss of 93 occupants in a fire that spread rapidly through the Our Lady of Angels School in Chicago in 1958 [5]. The school consisted of a pair of two-story brick buildings connected together. However, per the applicable code, the building was considered one fire area, since the masonry wall separating the two annexes did not have protected openings, and the majority of the stairways within the buildings were not enclosed. The actual origin of the fire is not known, but it was located in a rear unenclosed stairway. Combustible materials here, as well as in adjoining corridors, contributed to rapid spread from the stairway to other areas of the building. Additionally, combustible ceiling tiles in the classrooms likely added to fire growth and spread.

After the fire was discovered and efforts were made to locate the school principal, the few teachers aware of the fire evacuated their own classes to another building. Only after returning did they activate the school's fire alarm and initiate general evacuation. Because the fire had moved up the open stairway in which it initiated and was largely burning in the second floor corridor, the first floor occupants were able to evacuate through the five available exit stairs. Some of the upper level occupants were able to escape because someone closed the dividing door between the two annexes, thus largely confining the products of the fire to the North wing. However, occupants of the North wing could not use the corridor to escape because of smoke and heat, and thus were forced to jump from the second-story windows or to be rescued by fire fighters using ladders. The majority of the fatalities occurred in this area.

The following details regarding this incident are of note:

- Only two of the five available stairways were enclosed, and these had inadequate opening protection at their landings. At the time of the fire, the doors to these stairwells were propped open;
- Combustible materials in the stairwell where the fire started, combustible wood trim in the main second-floor corridor, and combustible ceiling tiles in the classrooms all contributed to rapid and widespread fire impact on the second floor of the North annex;
- Notification was delayed because teachers evacuated their own classes before sounding a general alarm. By the time a general evacuation was initiated, dense smoke and heat had reached the upper corridor through the open stairwell. This prevented occupants of the upper floor of the North annex from reaching the enclosed exit stairway at the North end of the corridor;
- The opening protection between the two annexes was substandard, and the door in the upper corridor was propped open leading up to the fire. An occupant closed it during the fire, thus isolating the occupants of the second story portion of the South annex from the heat and smoke of the fire.

### **Impact on Regulation or Practices**

Spurred by the Our Lady of Angels fire, the Los Angeles Fire Department conducted a series of tests designed to explore methods of protecting multistory school buildings containing open stairways. One of the major conclusions of these tests was that automatic sprinkler systems provided the best chance of occupant safety and egress.

Generally speaking, the Our Lady of Angels fire awakened much of the US to hazards present in the country's schools, and efforts were undertaken to improve conditions. One year after the fire, the NFPA polled fire departments regarding fire safety in schools, and it was found that the majority of communities had implemented better fire drill procedures, improved waste control measures, refined inspection requirements, and more appropriate storage of combustible goods;

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In response to the Our Lady of Angels fire and the Los Angeles fire tests, the NFPA reorganized its provisions for educational occupancies, which included requirements for sprinklers in school buildings of different types.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

The 1960 edition of BOCA contained changes in the Interior Finish requirements which modifying how material combustibility was classified. It is uncertain if any changes occurred in the requirements for the types of materials allowed in various occupancies.

#### ***Standard Building Code (SBC)***

The first edition of the SBC was not published until 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.11 Upstairs Lounge Fire, New Orleans, Louisiana, 1973**

On June 24, 1973, an arson fire killed 32 patrons of the Upstairs Lounge in New Orleans, Louisiana [14]. The fire was started in the only staircase serving the upper floors of the three-story building. The second floor was the lounge, and the third floor included unoccupied apartments. At the time of the fire, there were 65 people in the lounge, which had a capacity of 110. Once established, the fire spread rapidly up the stairwell, fueled by combustible wood paneling and carpeting. The stairway was separated from the lounge on the second floor by a wood-framed partition with plaster-on-lath covering the studs. An approved fire door assembly was installed in this partition. However, on the night of the fire, a patron responding to repeated rings of the doorbell opened this door, and fire rushed into the lounge.

The location of the fire in the exit staircase prevented occupants from evacuating down the main exit stairs. An alternate escape path, opening onto an adjacent building's roof, was located in the back of the lounge, but was not marked as an exit. Also, the path to this door was obstructed by equipment on a stage, and the door had an improvised latch. The bartender attempted to lead people to this door, and was successful in evacuating several people in this fashion. However, on his second attempt to move people to the back door, he received no response, and evacuated, latching the fire door behind him. The final exit option was through the windows of the club. The building was equipped with a single fire escape, accessed through one of the windows. Many windows in the lounge were boarded up; other windows in the bar area were equipped with metal bars to prevent patrons from falling through. This proved to hamper escape efforts. Some occupants were able to squeeze through the bars and reach the outside, where they jumped, slid down drainpipes and other building features, or utilized the fire escape. Many of the fatalities occurred in the bar area in the vicinity of the exterior windows.

The following details regarding this incident are of note:

- The fire spread rapidly up the only stairway in the building due to the combustible interior finishes within the stairwell;
- The fire door at the top of the stairwell, which initially blocked the heat and smoke from the fire, was opened by a patron and, presumably, remained open for the duration of the fire. Smoke and flames entered the lounge immediately after this door was opened, and patrons had little time to react;
- A rear door, which turned out to be the only safe exit, was not properly marked as an exit, and the path to it was hidden and obstructed by a stage and associated equipment. Also, it had an improvised latch, which may have been difficult to operate by those unfamiliar with it;
- Numerous windows were boarded up, and the rest were equipped with steel bars to prevent people falling through the large glass panels. Many of these also had wooden shutters over their lower sections.

### **Impact on Regulation or Practices**

#### ***NFPA 101®: Life Safety Code®***

There do not appear to be any changes to NFPA 101 directly associated with this incident.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCRC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

### ***BOCA Building Code (BOCA)***

While it is unclear if changes were perpetuated by this incident, a number of changes appear in the 1975 BOCA code. Due to the fact that these changes tend to make the Code more lenient, it is doubtful that they were in response to this incident. These include:

- Increases in the egress capacities of doors and stairs as follows:
  - Unsprinklered - 75 people per unit width for stairs and 100 people per unit width for doors;
  - Sprinklered – 113 people per unit width for stairs and 150 people per unit width for doors;
- Before the 1975 edition, the egress capacities for unsprinklered buildings was 60 people per unit exit width for stairs and 90 people per unit exit width for doors;
- Travel distances were increased to 150 ft. for unsprinklered buildings and 200 ft for sprinklered buildings. Before the 1975 edition, the travel distance was 100 feet for all construction types;
- Panic hardware was now required for all assembly occupancies with an occupant load greater than 100 persons;
- Sprinkler systems were now more widely required for various assembly spaces;
- Standpipes were more widely required for assembly spaces with more than 300 occupants.

### ***Standard Building Code (SBC)***

The first edition of the SBC was published in 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.12 Gulliver's Discotheque Fire, Port Chester, NY, 1973**

On June 30, 1974 a fire killed twenty-four people in a nightclub called Gulliver's in Port Chester, New York [15]. Gulliver's was part of a small shopping center on the Connecticut-New York border that also housed a bowling alley, a men's clothing store, and a barbershop. It was a one-story building with a basement. The basement was used for storage, offices and a children's playroom that the bowling alley rented. The fire started in the basement in a children's playroom. The fire was deliberately set.

The dance floor itself was five feet lower than the dining room and had two adjacent sets of stairs leading to the basement and to the dining room. These were the only exits from the dance floor. At approximately 1:00 am people in the service bar area of the basement at the foot of the stairs to the dance floor noticed smoke. Someone called the fire department while someone else notified the bandleader who told people to leave the building. The evacuation was orderly, but within a minute heavy smoke started coming up the stairs from the basement to the dance floor. Smoke had traveled in the floor joist channels above the playroom into the service bar area below the dining area and then billowed up the stairs leading

to the dance floor. Occupants were forced to leave by using the “up” stairs leading to the dining room adjacent to the basement stairs. Even though the stairs were 5 ½ feet wide there was not enough time for the crowd to evacuate and the twenty-four people that died did so of smoke inhalation.

Once the crowd was warned to evacuate there was not enough time to complete evacuation before smoke exposure became a problem. Some of the reasons for the lack of evacuation time were:

- Delayed discovery of the fire, since it originated in the unoccupied children’s play area in the basement;
- Lack of a fire-rated wall between the discotheque and the rest of the shopping center;
- Lack of a fire-rated door at the bottom of the stairs from the service bar to the dance floor;
- Lack of occupant load restrictions;
- Exits from the dance floor were not remote from each other.

### **Impact on Regulation or Practices**

#### ***NFPA 101®: Life Safety Code®***

There do not appear to be any changes to the 1976 edition of NFPA 101 directly associated with this incident. However, this incident is specifically mentioned in a proposal to change the fire alarm / notification system requirement for the 1981 edition of NFPA 101. The proposal as submitted was rejected, but the concepts were accepted toward creating a new requirement for fire alarm / notification systems in assembly spaces with an occupant load greater than 300 persons.

#### ***Board for the Coordination of Model Codes (BCMC)***

The earliest BCMC reports obtained were from 1977; therefore, information on changes prior to 1977 was not available.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

While it is unclear if changes were perpetuated by this incident, a number of changes appear in the 1975 BOCA code. Due to the fact that these changes tend to make the Code more lenient, it is doubtful that they were in response to this incident. These include:

- Increases in the egress capacities of doors and stairs as follows:
  - Unsprinklered - 75 people per unit width for stairs and 100 people per unit width for doors;
  - Sprinklered – 113 people per unit width for stairs and 150 people per unit width for doors;
- Travel distances were increased to 150 ft for unsprinklered buildings and 200 ft for sprinklered buildings;
- Panic hardware was now required for all assembly occupancies with an occupant load greater than 100 persons;

- Sprinkler systems were now more widely required for various assembly spaces;
- Standpipes also more widely required for assembly spaces with more than 300 occupants.

### ***Standard Building Code (SBC)***

The first edition of the SBC was published in 1945. Details of proposed changes and committee reports were not available prior to 1977.

### **C.3.13 Beverly Hills Supper Club Fire, Southgate, Kentucky, 1977**

Few assembly occupancy fires have been investigated and documented as thoroughly as the one that occurred at the Beverly Hills Supper Club in Southgate, Kentucky, in 1977. This sprawling nightclub had multiple event rooms of varying sizes. On the day of the fire, multiple events were scheduled, including a wedding reception earlier in the afternoon, and a show was in progress when the fire broke out. In total, 2400 to 2800 people were in the building at this time, and 1200 to 1300 of these were in a single event room (the Cabaret Room). The fire initiation, assumed to be electrical in nature, occurred in an unoccupied room where an event had taken place earlier in the day [5,6]. Employees noticed the flames, and attempted to extinguish them using fire extinguishers. The fire was seated in a concealed space within the wall, and the employees' extinguishment efforts were unsuccessful. Largely because of the unsuccessful efforts to extinguish the fire, approximately 15 minutes elapsed between the discovery of the fire and the general notification of the employees and occupants. Additionally, it is reported that some employees were not sure of evacuation procedures, and this may have further delayed notification.

According to witness accounts, the initial evacuation of patrons followed an interesting trend. Employees tended to notify only those patrons for which they were responsible during the normal operations. In other words, a given waitperson might only have notified the people seated at the tables that that person served. This led to delayed notification of some guests in remote parts of the building. Unfortunately, during the performance in the Cabaret Room, the wait staff was isolated from the patrons so as not to interrupt the performances, and thus employees did not instinctively notify occupants in the Cabaret Room. This led to delayed notification within the Cabaret Room; thus, almost all of the 164 fatalities occurred in the Cabaret Room.

Many survivors of this fire owe their lives to a calm and quick-thinking busboy, who took the stage in the crowded Cabaret Room, pointed out the available exits, and asked people to leave. Some followed his advice, but many did not perceive the danger until smoke and heat reached the area outside of the Cabaret Room. At this point, occupants began to rush to the exits. Some tripped or were knocked down, and the exits became blocked. According to the busboy, one of the three available exit doors was locked, and he was unable to break it open.

The following details regarding this incident are of note:

- While the applicable codes of the time limited the occupancy of the club to 1511 based on its construction, more than 2400 occupants were inside at the time of the fire;
- The Cabaret Room was vastly overcrowded, with tables pushed together and additional seating placed in the aisles, thus blocking egress movement. Based on the codes at the time the capacity of the Cabaret Room was just over 500, but there were over 1000 occupants in the room that evening [3];
- The exit capacity of the egress system was approximately 60% of the code-required capacity;

- The Cabaret Room should have had four separate exits, but it only had three, and at least one was locked at the time of the fire. Some of these exits were poorly marked or intentionally masked;
- There was no evacuation plan and personnel were not properly trained;
- Once established in the compartment of origin, fire spread rapidly across combustibile interior finish within the room of origin and the main corridor of the building;
- Many occupants did not perceive the severity of the fire until it was too late, and few evacuated immediately upon being told to do so. No alarm system was installed within the building.

### **Impact on Regulation or Practices**

#### ***NFPA 101®: Life Safety Code®***

According to information in the Life Safety Code® Handbook:

- Previous to the Beverly Hills Supper Club fire, the NFPA 101 Life Safety Code required alarm systems in all occupancies except storage spaces and places of assembly. The reasoning for the latter was that it was felt that an alarm might cause panic. This fire showed the importance of rapid notification, and the next version of the Code, the 1981 edition, included a requirement for alarm systems in places of assembly. Additionally, a note was added requiring that notification of places of assembly be done through a voice alarm or a public address system. These requirements were implemented retroactively in existing buildings, as well;
- The Life Safety Code historically only required sprinkler systems in assembly occupancies when those spaces were used as exhibit halls. After the Beverly Hills Supper Club incident, provisions were added to the 1981 edition of the code requiring sprinkler systems in different assembly occupancies based on the types of construction used. Some of these requirements were also issued retroactively.

#### ***Board for the Coordination of Model Codes***

There do not appear to be any recommended changes to the model building code from the BCMC as a result of this event.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

While unclear if changes were directly related to this incident, a few changes appear in the 1978 BOCA code. These include:

- Panic hardware in all assemblies with 50 or more occupants.
- Door swing in the direction of travel when serving 50 or more occupants.

#### ***Standard Building Code (SBC)***

There do not appear to be any changes to the SBC directly related to this incident.

## **Modeling Efforts**

In the early 1980s Emmons [44] attempted to estimate mathematically fire growing and fire gas spread rate in the Beverly Hills Summer Club fire. Using a resistor network diagram and mean flow volume equations this “educated guess” clearly showed that the act of opening doors to escape drew the fire into the escape routes.

### **C.3.14 “The Who” Concert, Cincinnati, Ohio, 1979**

The Who concert was a sold out show and many ticket holders had arrived to the Coliseum early and were waiting to be let into the venue to claim the best seats. There were over 18,000 general admission tickets sold and as many as 8,000 ticket holders waiting outside competing for the preferred general admission seating [3]. Two banks of eight doors were finally opened, but according to many in the crowd, not all of the doors were opened. The guards would let in people until the lobby was full and then they would temporarily close the doors. This resulted in the crowd pushing forward. Within an area outside one of the banks of doors, several people fell. The people behind those that had fallen were pushed forward by the crowd. The surge toward the Coliseum resulted in eleven people being crushed to death and approximately two-dozen more becoming injured from the incident [17]. Concertgoers told of only one or two doors being open out of a possible sixteen to process the incoming crowd.

The following details regarding this incident are of note:

- Poor crowd safety was the major cause of this tragedy;
- Only a few doors out of a total of 16 were open to accommodate 8,000 people and when the lobby filled the guards closed the doors, which caused the crowd to become concerned about getting into the arena.

### **Impact on Regulations or Practices**

This incident spurred the Cincinnati government to take action. By the end of the month the Mayor and City Council had passed legislation that banned festival seating and gave the police emergency on-the-scene authority at major public assembly venues. In addition, a full-scale investigation was conducted by an independent citizen’s task force called “The Task Force on Crowd Control and Safety”, which was established by the City Council. The Task Force released a report called Crowd Management in 1980 that offered 108 crowd safety recommendations. The report is now in its fourth printing and remains one of the important manuals on facility rock concert crowd management.

#### ***NFPA 101®: Life Safety Code®***

A requirement regulating festival seating-type assembly areas was introduced into the code for the 1994 edition.

#### ***Board for the Coordination of Model Codes***

There do not appear to be any recommended changes to the model building code from the BCMC as a result of this event.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

There do not appear to be any changes to the BOCA code directly related to this incident.

#### ***Standard Building Code (SBC)***

There do not appear to be any changes to the SBC directly related to this incident.

### **C.3.15 Haunted Castle Amusement Facility Fire, Jackson Township, NJ, 1984**

On May 11, 1984 a fire destroyed the “Haunted Castle” amusement at the Six Flags Great Adventure Park located in Jackson Township, New Jersey [18]. Eight young adults died as a result of smoke inhalation and carbon monoxide poisoning. The structure was composed of seventeen commercial trailers connected by plywood and wood framing. The interior of the amusement was constructed of plywood partitions creating a convoluted path 450 ft. long. Other materials used in the interior of the structure were synthetic foam, various fabrics and plastics, and tarpaper. The cause of the fire was the accidental ignition of a wall mounted, polyurethane foam pad by a cigarette lighter from a visitor trying to light their way through the dark path. The foam pad burned rapidly and fire spread down the corridor fueled by plywood construction of the ceiling, floor, and walls. The foam was not flame retardant and the plywood was untreated.

At approximately 6:30 PM an employee in the Haunted Castle smelled smoke and went to investigate. Coming upon heavy smoke he went to the main gate to instruct employees to discontinue entry of visitors and then went to the control room inside the facility to call the park fire brigade. Meanwhile, a visitor in the amusement discovered the fire and alerted an employee. There was approximately a five-minute delay between the employee detecting the fire and alerting the fire brigade.

There were a total of seven exits including the main entrance and fire protection features included emergency lighting and portable fire extinguishers. There were no automatic detection or sprinkler systems provided in the facility.

The following details regarding this incident are of note:

- The fire was not detected and suppressed in its incipient stage because of the lack of automatic detection and suppression systems;
- There was a large amount of combustible material present including interior finishes such as foam and plywood;
- The occupants had difficulty escaping due to fire conditions in the haunted house type of environment.

#### **Impact on Regulation or Practices**

##### ***NFPA 101®: Life Safety Code®***

Though unclear if directly related to this incident, the interior finish requirements were changed for the 1985 edition of NFPA 101 so that rooms with an occupant load greater than 300 were limited to Class II interior finish materials. Class III materials were still allowed in rooms with less than 300 occupants.

In direct response to the Haunted Castle amusement facility fire, NFPA added a new section on *Special Amusement Buildings* to the 1988 edition. This category of assemble occupancy use establishes criteria that are unique to an environment that may intentionally confuse or confound the occupants.

##### ***Board for the Coordination of Model Codes (BCMC)***

The BCMC report dated February 19, 1985 included recommendations for the size, location and illumination of exit signs. It is uncertain if these recommendations were directly related to this incident, but they certainly address the pertinent issue of the Haunted Castle fire.

##### ***Uniform Building Code (UBC)***

Though unclear if directly related to this incident, the interior finish requirements were changed for the 1985 UBC so that rooms with an occupant load greater than 300 were limited to Class II interior finish materials. Class III materials were still allowed in rooms with less than 300 occupants.

### ***BOCA Building Code (BOCA)***

There do not appear to be any changes to BOCA directly related to this incident.

### ***Standard Building Code (SBC)***

While unclear if directly related to this event, the main exit provision was modified for the 1985 edition of the SBC. The new requirement called for 1/2 of the total egress capacity to be provided through the main exit and 2/3 of the total egress capacity to be provided by all other exits.

## **C.3.16 Happy Land Social Club Fire, New York, New York, 1990**

Early on the morning of March 25, 1990, numerous patrons were in the Happy Land Social Club in the Bronx borough of New York City [20,21]. It is suspected that an arsonist used an accelerant to ignite a fast-growing fire in the building's main lobby, and that combustible interior finish contributed to the rapid growth of the fire. The ground floor of the building, which is where the lobby was located, had been left unsprinklered during a previous renovation, and thus the fire spread unimpeded. Coatroom employees discovered the fire, and alerted first floor occupants. Another employee went up to the second floor, where the majority of occupants were located, to alert patrons to the fire. Only two occupants from the second floor survived, although one of these sustained severe burns running through the lobby to the main exit; these individuals left the second floor immediately upon being informed of the fire. Fire damage was limited to the front portion of the building. A total of 87 people died in this fire, 18 on the first floor, and 69 on the second.

The following details regarding this incident are of note:

- At the time of the fire, the club was in violation of New York City building and fire code regulations, and had been ordered shut down, but was still in operation;
- At some point in its history, the building had been converted from one story (high ceiling) to two, and the original sprinkler system was not extended to the first floor. Also, part of the sprinkler system on the second floor was not functional. The fire initiated in an unsprinklered area;
- One of the two main exit doorways to the front exterior of the building was covered by an unlocked roll-down steel security door. The swinging doors here were locked, and the doorway was not marked from the inside as an exit. However, at some point during the evacuation, an employee unlocked this door, and it was used by several egressing occupants;
- Four additional doors separated patron areas from an entrance lobby. All of these doors swung in the direction of egress travel, but three of the four were locked at the time of the fire;
- The two available exit stairs were not enclosed. The stairway closer to the front exit was a steep "ships ladder" type stair. The primary stair access to the second floor, and the stairway labeled as the main exit, was at the back of the building. This stair had uneven risers, as well as a 90° bend and a width that varied down to 19 inches;

- Combustible interior finishes in the lobby area, where the fire was ignited, led to rapid fire growth, thus blocking the only available exits from the building.

### **Impact on Regulation or Practices**

#### ***NFPA 101®: Life Safety Code®***

There do not appear to be any changes to NFPA 101 directly associated with this incident.

#### ***Board for the Coordination of Model Codes***

There do not appear to be any recommended changes to the model building code from the BCMC as a result of this event.

#### ***Uniform Building Code (UBC)***

Though it is unsure if this incident had any direct impact, the following were changes incorporated into the 1991 edition of the UBC:

- Required egress width requirements changed to provide 0.3 inches of stair width and 0.2 inches of door width for each occupant. The 1946 through 1988 editions of the UBC specified required exit width as the number of occupants divided by 50. However, in the 1943 version of the UBC required 0.24 inches per person for occupancies with 1 to 1000 occupants, which is greater than the width required in 1991;
- A fire alarm / notification system was now required for assembly spaces with an occupant load greater than 300.

#### ***BOCA Building Code (BOCA)***

The 1993 edition of the BOCA code incorporated changes in the requirements for sprinkler and standpipe system, but it is unclear if these changes were related to this incident.

#### ***Standard Building Code (SBC)***

There do not appear to be any changes to the SBC directly related to this incident.

### **C.3.17 Indianapolis Athletic Club Fire, Indianapolis, Indiana, 1992**

On February 5, 1992 a fire occurred at the Indianapolis Athletic Club that killed two fire fighters and one patron [22]. At 12:06am the Indianapolis Fire Department received a phone call reporting the fire. Upon their arrival, they could find no external evidence of fire in the high-rise building, but once inside they found heavy smoke in the first floor lobby. Investigating further, they discovered a room on the third floor that was fully involved in fire. During suppression operations on the third floor, a flashover occurred in the room adjacent to the room of fire origin. The sudden increase in the magnitude of the fire caused it to spread to other areas and resulted in the death of two fire fighters. Several other fire fighters were injured. A search of the building revealed that one patron died in the fire between the sixth and seventh floors.

The fire department determined that the fire was accidental and caused by an electrical fault involving a refrigerator caused the ignition of wood paneling in a third-story bar. It was further determined that the release of combustion gases which were trapped in a concealed space contributed to the flashover that killed and injured the fire fighters. After the flashover, the fire spread to other areas of the third floor and it also spread to the fourth floor via an open stairway. The HVAC systems also continued operation until electrical power was lost and contributed to the spread of smoke throughout the building.

The following details regarding this incident are of note:

- The lack of an approved automatic sprinkler contributed to the spread of the fire;
- Unprotected penetrations in the wall and ceiling assemblies aided the fire spread;
- Concealed spaces increased the hazard for fire suppression personnel;
- Combustible interior finish which included wood paneling on walls and ceiling tiles left in concealed spaces after a building renovation also contributed to the magnitude of the fire.

### **Impact on Regulation and Practices**

#### ***NFPA 101®: Building Exits Code®***

There do not appear to be any changes to NFPA 101 directly related to this incident.

#### ***Board for the Coordination of Model Codes (BOCA)***

There do not be any recommended changes from the BOCA directly relating to this event.

#### ***Uniform Building Code (UBC)***

There do not appear to be any changes to the UBC directly related to this incident.

#### ***BOCA Building Code (BOCA)***

Changes to the automatic sprinkler requirements appeared in the 1993 BOCA code. Sprinkler system were now required as follows:

- In A-1 (theaters), A-3 (amusement / entertainment spaces), and A-4 (churches / schools) where the fire area exceeds 12,000 ft<sup>2</sup>;
- In A-2 (dance halls / clubs) where the fire area exceeds 5,000 ft<sup>2</sup> or is located above or below the level of exit discharge.

It is uncertain if these changes are directly related to this incident.

#### ***Standard Building Code (SBC)***

There do not appear to be any changes to the SBC directly related to this incident.

### **C.3.18 E2 Nightclub, Chicago, Illinois, 2003**

In the early morning hours of February 17<sup>th</sup>, 2003 21 people were killed and 57 people were injured when a stampede occurred at the E2 nightclub in Chicago [23]. A fight had broken out on the dance floor between two women and escalated to include a larger group. Security guards sprayed pepper spray into the crowd triggering a stampede toward the front exit. The nightclub is located on the second floor of the building, so the front exit was a set of stairs leading down to the main exit door. The surge toward the main exit stairway resulted in the deaths of 12 women and 9 men. Most of the deaths occurred at the top of the stairs.

The nightclub was on the second floor of a building. There was a restaurant on the first floor of the building that housed the nightclub that was not open at the time of the incident. The club had been ordered closed due to fire and structural building code violations months before the incident. However, the Chicago Fire Department estimated that 500 people were in the building that night.

The following details regarding the incident are of note:

- The club should have been closed due to numerous building code violations;
- Alternate exits were not easily assessable to the patrons [24];
- A consultant hired by the lawyers representing some of the victims and their families found 20 code violations including that the two rear exit signs were not lighted and based on the width of the exit doors the second floor of the building could safely handle 240 to 300 people, which would mean that the club was overcrowded since the FD estimated there to be 500 occupants at the time [25];
- Although the violations involving the back exit doors did not contribute to the deaths, one of the back doors was locked and another was partially blocked by laundry bags.

### **Impact on Regulation or Practices**

Because The Station fire occurred within 6 days of the E2 incident, the impact of E2 on egress codes is difficult to distinguish from the impact resulting from The Station. Within 5 months of the two tragedies, NFPA issued Tentative Interim Amendments (TIAs) to require trained crowd managers for existing and new assembly occupancies, to restrict festival seating in new and existing facilities if occupant load is greater than 250 unless a life-safety evaluation is conducted, and to require of the owner an means of egress inspection and record keeping.

#### **C.3.19 Summerland Fire, Isle of Man, United Kingdom, 1973**

On August 2, 1973 a fire broke out in a kiosk outside the Summerland entertainment complex on the Isle of Man and killed 51 people [26]. It is believed that adolescents smoking in the kiosk started the fire. The burning kiosk fell against the adjacent building and ignited the outside of the building. The building was clad with combustible transparent acrylic sheeting called Oroglasso. When ignited, the material became molten and dripped on the people trying to escape. In addition to the combustible exterior, there was a flammable material used to line the inner walls for soundproofing purposes. These materials caused the fire to spread rapidly.

Upon hearing of the fire, people began to leave, but an employees told the crowd that it was just a chip-pan fire and that there was no need to worry. Some of the people returned to their seats. It took the staff twenty-five minutes to contact the fire brigade. Later the fire burst into the building and the evacuation of the building became pandemonium. Emergency doors had been padlocked and there were turnstiles that could not handle the amount of people evacuating.

The following details regarding this incident are of note:

- It took twenty-five minutes for the staff to notify the fire brigade;
- Combustible exterior sheeting as well as combustible interior finishes aided fire spread;
- Emergency doors had been padlocked;
- There were turnstiles that could not handle the size of the crowd.

### **Impact on Regulation or Practices**

The aftermath of Summerland fire led to the tightening of fire regulations on public buildings across the Isle of Man and the United Kingdom.

#### **C.3.20 Stardust Cabaret, Dublin, Ireland, 1981**

In the early morning hours of February 14<sup>th</sup>, 1981, a fire spread through the Stardust Cabaret in Dublin, killing 48 young people and seriously injuring 128 [27]. It was originally intended that the building be used for cabarets and concerts, but it was subsequently used as a disco. The space consisted of a dancing area, a small stage, and two seating areas. The fire started in the back row of one of the seating areas. The fire spread rapidly from seat to seat in the area of origin and ultimately through the entire area due to the presence of a tier of seats containing quantities of combustible material abutting a wall lined with combustible carpet tiles, the presence of a low ceiling, and the presence of a large area of combustible seating. Although there were eight exits from the ballroom, five of these being principal emergency exits, forty-eight young people died because of the rapid fire spread. The investigation concluded that the fire was set deliberately and that the arsonist aided the fire spread by slashing the seats and igniting them or by lighting newspapers under a seat.

There was adequate exit capacity in the Stardust, but the fire spread rapidly, resulting in the large death toll. Combustible seating and interior finishes aided the fire spread.

### **Impact on Regulations or Practices**

The Irish Government established a Tribunal to carry out a full investigation of the fire. The Tribunal made a significant range of recommendations that were examined by the Irish authorities. However, it was not confirmed whether the Stardust fire led to changes in regulation.

#### **C.3.21 Dance Hall Fire, Gothenburg, Sweden, 1998**

During a Halloween party in 1998 at a second-floor dance hall in Gothenburg, Sweden, an arsonist initiated a fire in one of the two available exit stairways [28]. The fire spread through the stairwell, fuelled by combustible furniture and wall coverings within the stairwell. At the time of the fire, approximately 400 people were in the hall. Based on the size of the hall and the available exit door width, US codes of the time would have limited the occupant load to 312 people. The local fire brigade has indicated that, based on the exit door width, they would have limited the occupant load to 150.

The dance hall was equipped with two separate exit doors at opposite ends of the space. Each exit door swung in the direction of egress travel. The main entrance/exit door was noncombustible, and was equipped with an automatic closer. The other door was constructed of combustible material, but had a 30-minute rating, and was equipped with an automatic closer. Because the fire was located in this second stairway, it was not used in the evacuation. It is not clear if this door remained open after the discovery of the fire. Both doors had an opening width of 31.2 in.

The large number of people in the yard surrounding the building hampered fire department access to the incident. Once inside the main entrance of the two-story building, firefighters discovered numerous victims on the stairway leading to the second floor. These victims were removed, and firefighters continued to the second floor, where they discovered a stack of additional victims in the exit doorway from the main hall. Victims, some alive and others unconscious were apparently stacked right up to the top doorjamb. As firefighters pulled the occupants out, others from inside the hall took their places on the pile. Eventually, the doorway was cleared, and the fire was quickly extinguished. Additional victims were later discovered in a small office where they had attempted to seek refuge when they discovered that the exit was blocked. Smoke had breached this room through failed glass panels near the ceiling.

An occupant-use fire hose was available in the main entrance stairwell, but was not used. Its condition prior to the fire was not known. The building was not equipped with an alarm system or sprinklers.

In total, 63 people died in this incident. None were older than 20 years. 43 of the victims were found piled up at the exit doorway. Another 20 victims were found in a small office. An additional 180 people were injured in the incident.

The following details regarding this incident are of note:

- Fire growth and spread was somewhat rapid due to the fuel loads within the stairwell where the fire was initiated and in the dance hall itself;
- The hall was severely overcrowded, and even though two remote exits were provided, the sheer number of evacuating occupants caused a bottleneck in the one available exit door. It has been theorized that the exit capacity would have been sufficient had the occupant load restrictions been enforced;
- The building was not equipped with a fire alarm or an automatic sprinkler system;
- The occupant (the disc jockey) who first discovered the fire apparently immediately jumped out of a window, and did not notify the other occupants of the fire. It is unclear how much of a delay occurred between initial discovery of the fire and the commencement of a general evacuation;
- Numerous people jumped from the high windows, 20 ft above the ground level. These windows were over 7 ft above the floor level in the dance hall, and were not viable exits;
- Fire brigade arrival at the scene and access to the building were hampered by the crowds of people in the yard surrounding the building. Additionally, there were reports of assaults on firefighters, both in and out of the building, as they attempted to rescue occupants.

### **Impact on Regulation or Practices**

There was some discussion after the investigation of the fire in relation to code requirements for public halls and auditoria. For example, it was questioned whether multiple "normal" exit door widths (0.8 m.) might be better than fewer wider exits ( $\geq 1.2$  m.) and whether the requirements for the floor surface hazard properties should be made more strict.

Note that these discussions were related to public halls and auditoria. The "dance hall" in Gothenburg was not designed for this purpose and would hence not technically have been affected by such changes.

### **C.3.22 De Hemel Fire, Volendam, The Netherlands, 2000/2001**

A fire occurred during a New Year's eve celebration in a 125 m<sup>2</sup> (1346 ft<sup>2</sup>) café on the top floor of a three story building in The Netherlands [46]. Of the approximately 300 people present, fourteen died, primarily from smoke inhalation, and 200 were injured when the fire spread very rapidly through fir branches attached as holiday decorations to the ceiling of the café. Ignition of the branches occurred immediately when a sparkler held above the head of one of the patrons accidentally came in contact with the decorations. The fire quickly overpowered any attempts to extinguish it. There were two exits available from the café, but they were not obviously marked, and in any case, because the fire spread so rapidly, the exit doorways became blocked by those trying to escape.

Two recommendations were made by TNO [46] as a result of their investigation into the fire:

- to provide an organization that can learn from the mistakes already made (nationally and internationally)

- to increase awareness of the dangers of using flammable materials and the need for sufficient escape routes

## **C.4 DETAILS OF SUCCESSFUL INCIDENTS**

### **C.4.1 School Fire, California, 1992**

A grease fire ignited on a stove in the home economics classroom of a single story 4,800 square-foot school building of unprotected ordinary construction [30]. There was a delay in the activation of the alarm system because of a nonfunctioning smoke detector and failure of school personnel to use manual alarms. The students and staff were able to safely evacuate but the fire impinged on the room's ceiling. Personnel saw smoke coming from the classroom and investigated but failed to initiate the alarm system. Building personnel attempted to extinguish the fire with portable extinguishers but the fire re-ignited.

The fire department arrived and the building was still occupied by approximately 1,000 students and staff. The fire department ordered the evacuation by the manual fire alarm system and extinguished the fire. The damage to the building was estimated to be \$2,500 and there were no injuries because there were a limited number of students in the involved section.

The following details regarding this incident are of note: the smoke detection failed and there was a delayed evacuation of the building, but there were no injuries because of the limited number of occupants in the area of the fire.

### **C.4.2 Nightclub Fire, Texas, 1992**

At about 12:30 am on a weekend evening, a short circuit occurred in suspended sound equipment on the second floor of a crowded two-story nightclub occupied by hundreds of patrons [31]. The building was 10,000 square foot building of unprotected, noncombustible construction that was located in a mall and housed a two-story nightclub. The automatic sprinkler system operated immediately and quickly extinguished the fire, but smoke and water forced an evacuation of the building.

The fire department arrived and found that four sprinklers had operated and extinguished the fire. Damage was limited to the electrical equipment and was estimated to be \$150,000. Several of the occupants were treated for minor smoke inhalation but none were transported to a hospital.

The following details regarding this incident are of note: four sprinklers quickly extinguished the fire and allowed for occupants to safely escape.

### **C.4.3 School Fire, Oregon, 1992**

An 11-year-old child set a fire in a closet of an unoccupied classroom. The fire quickly spread to the attic space of the building [32]. There were 450 students present when the fire occurred. It was discovered by a passerby and a teacher almost simultaneously. The teacher activated the manual evacuation alarm that alerted students and staff to evacuate the building.

The building was constructed in several stages during the 1940's with a total of 37,500 square feet and consisted primarily of wood-frame components. The building was designed so that it circled an interior courtyard on three sides. In 1975, a partial sprinkler system was installed that covered common hallways and areas above classroom doors but there were no other suppression systems installed in the building.

Damage to the building was limited to the attic area and to classrooms below sections where the roof and ceiling collapsed. There were no injuries to students and staff during the evacuation.

The following details regarding this incident are of note: the fire was started in a closet and quickly burned into the attic; the ceiling assembly provided protection to occupants as they escaped.

#### **C.4.4 School Fire, Massachusetts, 1992**

Fireworks ignited a fire on the roof of a regional high school after an outside assembly for graduating students had begun [33]. A school official climbed to the roof and discovered an intense fire that involved the roof covering. An attempt was made using portable extinguishers before the fire department was notified, which delayed the response.

The fire department limited and prevented the fire from spreading to the interior, which was confined to the tar and rubber covering of the built-up roof of brick, block, concrete and steel building. There were no injuries that resulted from the incident or the evacuation of the occupied school.

The following details regarding this incident are of note: an exterior fire on the roof required the evacuation of the school; the building materials prevented the fire from spreading to the interior of the building.

#### **C.4.5 School Fire, Oregon, 1994**

A fire occurred in a two-story middle school that was constructed of unprotected wood framing and a brick veneer on the exterior [34]. The school's automatic smoke detection system alerted students and faculty of an electrical fire that started in the ceiling and roof voids. The building was not equipped with a sprinkler system but the detection system was connected to an automatic dialer, which notified the fire department.

The fire department found the blaze in concealed wall voids and in the attic where it was spreading laterally over the classrooms. Firefighters made a trench cut, which helped stop the spread of fire. The fire was confined to one wing of the building and limited damage to classrooms, offices, lockers, and a bathroom. An investigation determined that an electrical conduit in the wall void that was placed directly against wood shiplap siding had heated the siding over a period of time. It eventually ignited at a spot level within the ceiling. There were no injuries.

The following details regarding this incident are of note: fire occurred in a concealed space but a smoke detection system notified the occupants of the hidden danger.

#### **C.4.6 Restaurant Fire, Indiana, 1996**

A grill fire damaged a restaurant when the flames spread to the ductwork and then to the concealed attic space [35]. The fire occurred in a single story 3,200 square foot facility that was constructed of unprotected, wood-frame construction. The building did contain a localized dry chemical system that was installed in the hood over the grill.

The cook dropped a plastic container filled with an oil-based marinade on to the hot grill. The plastic container melted and the marinade ignited, which caused flames to flare up toward the hood and ductwork. The fire spread to the concealed attic space before the suppression system could be activated. An employee immediately called the fire department, which arrived to find flames extending from the roof ducts. Firefighters surrounded the building and prevented spread to two adjacent buildings. There were no injuries during the fire.

The following details regarding this incident are of note: an accidental fire occurred on the grill and spread to the attic space in an unprotected building that did not injure any occupants.

#### **C.4.7 Dinner Theater Fire, Florida, 1996**

A fire occurred in a two-story, 20,000 square-foot building that was constructed of concrete walls and floors with unprotected steel roof with metal deck and built up roof covering [36]. The building contained a wet-pipe sprinkler system throughout, which was monitored by a central station alarm company.

During a performance, someone fired a pyrotechnic device that ignited a burlap net attached to a curtain. The net ignited and smoke began to fill the auditorium that contained 400 children and teachers. Four sprinkler heads were activated that extinguished the fire. Almost simultaneously, an occupant and the alarm company notified the fire department that arrived to find the safe evacuation of the children and teachers.

A majority of the loss of the contents was due to water damage to electronic equipment. There were no injuries to the occupants of the facility.

The following details regarding this incident are of note: a pyrotechnic device ignited materials on the stage that was controlled by sprinklers. The 400 children and teachers were able to safely evacuate the auditorium without injury.

#### **C.4.8 Restaurant Fire, Michigan, 1996**

A fire occurred in a single story 3,000 square-foot, single-story restaurant that was constructed of wood framed walls and a wood truss roof deck [37]. The building had no detection system or sprinklers but there were portable extinguishers installed in the building.

An employee in the storage/break room area was waiting for her shift to start and noticed flames coming from the top of a cooler/freezer. She alerted other staff members, notified the fire department and evacuated patrons. An unsuccessful attempt was made by another employee to extinguish the fire using a portable extinguisher.

The fire department arrived to find heavy smoke coming from the restaurant. The fire had spread to the concealed ceiling spaces and the wood trusses. Investigators believe the controls located at the top of the cooler/freezer malfunctioned, starting the fire. The restaurant was destroyed, but there were no injuries during the blaze.

The following details regarding this incident are of note: a malfunctioning cooler/freezer sparked a fire that destroyed the restaurant that was discovered by an employee. There were no injuries during the evacuation, but the building was destroyed.

#### **C.4.9 Community Center Fire, Pennsylvania, 1997**

An fire of electrical origin broke out between the fourth and fifth floors of a religious community center [38]. The building was five-stories tall and had a footprint of 10,000 square feet that contained a religious community center, a school and a synagogue. The building was constructed with heavy timber with exterior brick walls and a wooden roof deck that contained a built-up roof covering. There were smoke detectors and manual pull stations located throughout the building along with a partial sprinkler system in a second floor day care center.

There were nearly 100 staff members and students present when an occupant discovered a fire who activated a manual pull station. A central station notified the fire department while the occupants began to evacuate. The fire was confined to the fourth and fifth floors of the auditorium.

An investigation determined that the fire started in a fault in the wiring of a HVAC unit that ignited the structural framing in the concealed void between the fourth floor ceiling and the gymnasium roof. Two firefighters and two civilians were injured.

The following details regarding this incident are of note: an electrical fault in a community center led to the injuries of two civilians and two firefighters along with extensive damage to two floors of the structure.

#### **C.4.10 Restaurant Fire, Massachusetts, 1997**

A fire occurred in a 7,200 square-foot restaurant that was located in a one-and-a-half-story shopping mall located in Massachusetts that was constructed of unprotected noncombustible construction [39]. There were 25 occupants present when a fire in a portable chicken broiler, which was installed after the fire department inspection and was not protected by the chemical suppression system that protected all of the cooking surfaces ignited. All of the occupants safely evacuated the building.

The burners ignited a grease buildup in the bottom of the broiler cabinet. The central station that monitors the wet-pipe sprinkler system received an alarm and notified the fire department. On arrival of the fire department they found a sprinkler located above the cabinet had extinguished the blaze.

The following details regarding this incident are of note: sprinklers extinguished the fire before arrival of the fire department and occupants were assisted with their evacuation.

#### **C.4.11 School Fire, California, 1998**

A fire occurred in an unoccupied classroom of an 8,800 square foot, eight-classroom school in California [40]. The fire spread in the attic and concealed spaces between the ceiling and roof of this single story elementary school that consisted of unprotected wood framing with a stucco exterior. The building did not have a fire detection system or sprinklers and the manual fire alarm was out of service when the fire occurred.

The fire is believed to have been started by a short circuit or a circuit overload in fixed wiring in the attic. Teachers had reported several electrical malfunctions in the past prior to the fire. The discovery of the fire by a student led to the notification of the fire department who arrived to find flames coming from the building's roof and that two of the classrooms were fully involved. The fire spread horizontally because of the lack of fire stops and then burned through the ceiling to the classrooms below igniting the heavy fuel load. There were no injuries to the occupant during the fire.

The following details regarding this incident are of note: a lack of a detection system and the unoccupied classroom allowed for the fire to grow within the attic space, but the ceiling assembly protected the occupants.

#### **C.4.12 Casino Fire, Nevada, 1998**

A fire started from unknown causes on the roof behind the casino's façade and then spread through the roof and down through the structure of a three-story casino and hotel [41]. The building was constructed with noncombustible construction and had a ground floor area of 30,000 square feet. The building had a complete-coverage heat and smoke detection system but there were no devices located in the area of origin of the fire. Additionally, there was a complete-coverage wet pipe sprinkler system but was not effective because it did not extend to the area of origin of the fire.

The fire spread was too rapid to allow for extinguishment by handheld extinguishers but was limited to the casino by a firewall and doors that connected the hotel and casino. One civilian was injured.

The following details regarding this incident are of note:

- A fire occurred in the façade and roof area that burned for a significant time in a concealed area before notification of the fire department.
- The area of origin did not contain any suppression or detection devices.

#### **C.4.13 Restaurant Fire, New Jersey, 1998**

A three-story restaurant sustained substantial damage as a result of a fire caused by carelessly discarded smoking materials [41]. The restaurant was built partially over a pier and the fire broke out under the pier. The fire spread up the side of the restaurant to a breezeway, and then moved into the kitchen above a drop ceiling. The restaurant was constructed of protected, wood-frame construction.

A full-coverage smoke detection system activated and prompted evacuation. A partial wet-pipe sprinkler system also activated, but it could not control the fire. There was also a partial-preaction system under the pier that activated and prevented the fire from spreading along the underside of the pier. At the time of the fire the restaurant was in full operation and was hosting several parties. There were no injuries to occupants, but two fire fighters were injured.

The following details regarding this incident are of note:

- The smoke detection system activated and initiated evacuation of the building, so that no occupants were injured.
- The partial sprinkler system could not control the fire and the fire spread above the sprinklers.

#### **C.4.14 Restaurant Fire, Michigan, 1998**

A fire initiated in a broiler exhaust hood and then spread to concealed spaces during the operation of the restaurant [41]. The fire occurred in a two-story, unprotected wood-frame structure that had no fire or smoke detection or suppression system. There was a dry chemical extinguishing system that protected the exhaust hood system.

An employee smelled smoke in the kitchen and found a fire in the baffle filters over the operating broiler. After the discovery of the fire the patrons were evacuated and the fire department was notified. Initially, two employees were able to control the fire using portable extinguishers but on the arrival of the fire department there was heavy smoke showing from the vents over the kitchen. The fire spread to the roof/ceiling space and could not be extinguished by the fire department.

An investigation found that the fire originated in a broiler exhaust stack. The fire caused the supports to fail, which allowed the connections in the ductwork to fail and the fire to spread to the void and roof. There were no injuries to the occupants.

The following details regarding this incident are of note:

- The fire occurred in a concealed space that protected the occupants but lead to the discovery of a significant fire that was not easily extinguishable.

- There was a delay of the activation of the dry chemical system protecting the exhaust hood system because the blower was drawing heat and flames away from the fusible links in the hood.

#### **C.4.15 Theater Fire, Nevada, 1999**

A fire broke out in the showroom/theater of a large 17-story hotel and casino [41]. The building was equipped with an automatic sprinkler system and smoke exhaust system. Staff noticed flames spreading up the drapes near the stage. Two employees attempted to pull the drapes to the floor while other staff activated the safety evacuation plan.

Firefighters arrived within five minutes to find the evacuation of the theater and the fire that was extinguished by the sprinklers. The smoke exhaust system was used which limited smoke damage. The fire department evaluated five employees for minor smoke inhalation.

An investigation of the fire determined that the fire began near a television monitor that was plugged into an electrical receptacle outlet. The components did not show any signs of fault but a similar monitor located on the other side of the stage had decorative drapes, which had a gold metal base that conducted electricity. The plug was not completely inserted into the receptacle and energized the hanging fabric.

The following details regarding this incident are of note: sprinklers extinguished the fire while employees activated the safety evacuation plan, which led to the successful evacuation of the theater.

#### **C.4.16 Fine Line Music Café, Minneapolis, Minnesota, February 13, 2003**

On February 17, 2003 the warm-up band was playing its encore when it set off a pyrotechnic display [43]. This started a fire in the ceiling of the club about 7:15 pm with an estimated crowd of 120 present in the building. The employees had just reviewed safety procedures the previous day and were quick and effective during the evacuation process. All of the occupants escaped and the fire was extinguished by the building's sprinklers within 15 minutes.

The Fine Line Music Café has a capacity of 720 people and occupies a 100-year-old Consortium Building located at 318 1<sup>st</sup> Avenue North in the warehouse District of Minneapolis, MN. No one was injured in the incident.

The following details regarding this incident are of note:

- The club had a sprinkler system and staff had reviewed the safety procedures the day before the event.
- All of the occupants were outside of the building when the fire department arrived.

### **C.5 REFERENCES FOR APPENDIX C**

- [1] Heary, Monica, *Theatre of Death*, The Daily Telegraph, Sydney, Australia, 26 June 2001.
- [2] Chicago Public Library, "1903, December 30: Iroquois Theater Fire".
- [3] Chertkoff, Jerome M. and Kushigian, Russell H., *Don't Panic: The Psychology of Emergency Egress and Ingress*, Praeger Publishers, Westport, CT.
- [4] McGunagle, Fred, *Horror in Collinwood; 172 Students Die in City's Worst Disaster*, Plain Dealer, Cleveland, Ohio, 29 March 1998.

- [5] Coté, Ron. *Life Safety Code Handbook, Eighth Edition, Supplement 1* (Paul E. Teague, M.A.). National Fire Protection Association, Quincy, MA, 2000.
- [6] Daily Mining Gazette, "Italian Hall Confession", March 16, 1982.
- [7] Callahan, Kevin. "Survivor Remembers Clinic Fire," *Plain Dealer*, Cleveland, Ohio, May 13, 1994.
- [8] McGunagle, Fred. "123 Die in Clinic Disaster; Poison Gas Seeps into System; Explosion Rocks Building," *Plain Dealer*, Cleveland, Ohio, 23 August 1998.
- [9] NFPA Fire Investigation Report, *Dance Hall Fire (Rhythm Club), Natchez, MI*, April 23, 1940. As published in: "The Natchez Dance Hall Holocaust." *NFPA Quarterly*, 34 #:70-75. 1940.
- [10] Second International Conference on Fire Research and Engineering. Gaithersburg, Maryland, USA. 3-8 August 1997.
- [11] Brownlee, Ken. *A Date 'Living in Infamy' Fire Years Later; The Winecoff Hotel Fire, Atlanta, Dec. 7, 1946* Claims Magazine, December 2002.
- [12] Morehouse, Macon. "Focus on Winecoff Fire," *The Atlanta Journal and Constitution*, Atlanta, Georgia, December 6, 1996.
- [13] Soto, Lucy. "Memories of Fear and Destruction," *The Atlanta Journal and Constitution*, 6 December 1993.
- [14] NFPA Fire Investigation Report, Night Club Fire (The Upstairs Lounge), New Orleans, LA, June 24, 1973. As published in: "Upstairs Lounge Fire," A. Elwood Willey, *NFPA Journal*, 68 #1: 16-20. 1974.
- [15] Lathrop, James K., *Discotheque Fire Twenty-Four Dead*, National Fire Protection Association, Quincy, MA, 1974.
- [16] NFPA Fire Investigation Report, Beverly Hills Supper Club Fire, Southgate, KY, May 28, 1977. Includes: "Tragedy in Kentucky," Robert L. Best, *Fire Journal*. (1978) 72#1:21, 36-40; "Comparing the Club with the Code." *Fire Journal*. (1978) 72#1:21, 36-40; "Human Behavior in the Beverly Hills Fire," Joseph A. Swartz, *Fire Journal*, (1979) 73#3:73-74, 108.
- [17] Wertheimer, Paul L., *"The Who" Rock Concert Tragedy: When Rock Concert Crowd Management Came of Age*, Engineering for Crowd Safety, 1993.
- [18] Bouchard, John, NFPA Investigation Report, National Fire Protection Association, Quincy, MA, 1984.
- [19] International Conference on Fire Research and Engineering. Orlando, Florida, USA. September 10-15, 1995.
- [20] *NFPA Alert Bulletin*, "Social Club Fire Bronx, New York". Number 90-2, May 1990.
- [21] "Arson Suspected as 87 Die in New York Disco Blaze". *The Independent* (London). March 26, 1990.
- [22] Isner, Michael, *Fire Investigation Report: Private Club Fire*, National Fire Protection Association, Quincy, MA, 1992.

- [23] Johnson, Mark, *Chicago Club had been told to Close*, Milwaukee Journal Sentinel, 18 February 2003.
- [24] Reed Business Information US Staff, *Disasters Offer Lessons for Future*, Consulting-Specifying Engineer, 1 March 2003.
- [25] Ciokajlo, Mickey and Deardorff, Julie, *Expert Finds E2 Violations*, Chicago Tribune, 20 February 2003.
- [26] Carter, Helen. "Isle of Man's Forgotten Holiday Horror." *The Guardian*, London, August 2, 2003.
- [27] Pigott, Pierce T. "The Fire at the Stardust, Dublin: The Public Inquiry and its Findings," *Fire Safety Journal*, #7, 1984.
- [28] *NFPA Fire Investigation Report, Dance Hall Fire, Gothenburg, Sweden*, National Fire Protection Association, Quincy, MA, 1998.
- [29] Jiang, H. et. al. "The Use of Evacuation Simulation, Fire Simulation and Experimental Fire Data in Forensic Fire Analysis." *Pedestrian and Evacuation Dynamics 2003: Proceedings of the 2nd International Conference*. Greenwich, Uk. Ed. Galea, E. R.
- [30] "Firewatch: Students, Staff Evacuate Safely Despite Delay in Alarm." *NFPA Journal*. November/December 1992.
- [31] "Firewatch: Sprinklers Extinguish Fire in Crowded Nightclub." *NFPA Journal*. November/December 1992.
- [32] "Firewatch: 11-Year-Old Ignites \$1 Million Fire." *NFPA Journal*. March/April 1992.
- [33] "Firewatch: Student Prank with Pyrotechnic Device Ignites School Roof." *NFPA Journal*. July/August 1992.
- [34] "Firewatch: Detectors Alert Occupants to Fire in School." *NFPA Journal*. September/October 1994.
- [35] "Firewatch: Grill Fire Damages Restaurant." *NFPA Journal*. September/October 1996.
- [36] "Firewatch: Sprinklers Extinguish Fire in Occupied Dinner Theater." *NFPA Journal*. March/April 1996.
- [37] "Firewatch: Fire Destroys Restaurant, Patrons Evacuate Safely." *NFPA Journal*. May/June 1996.
- [38] "Firewatch: Electrical Fire Damages Community Center." *NFPA Journal*. September/October 1997.
- [39] "Firewatch: Sprinkler Controls Grease Fire." *NFPA Journal*. July/August 1997.
- [40] "Firewatch: Fire in Concealed Space Damages Occupied School." *NFPA Journal*. January/February 1998.
- [41] "1998 Large Loss Fires and Explosions." *NFPA Journal*. November/December 1999.
- [42] "Firewatch: Drapes Ignite in Theater." *NFPA Journal*. May/June 1999.
- [43] Chanen, David. Warm-up act sets Fine Line afire; No one hurt; club has heavy water damage. *Star Tribune*. Minneapolis,

- [44] Emmons, Howard. 'Analysis Of A Tragedy'. Harvard University, Cambridge, Ma. *Fire Technology*, Vol 19, No. 2, 115-124, May 1983.
- [45] "Evaluation of Limitations to Egress through Doorways in Emergency Situations," vol. 1, Ove Arup & Partners Massachusetts Inc., Job number 32979, Westborough MA, February 18, 2004.
- [46] Lostetter, S.M.O., and Reijman, P.B., "Reconstruction of the Fire in 'de Hemel' in Volendam, New Years Eve 2000/2001," Interflam 20

## APPENDIX D. SMALL SCALE LABORATORY TESTS

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### D.1 INTRODUCTION

Computational fire models incorporate specific material properties in order to calculate fire development and growth for a given fire incident. These material properties, such as thermal conductivity, heat capacity, density, flame spread, and heat of combustion, are utilized by the model to predict if and when a component will ignite and how much energy or heat will be released as the component burns. The ignition and subsequent release of energy cause the fire to grow and spread throughout a structure.

The type and composition of the materials that were identified as being present inside the nightclub were characterized generically as polyurethane foam, ceiling tiles, wood paneling, carpet, and an industrial pyrotechnic device. This materials testing conducted by NIST and described in this appendix did not include any materials actually recovered from the nightclub.

#### D.1.1 Previous Research on Combustion of Polyurethane Foam

Since the ignitability and flame spread characteristics of polyurethane foam played a critical role in the early fire development, we examined the previous research that had been done involving the combustion of polyurethane foam. Approximately 200 journal publications, reports, and presentations dating back to the 1960s were identified, dealing primarily with rigid polyurethane foam construction materials, furniture flammability, and the toxicity of combustion products. A smaller number of articles were identified that dealt with reconstruction of actual fires, codes and standards, and miscellaneous topics, including detector response, patents, and computer models.

The rigid foam articles typically focused on describing the combustion of rigid polyurethane foam or assemblies of rigid polyurethane foam with interior walls, exterior walls, and roofing panels. None of these provided much insight into the combustion properties of flexible polyurethane foam because rigid polyurethane foam has significantly different mechanical properties, including surface finish and flexibility. The articles that discussed furniture flammability typically described either the transition from smoldering ignition to flaming ignition, or the performance of assembled systems such as a foam cushion covered by cotton or polyester material or complete chairs or mattresses. While the research involving the transition from smoldering to flaming ignition did provide some data on ignition temperatures of polyurethane foam, the transition was typically investigated at low heat flux rates ( $\sim 6 \text{ kW/m}^2$ ) [1] and the smoldering occurred over a relatively long time period. In the nightclub fire, the transition from impingement by hot metallic particles to flaming foam occurred in less than 10 s and, once flaming ignition had taken place, the flames spread aided by much higher heat fluxes ( $> 25 \text{ kW/m}^2$ ).

Heat release data was typically not included in the early research. Often, burning length or mass loss rate was reported, but one is forced to assume a density and heat of combustion for the foam in order to convert the data to heat release rates. Flame spread data was also difficult to interpret because it typically involved relatively small samples of foam and poorly characterized heat flux and flow rates. While the foam was often described as being polyurethane, additional details were not always included as to the chemical structure, whether the foam was polyether or polyester, or whether or not the shape was convoluted.

Schmitt [2] discussed the thermal degradation of polyurethane (possibly polyester polyurethane) packing foam in flowing helium and flowing air. The ignition temperature reported by Schmitt varied between 320 °C and 329 °C at an air velocity of 5 cm/s. Schmitt also reported relative amounts of hydrogen cyanide in gases, between  $1 \times 10^{-6}$  (vol %) and  $50 \times 10^{-6}$  (vol %) that were collected at 45 min, 75 min, and 100 min into the degradation experiments. The sample location, sample rate, and ventilation/dilution factors were not described in detail.

Research on a polyether polyurethane foam with a phosphate-based fire retardant (classified at the time as “self-extinguishing”) was conducted by Roberts [3]. He reported the values of density ( $40 \text{ kg/m}^3$ ), specific heat ( $1.1 \text{ kJ kg}^{-1} \text{ K}^{-1}$ ), and thermal conductivity ( $0.000022 \text{ kJ m}^{-1} \text{ s}^{-1} \text{ K}^{-1}$ ). The foam exhibited twice the density of the foam that had been mounted on the walls of the nightclub. Roberts’ foam pyrolyzed and left a char layer from 20 % to 60 % of initial mass. This was significantly different than the negligible residue that remained after cone calorimeter tests on the polyether- or polyester-polyurethane foam tested by NIST. Mass loss rates were reported, but the mass loss rates excluded the mass loss due to blowing agent which could account for up to 15% of the foam mass. Roberts did conclude that the burning rate of polyurethane was more sensitive to incident heat flux than the burning rate of beech wood. The author also concluded that “the observed behavior of polyurethane illustrates the need for assessing its fire resistance by means of tests that submit samples to realistic levels of applied heat flux”.

In research on four different flexible polyurethane foams, Stark et al. [4] demonstrated that burning polyurethane can rapidly increase upper layer temperatures, deplete the oxygen, and produce significant amounts of hydrogen cyanide. In tests that burned between 0.8 kg and 127 kg of polyether polyurethane in a small room (approximately  $40 \text{ m}^3$ ), Stark observed upper layer gas temperature of 850 °C, oxygen concentrations of less than 0.5 %, and hydrogen cyanide volume fractions exceeding  $500 \times 10^{-6}$ . These values were recorded between 90 s and 120 s after ignition. However, the research did not include data for ignition temperatures, heat release rate, thermal fluxes, or flame spread.

Previous work conducted at NIST (National Bureau of Standards) by Lee [5] used polyurethane foam as part of an investigation into the reproducibility of a Radiant Panel Test, ASTM E 162-67. The density of polyurethane foam was reported as  $60 \text{ kg/m}^3$  or about three times greater than the foam that was used in the full-scale mockup burns at NIST. Because the research focused on the reproducibility of the tests between different testing laboratories, only limited data were included on the flame spread characteristics including flame-spread factor,  $F_s$ , and flame-spread index,  $I_s$ . Because it is not clear whether the foam samples were polyether or polyester types and the density was much higher than the foam mounted in the full-scale mockup tests, these data could not be incorporated into the current computer simulations.

Stone et al. [6] focused on the smoke generation of non-combustion modified and combustion modified polyether- and polyester-polyurethane foam when the foams were exposed to  $10 \text{ kW/m}^2$  to  $25 \text{ kW/m}^2$  of radiant flux. Unfortunately, the research did not include data for ignition temperatures, heat release rate, or flame spread.

A series of tests conducted by Jayakody et al.[7] on flexible, molded polyether polyurethane foams, both non-fire retardant and fire retardant examined the impact of 17 different fire retardants on fire characteristics. The non-fire retardant polyether polyurethane foam was included as the baseline or control foam in a series of cone calorimeter and Bunsen burner tests. The test matrix included a range of fire retardant additives, from antimony oxide to graphite powder, but did not use any fire retardant polyester polyurethane foams. The cone calorimeter data included peak and average heat release rate,

time to ignition, and average carbon monoxide and carbon dioxide yields. One test was reported at 25 kW/m<sup>2</sup> heat flux exposure and a second test at 35 kW/m<sup>2</sup> (see Table D-5).

The literature search identified a significant amount of research that had been conducted on various polyurethane foams, but the need to conduct small-scale tests on the foams similar to what was thought to be in The Station and what was used in the full-scale mock-up of the platform area was apparent as a prerequisite to proper interpretation of the full-scale test and prediction of the fire spread in the actual nightclub.

### **D.1.2 Contribution of Different Fuels**

The contribution of a specific fuel is dependent on the relative amounts of the fuel and how quickly the fuel becomes involved in the fire. In addition to the polyurethane foam, other materials were present in the building that contributed to the fire spread and heat release. Wood was used in the flooring, wall paneling, and structural members (studs, joists and rafters), and provided the bulk of the energy released. The location of the fuel also impacted when and how rapidly a specific fuel became a contributor to the heat release rate. For instance, wood paneling near the ceiling became involved more quickly than wood flooring.

Carpeting was used on the platform and on a portion of the floor, and also contributed to the heat release and fire spread. Small-scale tests were run on wood paneling and on nylon carpet to provide input to the computational model. While the ceiling panels were not thought to contribute significantly to the fire spread, they were subjected to cone calorimeter testing for completeness.

## **D.2 TEST SERIES**

Five test series were conducted in this investigation: small scale heat release measurements using a cone calorimeter; ignition temperature determination by Southwest Research Institute; real-scale heat release and flame spread measurements of foam covered wall panels; heat flux and temperature measurements of pyrotechnic devices impinging on surfaces; and fire growth measurements in real-scale mockups of the raised platform (or stage), main floor, and alcove. This appendix describes the cone calorimeter and ignition temperature tests. The other test series are described in subsequent appendices: foam covered wall panels (Appendix E), pyrotechnic devices (Appendix F), and real-scale mockup (Appendix G).

### **D.2.1 Cone Calorimeter Test Series**

Cone calorimeter experiments were conducted on five different materials at five different levels of external heat flux. The tests conducted on the polyether- and polyester-polyurethane foams and the external fluxes that were imposed on the samples are tabulated in Table D-1. Similar information for the wood, carpet, and ceiling tiles is located in Table D-2.

The data from the cone calorimeter is summarized in tables and is also plotted graphically for each of the 38 cone tests. The test protocol detailed in ASTM E 1354 [8] was used for these experiments. The E-1354 test method utilizes a cone calorimeter (Figure D-1) to collect data on heat release rate, mass loss rate, optical density of smoke, and gas concentrations in combustion products. The cone calorimeter exposes relatively small samples (10 cm x 10 cm) to a uniform thermal flux. These samples were stored in a controlled humidity (50 % relative humidity) and temperature (23 °C) room for at least two weeks prior to testing. Each sample was wrapped in an aluminum foil, except for the exposed side, and positioned in a stainless steel specimen holder (Figure D-2). The thermal flux which is generated via a cone shaped electrical resistance heater was set to the desired test value of 20 kW/m<sup>2</sup>, 35 kW/m<sup>2</sup>,

<b>Table D-1. Cone Calorimeter Tests for Polyurethane Foams</b>			
<b>Material</b>	<b>Thermal Flux kW/m<sup>2</sup></b>	<b>Test ID</b>	<b>Manufacturer</b>
Polyurethane Foam (Ester) Convolutd / Egg Crate Non-Fire Retardant Gray Color	35	PUF-NFR-A-1	A*
	35	PUF-NFR-A-2	
	35	PUF-NFR-A-3	
Polyurethane Foam (Ether) Convolutd / Egg Crate Non-Fire Retardant Gray Color	20	PUF-NFR-B-13	B*
	20	PUF-NFR-B-14	
	20	PUF-NFR-B-15	
	35	PUF-NFR-B-1	
	35	PUF-NFR-B-2	
	35	PUF-NFR-B-3	
	35	PUF-NFR-B-4	
	35	PUF-NFR-B-5	
	35	PUF-NFR-B-6	
	40	PUF-NFR-B-16	
	40	PUF-NFR-B-17	
	40	PUF-NFR-B-18	
	60	PUF-NFR-B-19	
	60	PUF-NFR-B-20	
	60	PUF-NFR-B-21	
	70	PUF-NFR-B-7	
	70	PUF-NFR-B-8	
	70	PUF-NFR-B-9	
	70	PUF-NFR-B-10	
	70	PUF-NFR-B-11	
Polyurethane Foam (Ether) Convolutd / Egg Crate Fire Retardant Gray Color	35	PUF-FR-1	C*
	35	PUF-FR-2	
	35	PUF-FR-3	
<p>* Distributor purchases foam from a number of different sources based on price and availability. When foam arrives at warehouse, new stock is intermingled with old stock. Labeling on single pieces of foam identifies type of foam, such as polyurethane (ester), but does not provide information on manufacturer. Distributor unable to identify specific manufacturer of purchased foam. Fire retardant foam was purchased in single lot. Non-fire retardant foam purchased in two lots. Cannot rule out possibility that individual foam within the same purchase came from different sources.</p>			

<b>Table D-2. Cone Calorimeter Tests for Wood, Carpet, and Ceiling Tile.</b>		
<b>Material</b>	<b>Thermal Flux kW/m<sup>2</sup></b>	<b>Test ID</b>
Wood Paneling 5 mm thick  Plywood Substrate	35	WP-01
	35	WP-02
	35	WP-03
	70	WP-04
	70	WP-05
	70	WP-06
Carpet Flooring 100% Filament Olefin Ave. Tufted Face Weight 39 oz.  Polyester short nap 0.25" thick Beige color	35	CF-01
	35	CF-02
	35	CF-03
	70	CF-04
	70	CF-05
	70	CF-06
Ceiling Tile – 942 B Textured 610 mm x 1219 mm x 16 mm (24 in x 48 in x 0.6250 in)	35	CT-01
	35	CT-02
	35	CT-03
	70	CT-04
	70	CT-05
	70	CT-06

40 kW/m<sup>2</sup>, 60 kW/m<sup>2</sup>, or 70 kW/m<sup>2</sup>, and verified using a heat flux meter. The sample in the specimen holder was then positioned horizontally on the load cell and exposed to the thermal flux. An electric spark was used to ignite the combustible gases near the surface of the sample. A sample of polyurethane foam that was ignited under the cone is shown in Figure D-3. The smoke and combustion products were drawn through the center of the cone heater and into the instrumented exhaust duct. The load cell tracked mass loss rate throughout each burn. The small amount of residue left in the aluminum tray after the cone tests of three polyurethane foam samples is shown in Figure D-4. Additional instruments allowed the optical density of the smoke and gas concentrations to be monitored continuously. The distance between the top surface of the sample and the cone housing was 25 mm. The energy release per mass of oxygen depleted was assumed to be a constant 13.1 MJ/kg. While the cone calorimeter can provide heat release rate as a function of thermal flux, the impact of ventilation, corner geometries, and composite assemblies are difficult to characterize.

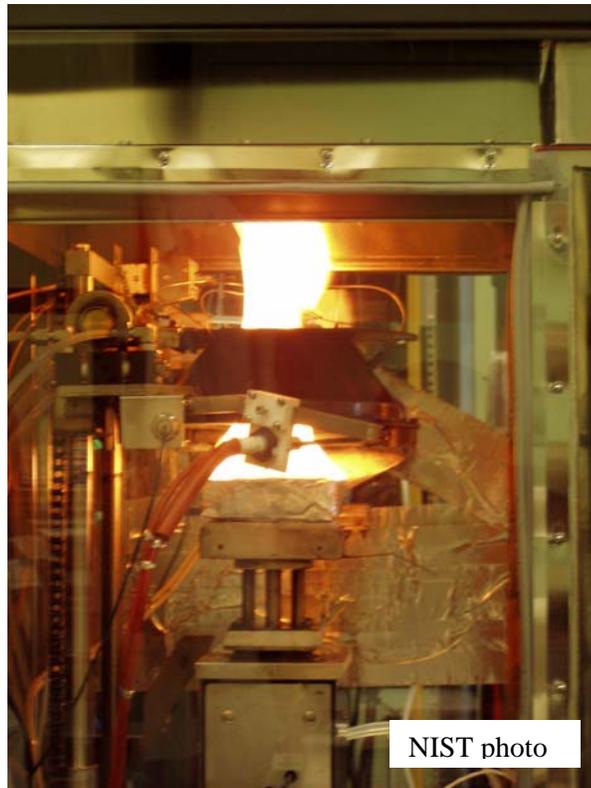
A test plus two replicates of each sample (total of three tests) were conducted with the cone calorimeter providing an external heat flux of 20 kW/m<sup>2</sup>, 35 kW/m<sup>2</sup>, 40 kW/m<sup>2</sup>, 60 kW/m<sup>2</sup>, or 70 kW/m<sup>2</sup>. The lower thermal fluxes represent a radiation exposure the materials might experience early in the fire development. The higher thermal fluxes simulate conditions that the material might encounter near the peak heat release rate in the fire.



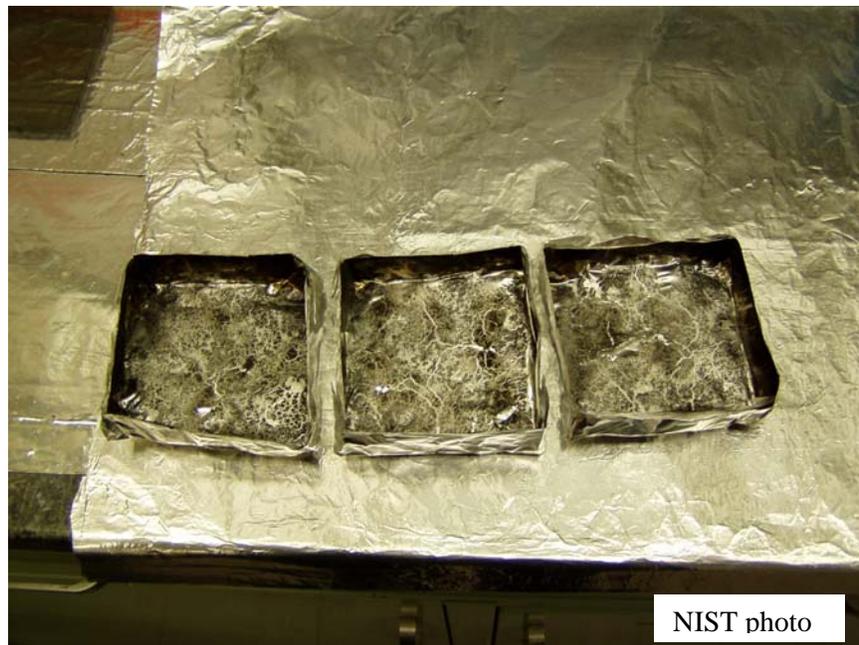
**Figure D-1. Cone Calorimeter – Test Chamber (right side), computer display (center), and gas analyzers (left side).**



**Figure D-2. Sample of Polyurethane Foam Placed in Aluminum Foil Tray on Top of Horizontal Sample Holder.**



**Figure D-3. Test Specimen – Exposed to thermal flux from cone shaped heater, combustion products drawn through center of cone, sample positioned on load cell.**



**Figure D-4. Burn Residue of Polyurethane Foam after Cone Calorimeter Test.**

The data that were collected during the cone calorimeter tests are summarized in tables in Section D.2.8 of this appendix. The data tables provide the time to sustained ignition, peak heat release rate, time to peak heat release rate, total heat release, 60 s average heat release rate, total mass loss, average mass loss rate, average effective heat of combustion, average smoke yield, average carbon dioxide yield, average carbon monoxide yield, time to ignition, time to flameout, and a number of specimen properties.

## **D.2.2 Polyurethane Plastics and Flammability Ratings**

Polyurethane refers to a large category of materials including surface coatings, elastomers, and foams, rigid or flexible, and thermoplastic or thermosetting. While large quantities of polyurethanes are used to manufacture adhesives and protective coatings, the foam type of polyurethane is widely used in the production of upholstered furniture, bedding, sponges, toys, wearing apparel, and medical dressings. Rigid urethane foams are used for insulation in building constructions. Flexible polyurethane foams are used in packaging materials and acoustical insulation panels. The urethane linkage, which all polyurethanes have in common, involves the reaction of an isocyanate group with a hydroxyl-containing group. A more detailed description of urethane formation chemistry is in Appendix H.

Fire retardant additives or compounds can be incorporated into polyurethane foam during the manufacturing procedure or can be applied to the foam in a post-production process. The molecular structure of polyurethane foam can also be adjusted to provide improved fire resistant properties. The polyurethane foam material itself is still a hydrocarbon compound, a long chain carbon based material that can act as a fuel source.

Fire performance tests, such as Flammability of Plastic Materials for Parts in Devices and Appliances (Underwriters Laboratories UL 94) have been developed to measure flammability characteristics of plastic materials. However, UL 94 specifically is not intended for foam plastics used in building construction or finish materials. Three of the UL 94 flame classifications relate to low density foam materials: HF-1, HF-2, and HBF. In each test, a small sample is positioned horizontally and exposed to a flame for 60 seconds. After the 60 second flame exposure, the flame is removed and the time required for the flaming to cease (after-flame) and the flaming and glowing to cease (after-glow) are monitored. The distance the flame travels across the sample is also recorded. Foams rated as HBF can sustain a limited flame spread; foams rated as HF-2 must self-extinguish in less than 30 s, but their drips are sufficient to ignite cotton fabric; an HF-1 rating is similar to HF-2, except that any dripping materials do not ignite a cotton fabric placed underneath the foam sample. The fire retardant foam from supplier C was identified by the supplier as being rated HF-1; the polyurethane foams from Lots A and B were not rated, and are thus considered non-fire retardant.

Fire retardant polyurethane foams may not ignite as quickly as non-fire retardant foams, and they also may have lower peak heat release rates than non-fire retardant foams. The classification of a foam as "fire retardant," however, does not prevent it from igniting and contributing to the fuel load and fire spread once the material is exposed to the high temperatures and high thermal flux conditions of a room fire. Both fire retardant foam and non-fire retardant foam were included in the cone calorimeter tests to help characterize time to ignition and heat release rate for each.

## **D.2.3 Test Results -- Non-fire Retardant Polyurethane Foam**

Both polyether and polyester formulations of polyurethane can be used as packaging materials. The polyurethane foam which is offered for packaging typically does not include any fire retardant additives or incorporate any fire retardant compounds into the urethane structure. As a packaging material, the

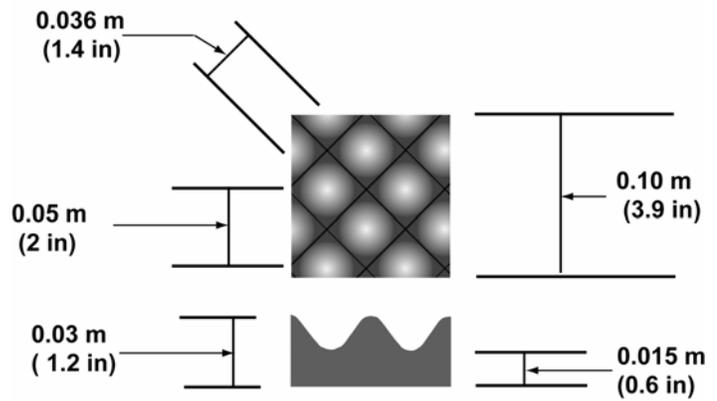
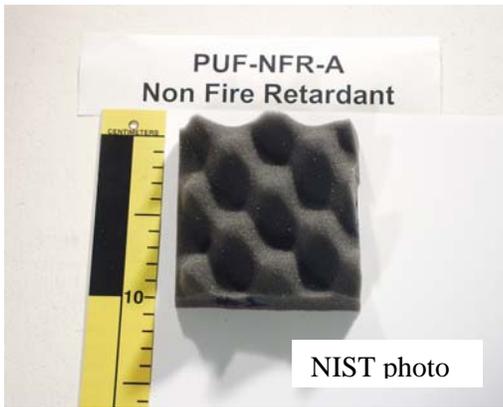
polyurethane foam (ether and ester) is commercially available in a range of sizes including 1.22 m (4 ft) x 2.44 m (8 ft) sheets. The gray colored foam can be obtained in several geometries including solid blocks, uniform thickness sheets, and convoluted or “egg-crate” sheets. In The Station nightclub, polyurethane foam had been installed on the rear wall, raised platform (stage) wall, and in the alcove as a sound attenuation material (see Figure 4-1). Photographs of the nightclub interior do not clearly demonstrate whether staples, nails, organic adhesive or some combination of all three were used to mount the foam on the wall. The polyurethane foam appeared to have been mounted over the top of the previous wall material, which, depending on the location may have been either wood paneling, gypsum board, or rigid polystyrene foam between vertical wood studs. The foam was installed in either full 1.22 m x 2.44 m sheets or was trimmed to fit the raised platform (stage), alcove, or rear wall geometry.

Each 1.22 m x 2.44 m sheet was supplied in a compressed roll, approximately 0.30 m (12 in) in diameter and 0.41 m (16 in) wide. After removing the wrapping, each compressed roll expanded to a 1.22 m x 2.44 m sheet. While the rear surface of each sheet was flat, the front side was convoluted. These convolutions were a series of peaks and depressions that resembled the surface of a continuous egg crate. There were approximately 36 peaks and 36 depressions per 0.09 m<sup>2</sup> (1 ft<sup>2</sup>). Peak to peak spacing was approximate 0.05 m (2 in) for all the foam (Figure D-5 and D-6). The thickest dimension of the foam was measured from the tip of a peak to the back surface. The thinnest dimension of the foam was measured from the bottom of a depression to the back surface. There were noticeable differences in thickest and thinnest dimensions between the foam purchased from supplier A and supplier B. Foam from supplier A was measured at 0.04 m (1.5 in) and 0.009 m (0.35 in) at its thickest and thinnest dimensions, respectively (Figure D-5). Foam obtained from supplier B was measured at 0.03 m (1.2 in) and 0.015 m (0.6 in) at its thickest and thinnest dimensions, respectively (Figure D-6).

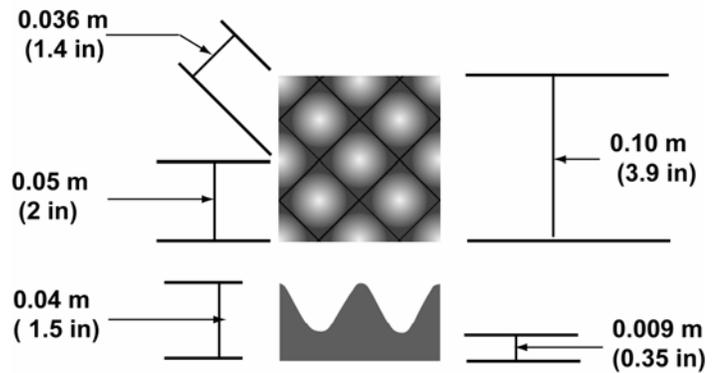
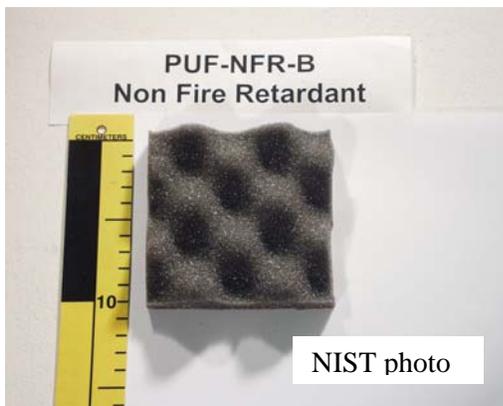
Twenty-three test samples were exposed to thermal fluxes ranging from 20 kW/m<sup>2</sup> to 70 kW/m<sup>2</sup>. The heat release rate for each sample is plotted versus time in Figures D-7 through D-13.

The non-fire retardant polyurethane foam samples exposed to an external heat flux of 20 kW/m<sup>2</sup> reached peak heat release rates from 440 kW/m<sup>2</sup> to 460 kW/m<sup>2</sup> in approximately 50 seconds. The average time to sustained ignition was 14 seconds (Table D-3). When exposed to 35 kW/m<sup>2</sup> of external heat flux, the non-fire retardant polyurethane foam reached its peak heat release rate in approximately 30 seconds. Peak heat release rates for all nine foam samples ranged from 520 kW/m<sup>2</sup> to 680 kW/m<sup>2</sup> with an average of about 590 kW/m<sup>2</sup>. There did not appear to be a significant difference in the range of peak heat release rates between the two suppliers. The average time to sustained ignition was 6 seconds and average time to peak heat release rate was 30 seconds.

Samples of the non-fire retardant foam, PUF-NFR-B, were exposed to external heat fluxes of 40 kW/m<sup>2</sup> and 60 kW/m<sup>2</sup>, reaching peak heat release rates in approximately 29 seconds and 24 seconds, respectively. Peak heat release rates for the three 40 kW/m<sup>2</sup> foam samples ranged from 700 kW/m<sup>2</sup> to 880 kW/m<sup>2</sup> with an average of about 820 kW/m<sup>2</sup>. The three 60 kW/m<sup>2</sup> exposures produced peak heat release rates ranging from 1000 kW/m<sup>2</sup> to 1300 kW/m<sup>2</sup> with an average of about 1150 kW/m<sup>2</sup>. The average time to sustained ignition was 4 seconds and 3 seconds for the 40 kW/m<sup>2</sup> and 60 kW/m<sup>2</sup> exposures, respectively. When exposed to 70 kW/m<sup>2</sup> of external heat flux, the non-fire retardant polyurethane foam reached its peak heat release rate in approximately 20 seconds. Peak heat release rates for all five foam samples ranged from 810 kW/m<sup>2</sup> to 1094 kW/m<sup>2</sup> with an average of 970 kW/m<sup>2</sup>. At the higher flux it required an average 3 seconds to reach sustained ignition and an average of 21 seconds to reach the peak heat release rate.



**Figure D-5. Photograph and Dimensioned Diagram of Non Fire Retardant Foam Lot A (PUF-NFR-A).**



**Figure D-6. Photograph and Dimensioned Diagram of Non Fire Retardant Foam Lot B (PUF-NFR-B).**

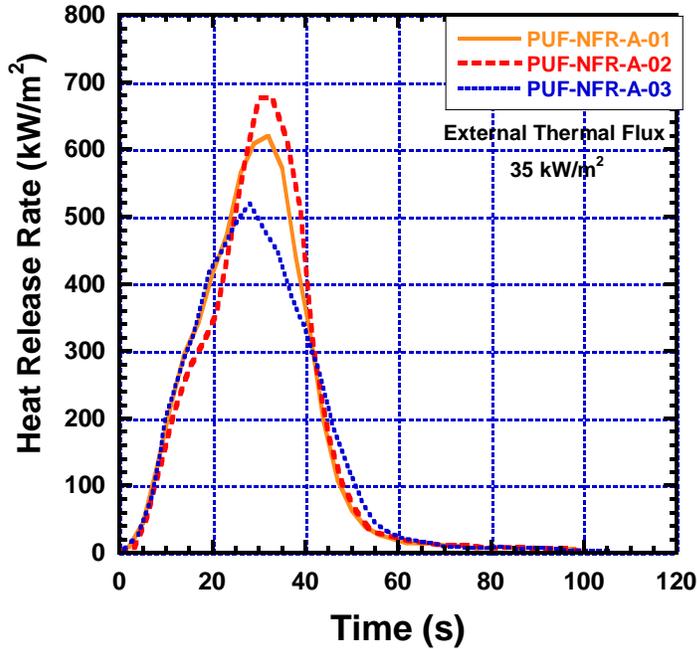


Figure D-7. Heat Release Rate versus Time for Polyurethane Foam Exposed to 35 kW/m<sup>2</sup> of External Heat Flux. Samples PUF-NFR-A-01, PUF-NFR-A-02, and PUF-NFR-A-03.

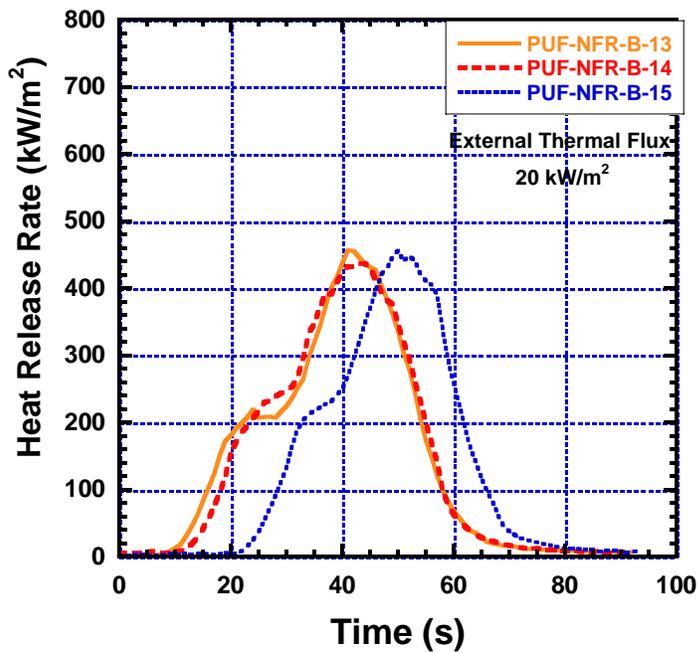


Figure D-8. Heat Release Rate versus Time for Polyurethane Foam Exposed to 20 kW/m<sup>2</sup> of External Heat Flux (PUF-NFR-B). Samples PUF-NFR-B-13, PUF-NFR-B-14, and PUF-NFR-B-15.

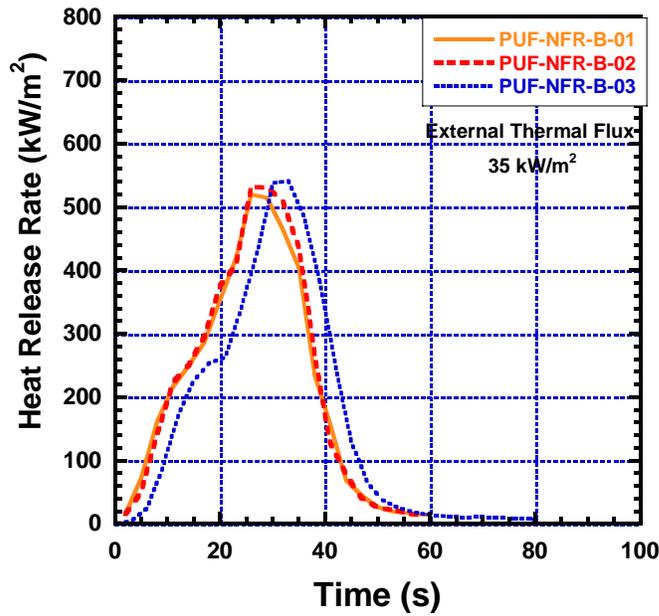


Figure D-9. Heat Release Rate versus Time for Polyurethane Foam Exposed to 35 kW/m<sup>2</sup> of External Heat Flux (PUF-NFR-B). Samples PUF-NFR-B-01, PUF-NFR-B-02, and PUF-NFR-B-03.

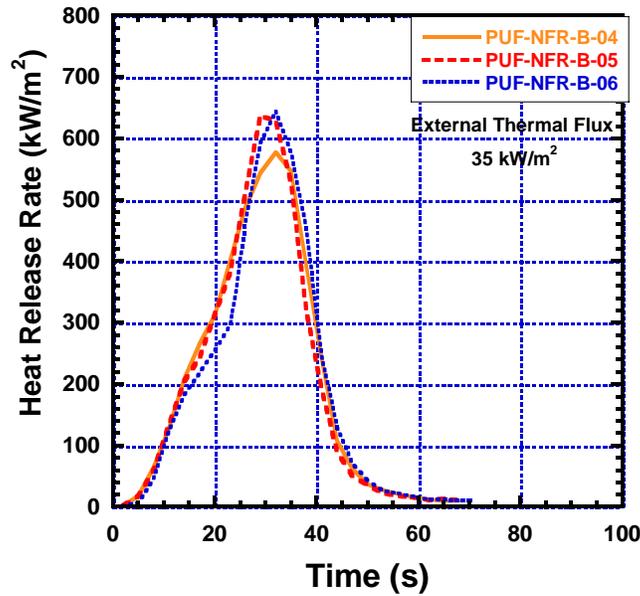


Figure D-10. Heat Release Rate versus Time for Polyurethane Foam Exposed to 35 kW/m<sup>2</sup> of External Heat Flux (PUF-NFR-B). Samples PUF-NFR-B-04, PUF-NFR-B-05, and PUF-NFR-B-06.

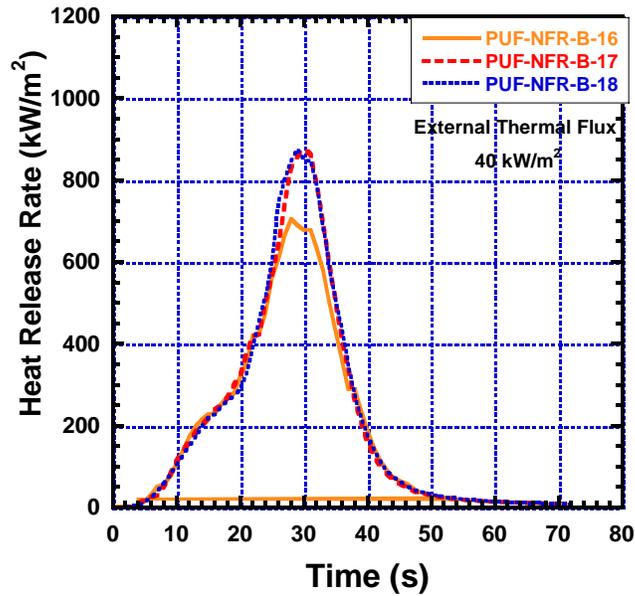


Figure D-11. Heat Release Rate versus Time for Polyurethane Foam Exposed to 40 kW/m<sup>2</sup> of External Heat Flux (PUF-NFR-B). Samples PUF-NFR-B-16, PUF-NFR-B-17, and PUF-NFR-B-18.

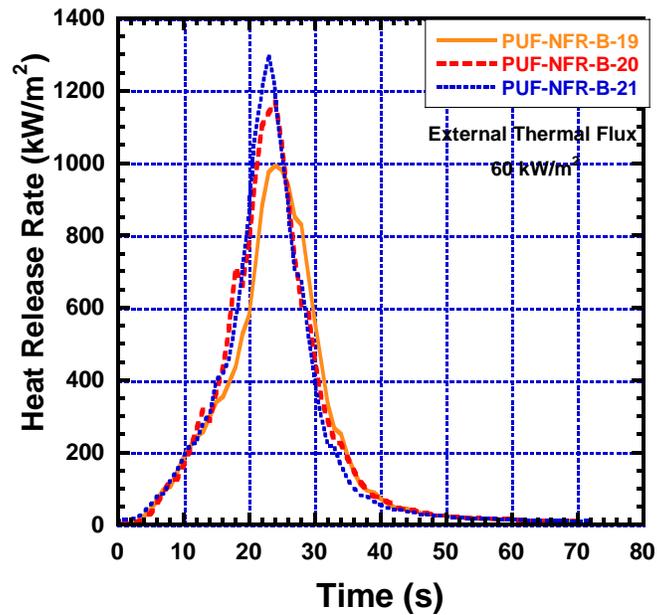
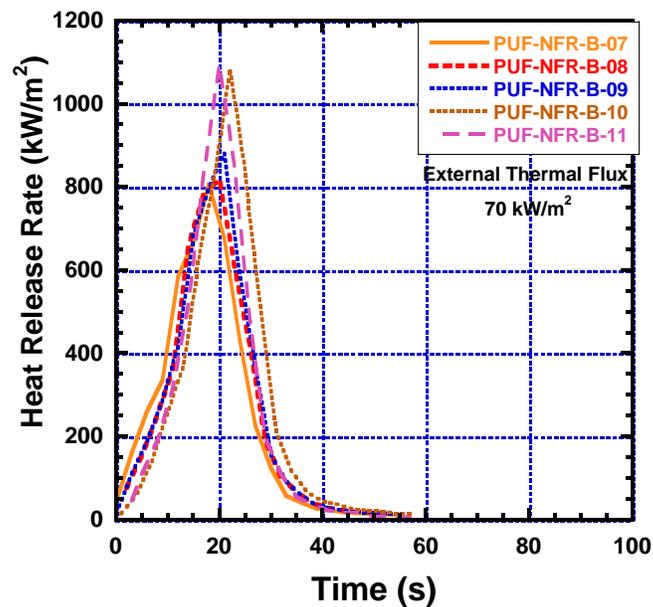


Figure D-12. Heat Release Rate versus Time for Polyurethane Foam Exposed to 60 kW/m<sup>2</sup> of External Heat Flux (PUF-NFR-B). Samples PUF-NFR-B-19, PUF-NFR-B-20, and PUF-NFR-B-21.



**Figure D-13. Heat Release Rate versus Time for Polyurethane Foam Exposed to 70 kW/m<sup>2</sup> of External Heat Flux (PUF-NFR-B). Samples PUF-NFR-B-07, PUF-NFR-B-08, PUF-NFR-B-09, PUF-NFR-B-10, and PUF-NFR-B-11.**

#### D.2.4 Test Results -- Fire Retardant Polyurethane Foam

Polyether polyurethane foam which is intended for packaging applications typically does not have additional fire retardant qualities, either through additives included in the manufacturing process or post-production treatments. It is still useful to characterize the performance of fire retardant foam in order to understand how the fire growth and spread differ from the non-fire retardant foam.

NIST purchased a number of 1.22 m (4 ft) x 2.44 m (8 ft) sheets of fire retardant polyester polyurethane foam from a commercial supplier. Unfortunately, the distributor was not able to identify the manufacturer of the foam.

As with the non-fire retardant foam, the fire retardant foam was supplied in compressed rolls, which were allowed to expand to a 1.22 m x 2.44 m sheet. Both the non-fire retardant and fire retardant foams were similar in the size, distribution, and number of peaks and depressions. There were approximately 36 peaks and 36 depressions per 0.09 m<sup>2</sup> (1 ft<sup>2</sup>). The thickest dimension of the foam was measured from the tip of a peak to the back surface. The thinnest dimension of the foam was measured from the bottom of a depression to the back surface. The fire retardant foam more closely resembled the non fire retardant foam obtained in the first lot (B). Fire retardant foam was measured at 0.03 m (1.5 in) and 0.010 m (0.4 in) at its thickest and thinnest dimensions, respectively (Figure D-14).

The heat release rate for each sample is plotted versus time in Figure D-15. When exposed to 35 kW/m<sup>2</sup> of external heat flux, the fire retardant polyurethane foam reached its peak heat release rate in approximately 36 seconds. Peak heat release rates for all three foam samples ranged from 430 kW/m<sup>2</sup> to 480 kW/m<sup>2</sup> with an average of 453 kW/m<sup>2</sup>. Each of the three fire retardant samples exhibited lower peak heat release rates than for the non-fire retardant foam samples. It required about twice as long for the fire

retardant foam, 13 seconds, to reach sustained ignition as required by the non-fire retardant foam (Table D-3). The time to peak heat release was longer for the fire retardant foam, increasing by about 20 %.

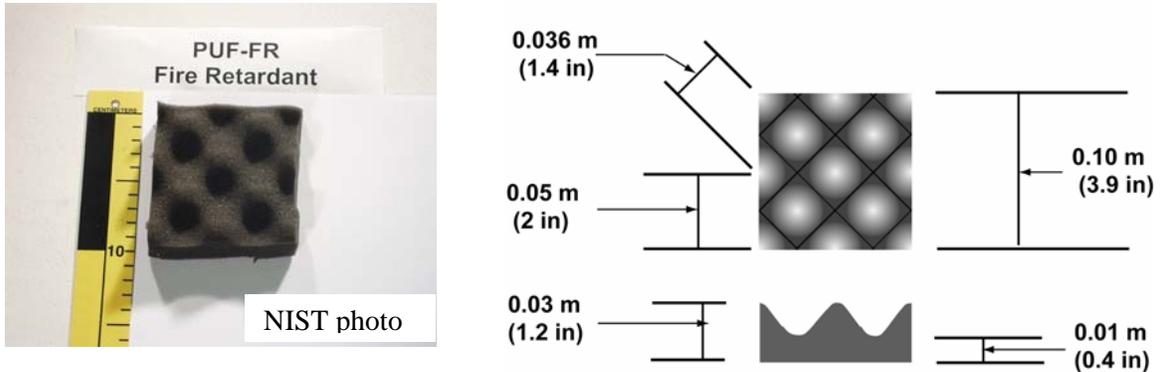


Figure D-14. Photograph and Dimensioned Diagram of Fire Retardant Foam (PUF-FR).

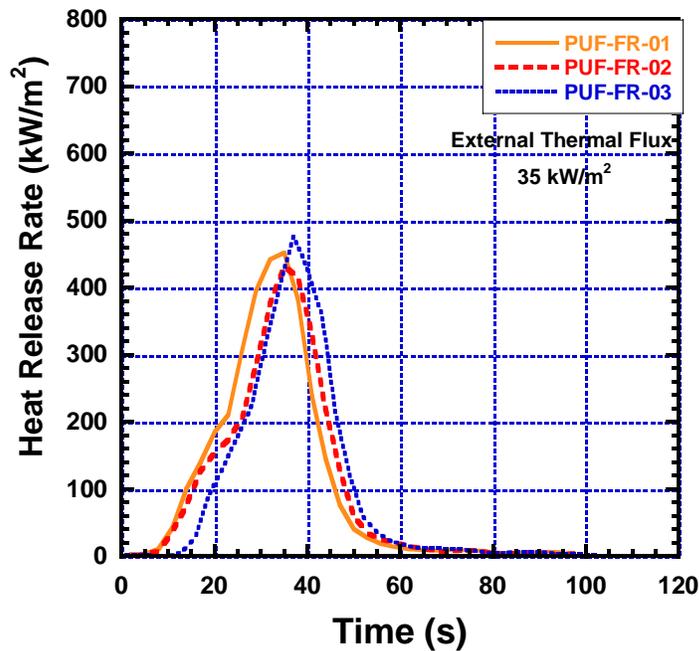


Figure D-15. Heat Release Rate versus Time for Fire Retarded Polyurethane Foam Exposed to  $35 \text{ kW/m}^2$  of External Heat Flux. Samples PUF-FR-01, PUF-FR-02, and PUF-FR-03.

<b>Table D-3 Time to Sustained Ignition, Time to Peak HRR, and Peak HRR for Polyurethane Foam Tested at National Institute of Standards and Technology.</b>				
<b>ID</b>	<b>External Thermal Flux kW/m<sup>2</sup></b>	<b>Time to Sustained Ignition, Seconds</b>	<b>Time to Peak Heat Release, Seconds</b>	<b>Peak Heat Release Rate kW/m<sup>2</sup></b>
PUF-FR-1	35	11	35	452
PUF-FR-2	35	11	35	432
PUF-FR-3	35	16	37	476
<b>Average</b>		<b>13</b>	<b>36</b>	<b>453</b>
PUF-NFR-A-1	35	9	32	620
PUF-NFR-A-2	35	7	30	676
PUF-NFR-A-3	35	6	28	520
<b>Average</b>		<b>7</b>	<b>30</b>	<b>605</b>
PUF-NFR-B-13	20	8	41	457
PUF-NFR-B-14	20	12	44	437
PUF-NFR-B-15	20	22	50	456
<b>Average</b>		<b>14</b>	<b>45</b>	<b>450</b>
PUF-NFR-B-1	35	4	26	519
PUF-NFR-B-2	35	5	26	532
PUF-NFR-B-3	35	9	33	541
PUF-NFR-B-4	35	5	32	577
PUF-NFR-B-5	35	5	29	637
PUF-NFR-B-6	35	5	32	644
<b>Average</b>		<b>6</b>	<b>30</b>	<b>586</b>
PUF-NFR-B-16	40	4	28	706
PUF-NFR-B-17	40	3	30	878
PUF-NFR-B-18	40	4	29	877
<b>Average</b>		<b>4</b>	<b>29</b>	<b>820</b>
PUF-NFR-B-19	60	4	24	993
PUF-NFR-B-20	60	3	24	1170
PUF-NFR-B-21	60	3	23	1299
<b>Average</b>		<b>3</b>	<b>24</b>	<b>1154</b>
PUF-NFR-B-7	70	4	18	806
PUF-NFR-B-8	70	3	20	820
PUF-NFR-B-9	70	3	21	881
PUF-NFR-B-10	70	3	22	1083
PUF-NFR-B-11	70	3	20	1094
<b>Average</b>		<b>3</b>	<b>21</b>	<b>970</b>

## D.2.5 ATF Test Results -- Polyether Polyurethane Foam from the Nightclub

A roll of gray convoluted foam was recovered from the basement of the burnt out nightclub one day after the fire and turned over to the West Warwick Police Department as evidence. The foam did not appear to have been painted or to have been mounted on any surface. Samples from this recovered foam were tested by the Bureau of Alcohol, Tobacco, and Firearms (ATF) in a cone calorimeter at the ATF Fire Laboratory in Maryland.

The time to sustained ignition, time to peak heat release rate, and the peak heat release rate for thermal flux exposures of 20 kW/m<sup>2</sup>, 40 kW/m<sup>2</sup>, and 60 kW/m<sup>2</sup> reported by ATF [9] are shown in Table D-4. For the 20 kW/m<sup>2</sup> flux exposure the ATF polyether foam required 9 seconds for sustained ignition which is less than the 22 seconds the NIST polyether foam required at 20 kW/m<sup>2</sup>. The time to peak heat release rate was also longer for the NIST foam, 50 seconds, than for the ATF foam, 37 seconds. For the ATF foam, the average peak heat release rate at 20 kW/m<sup>2</sup>, 260 kW/m<sup>2</sup>, was about half of the peak release rate for the NIST foam.

The 40 kW/m<sup>2</sup> heat flux exposure for the ATF foam resulted in a peak heat release rate of 297 kW/m<sup>2</sup>, less than half that observed for the NIST polyether foam. The time to peak heat release rate was 31 seconds and 29 seconds for the ATF and NIST foams, respectively. The time to sustained ignition was 3 seconds for the ATF tests and 4 seconds for the NIST samples. For the highest rate of external thermal flux tested by ATF, 60 kW/m<sup>2</sup>, the peak heat release rate, 415 kW/m<sup>2</sup>, was about a third of the value of 1154 kW/m<sup>2</sup> that was reported during the NIST cone calorimeter testing at 60 kW/m<sup>2</sup>. The time to sustained ignition was 1 second for the ATF polyether samples as compared to 3 seconds for the NIST tests, and the time to peak heat release was 26 seconds and 23 seconds for the ATF and NIST samples, respectively.

<b>Table D-4 Time to Sustained Ignition, Time to Peak HRR, and Peak HRR for Polyurethane Foam Tested at ATF [13].</b>				
<b>Sample ID</b>	<b>External Thermal Flux kW/m<sup>2</sup></b>	<b>Time to Sustained Ignition, Seconds</b>	<b>Time to Peak Heat Release Rate, Seconds</b>	<b>Peak Heat Release Rate kW/m<sup>2</sup></b>
03F0011-01	20	9	35	257
03F0011-02	20	8	39	267
03F0011-03	20	11	37	257
<b>Average</b>		<b>9</b>	<b>37</b>	<b>260</b>
03F0011-04	40	2	29	301
03F0011-05	40	3	31	291
03F0011-06	40	3	32	298
<b>Average</b>		<b>3</b>	<b>31</b>	<b>297</b>
03F0011-07	60	1	25	453
03F0011-08	60	2	29	415
03F0011-09	60	1	25	377
<b>Average</b>		<b>1</b>	<b>26</b>	<b>415</b>

## **D.2.6 Polyether Polyurethane Foam Tested by Jayakody et al. [ 7]**

Jayakody et al.[7] conducted cone calorimetry tests on polyether polyurethane foam to examine the impact or effectiveness of different fire retardant chemical additives. The baseline or "control" foam for this set of experiments was a polyether polyurethane foam. For the non-fire retardant foam, the paper only identified one test at 25 kW/m<sup>2</sup> and one test at 35 kW/m<sup>2</sup>, so only one value of time to sustained ignition and the peak heat release is reported for each flux exposure in Table D-5. Foams with 17 different additives were exposed to heat fluxes of 25 kW/m<sup>2</sup>, while samples with 15 different additives were tested at 35 kW/m<sup>2</sup>. Since there were a wide range of additives for the fire retardant foams, 17 tests at 25 kW/m<sup>2</sup> and 15 tests at 35 kW/m<sup>2</sup>, the values for all the tests were averaged and the range of values and average values were tabulated in Table D-5.

Overall, the limited data for non-fire retardant polyether polyurethane foam collected by Jayakody et al. appear closer to the results of the NIST polyether polyurethane test than to the foam data collected by ATF.

### **(i) Non-Fire Retardant Foam**

For the 25 kW/m<sup>2</sup> flux exposure the baseline polyether foam (non-fire retardant) required 16 seconds for sustained ignition which is more than the 14 seconds the NIST polyether foam required at 20 kW/m<sup>2</sup>. For the Jayakody foam (non-fire retardant), the average peak heat release rate at 25 kW/m<sup>2</sup>, 412 kW/m<sup>2</sup>, was slightly less than the peak release rate for the NIST foam, 450 kW/m<sup>2</sup>. The 35 kW/m<sup>2</sup> heat flux exposure for the non-fire retardant foam resulted in a peak heat release rate of rate of 563 kW/m<sup>2</sup>, about the same as that observed for the NIST polyether foam.

### **(ii) Fire Retardant Foam**

It is important to note that the NIST fire retardant foam was a polyester polyurethane foam while the Jayakody fire retardant foams were a combination of polyether polyurethane and chemical additives. The 25 kW/m<sup>2</sup> heat flux exposure for the fire retardant foam resulted in an average peak heat release rate of 337 kW/m<sup>2</sup> with a range of 234 kW/m<sup>2</sup> to 465 kW/m<sup>2</sup>. The average time to ignition was 20 seconds with a range of 11 seconds to 28 seconds. At the higher heat flux exposure of 35 kW/m<sup>2</sup>, average time to ignition was 9 seconds with a range of 5 seconds to 14 seconds. The fire retardant foam tested by NIST averaged about 13 seconds to ignition, slightly longer than the average of Jayakody foams, but still with the range of values for the Jayakody foams. At the higher heat flux, average peak heat release rate was 501 kW/m<sup>2</sup>, with a wide range of 241 kW/m<sup>2</sup> to 870 kW/m<sup>2</sup>. The average peak heat release rate for the NIST polyester polyurethane foam was 453 kW/m<sup>2</sup>, which was lower than the average value of the Jayakody foams, but again still within the range that was exhibited by the Jayakody foams.

## **D.2.7 Test Results -- Acoustical Ceiling Tiles**

A suspended or dropped ceiling had been installed in the nightclub except for in the sunroom, the raised platform (stage) area, and the dance floor areas (refer to Fig. 4-3). Each 0.61 m (2 ft) x 1.22 m (4 ft) x .016 m (0.625 in) panel had been installed or dropped into a metal grid support system. Photographs of the nightclub interior clearly demonstrate that the ceiling tiles had been painted black. It was not clear from the photographs whether the paint had been applied by brush, roller, or spray can. The surface of the tiles had a glittery appearance that may have been a result of the wet paint being dusted with glitter or sparkle dust. Some of the glitter would have become partially embedded in the wet paint and would have

<b>Table D-5 Time to Sustained Ignition, Time to Peak HRR, and Peak HRR for Polyurethane Foam Tested by Jakakody et al. [7]</b>					
<b>Sample ID</b>	<b>External Thermal Flux kW/m<sup>2</sup></b>	<b>Range of Times to Sustained Ignition, Seconds</b>	<b>Average of Times to Sustained Ignition, Seconds</b>	<b>Range of Peak Heat Release Rates, kW/m<sup>2</sup></b>	<b>Average of Peak Heat Release Rates kW/m<sup>2</sup></b>
Non Fire Retardant Polyether PUF CJ4-8	25	16	-	-	412
Non Fire Retardant Polyether PUF CJ4-8	35	7	-	-	563
Fire Retardant Polyether PUF Multiple Additives*	25	11 to 39	20	234 to 465	337
Fire Retardant Polyether PUF Multiple Additives**	35	5 to 14	9	241 to 870	501
* Polyether polyurethane foam with a range of 17 fire retardant chemical additives. Details provided in Jakakody et al. [7]					
** Polyether polyurethane foam with a range of 15 fire retardant chemical additives.					



**Figure D-16. Photograph of Acoustical Tile Showing Factory Painted Surface.**

provided a more glittery or sparkling appearance that was observed in some of the video of the nightclub interior.

Labeling found on a surviving acoustical tile indicated that the surviving tile was a mineral fiber type of material, a 942 (residential coding) or 755 (commercial coding). Samples of 942B acoustical tiles were purchased from a local supplier for these cone calorimeter tests. The front side of each panel (Figure D-16) exhibited a factory-applied coat of white vinyl-latex paint while the rear side of each panel was unpainted. Samples that measured 0.1 m x 0.1 m were cut from the larger panels. These samples were then stored in a controlled humidity (50 % relative humidity) and temperature (23 °C) room for at least two weeks. Each sample was wrapped in an aluminum foil, except for the exposed side, and positioned in the cone calorimeter. In all tests, the painted side was exposed to the thermal flux.

Three test samples were exposed to thermal flux at 35 kW/m<sup>2</sup>. Each test was terminated after 3 min of exposure when none of the three samples ignited (Table D-6). An additional three test samples were exposed to thermal flux at 70 kW/m<sup>2</sup>. The heat release rate for each sample is plotted versus time in Figure D-17. The heat release curves show an initial peak, a period of decline, and then a second peak.

The second peak was observed because as the material initially burns, some of the energy released by the combustion process is lost or conducted away into the unburned portion of the sample. As the test continued, the temperature of the unburned sample gradually increased with the continual heating from either the external flux or the combustion of the fuel itself. Eventually, the temperature of the material increased to the point where much less energy is lost through conduction. At this point, the energy, which was previously being conducted away, became available to increase the pyrolysis and subsequent burning of the fuel. This increase in the pyrolysis and burning resulted in a second peak in the heat release rate. Sometimes, if a sample contained some components that would ignite at a substantially lower temperature, these components would burn first and other components that had a higher ignition temperature would remain. As the sample temperature continued to increase and eventually reached the ignition temperature of the remaining components, even the higher ignition temperature fuel would begin to burn. This additional burning would have caused an increase in the heat release rate at some time after the initial peak due to the burning of the low temperature components.

When exposed to 35 kW/m<sup>2</sup> of external heat flux, the ceiling tiles did not ignite. As the thermal flux was increased to 70 kW/m<sup>2</sup>, ignition did occur and the samples reached their peak heat release rate in approximately 20 seconds. Peak heat release rates for all three ceiling tile samples ranged from 55 kW/m<sup>2</sup> to 61 kW/m<sup>2</sup> with an average of 57 kW/m<sup>2</sup>.

### **D.2.8 Wood Paneling**

Wood paneling had been installed in the nightclub around the raised platform area, around the sunroom, back bar area, and entry way (Figure 4-4). It is not clear whether or not there were any areas where polyurethane foam had been installed over wood paneling. Interior photographs of the nightclub did not provide sufficient information to identify the specific brand or type of paneling.

A veneer type paneling, which utilizes a plywood substrate, was selected as being most representative of the fuel load contributed by the paneling. The wood paneling was purchased from a local retailer in 1.22m (4 ft) x 2.44 m (8 ft) sheets. The 0.0005 m (0.0125 in) birch veneer was laminated to a 0.005 m (0.25 in) thick three-ply Luan mahogany backer layer. The front side of each panel (Figure D-18) had a glossy coat of finish while the rear side of each panel was unfinished plywood. Samples that measured 0.1 m x 0.1 m were cut from the larger panels. These samples were then stored in a controlled humidity (50 % relative humidity) and temperature (23 °C) room for at least two weeks. Then, each sample was

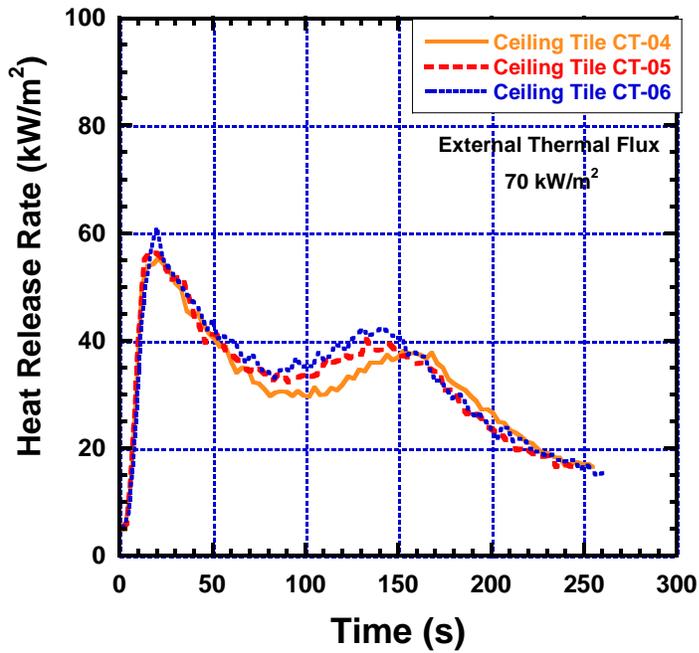


Figure D-17. Heat Release Rate versus Time for Ceiling Tile Exposed to 70 kW/m<sup>2</sup> of External Heat Flux. Samples are CT-04, CT-05, and CT06.



Figure D-18. Photograph of Wood Panel Sample Showing Veneer Surface.

wrapped in an aluminum foil, except for the exposed side, and positioned in the cone calorimeter. In all tests, veneer side was exposed to the thermal flux.

When exposed to  $35 \text{ kW/m}^2$  of external heat flux, the wood paneling reached its average peak heat release rate,  $440 \text{ kW/m}^2$  in approximately  $130 \text{ s}$  (Figure D-19). Peak heat release rates for all three wood samples ranged from  $413 \text{ kW/m}^2$  to  $460 \text{ kW/m}^2$ . At the lower thermal flux, each sample required about  $40$  seconds to achieve sustained ignition. At the higher flux rate of  $70 \text{ kW/m}^2$ , the wood panel samples required much less time, on average  $15$  seconds, to sustain ignition (Figure D-20). The higher external flux resulted in a higher average peak heat release rate of  $530 \text{ kW/m}^2$ , but required substantially less time,  $85$  seconds, to achieve the peak value.

The heat release curves exhibited a two-peak shape, with the second peak much greater than the first peak. Each wood panel sample charred significantly as it burned and the char represented a greater fraction of the total available fuel than that which was burned early in the test. In the higher thermal flux exposure, the additional flux caused more of the fuel to be burned early in the test, so the two peaks were closer in value.

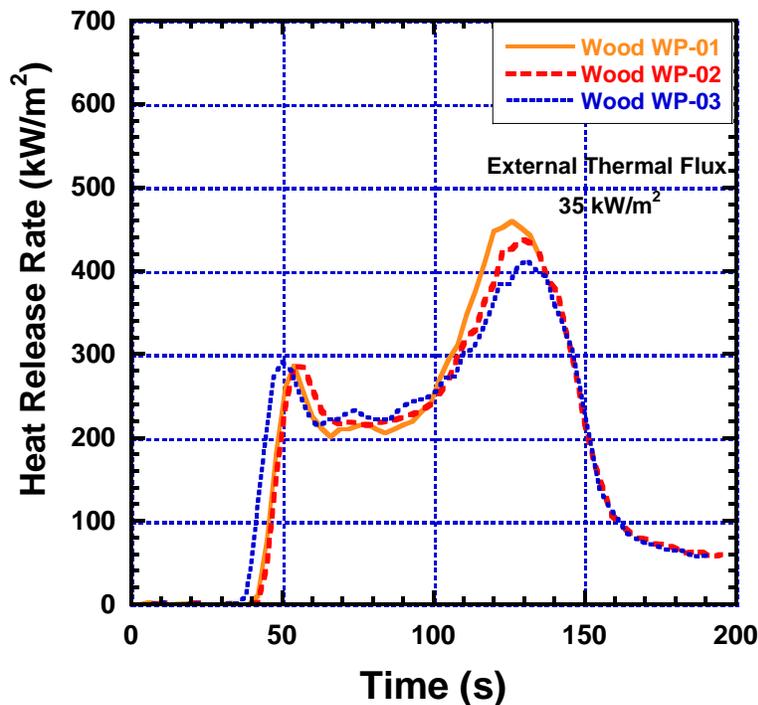
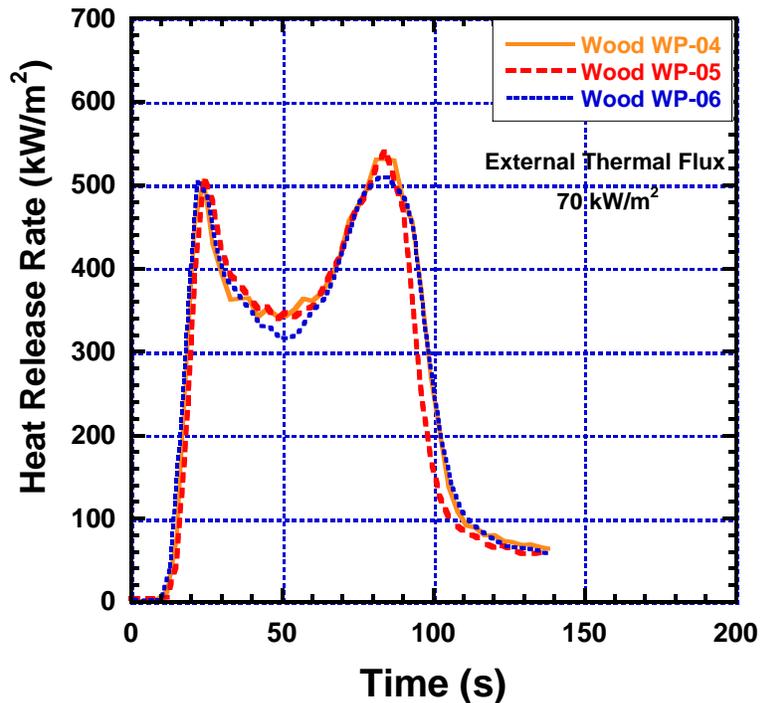


Figure D-19. Heat Release Rate versus Time for Wood Paneling Exposed to  $35 \text{ kW/m}^2$  of External Heat Flux (WP). Samples are WP-01, WP-02, and WP-03.



**Figure D-20. Heat Release Rate versus Time for Wood Paneling Exposed to 70 kW/m<sup>2</sup> of External Heat Flux (WP). Samples are WP-04, WP-05, and WP-06.**

### D.2.9 Test Results -- Carpet Flooring

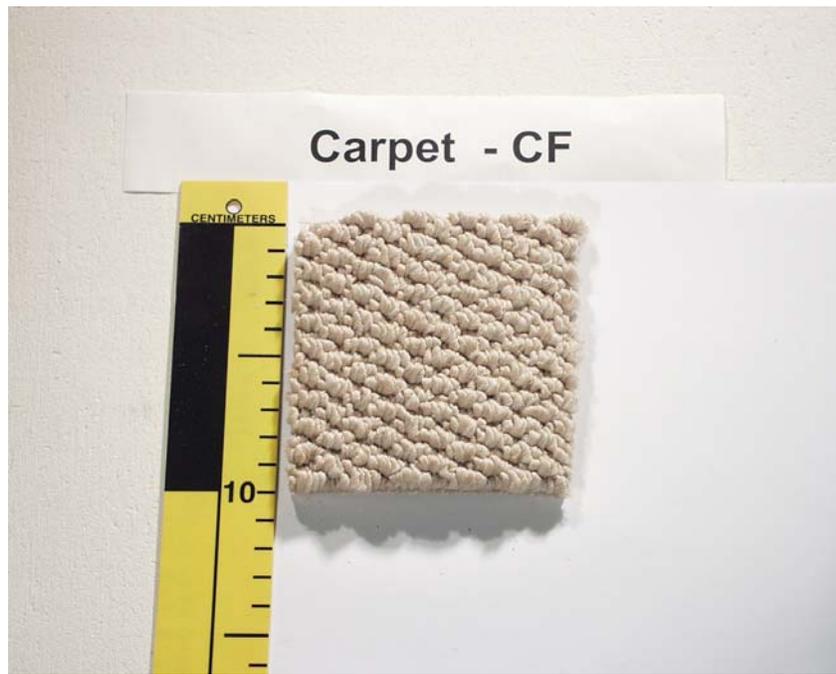
Carpet flooring had been installed in the nightclub on the elevated section along the rear wall and around the raised platform area. (Figure 4-5). Interior photographs of the nightclub did not provide sufficient information to identify the specific brand or type of carpeting.

A closed-loop olefin carpet with a binding layer was selected as representing the fuel load contributed by the carpeting. The carpet was purchased from a local supplier in a 3.2 m (12 ft) wide x 15.7 m (50 ft) long continuous roll. The 0.006 m (0.25 in) nylon pile was embedded in a 0.002 m (0.1 in) thick binding layer. Samples that measured 0.1 m x 0.1 m were cut from the roll (Figure D-21). These samples were then stored in a controlled humidity (50 % relative humidity) and temperature (23 °C) room for at least two weeks. Then each sample was wrapped in an aluminum foil, except for the exposed side, and positioned in the cone calorimeter. In all tests, the olefin pile side was exposed to the thermal flux.

When exposed to 35 kW/m<sup>2</sup> of external heat flux (Figure D-22), the peak heat release rates for the three carpet samples ranged from 474 kW/m<sup>2</sup> to 718 kW/m<sup>2</sup>. The carpet required about 54 seconds, on average, to achieve sustained ignition, and approximately 190 seconds to reach its peak heat release rate (Figure D-22). Three additional test samples were exposed to thermal flux at 70 kW/m<sup>2</sup> (Figure D-23) when exposed to the higher external heat flux, the carpeting reached its peak heat release rate in about

half the time. Peak heat release rates for all three-carpet samples ranged from 1290 kW/m<sup>2</sup> to 1450 kW/m<sup>2</sup>, with an average of 1370 kW/m<sup>2</sup>.

For the lower flux exposure, the heat release curve exhibited a relatively brief step at around 200 kW/m<sup>2</sup> and then increased gradually to a single broad peak. As the carpet initially began to burn, some of the energy released was conducted into the olefin pile, but instead of producing a char, the polymer melted and formed a more uniform density fuel. As the burning continued, it increased at a relatively steady rate, reached its peak and decreased at a more rapid rate. At the higher flux exposure, the additional energy from the internal heating caused the melting to occur more rapidly, so the initial step seen at the lower flux was not observed.



**Figure D-21. Photograph of Carpet Sample Showing Olefin Pile.**

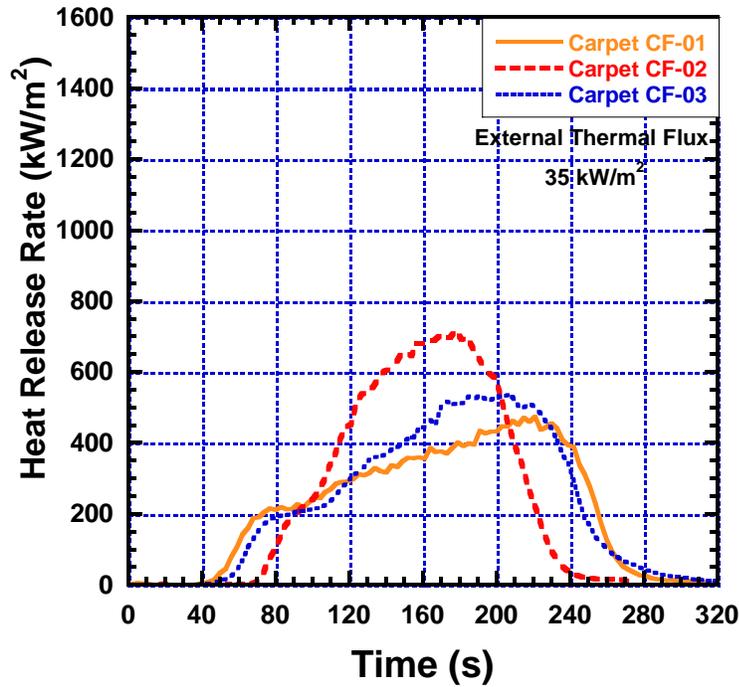


Figure D-22. Heat Release Rate versus Time for Carpet Sample Exposed to 35 kW/m<sup>2</sup> of External Heat Flux (CF). Samples are CF-01, CF-02, and CF-03.

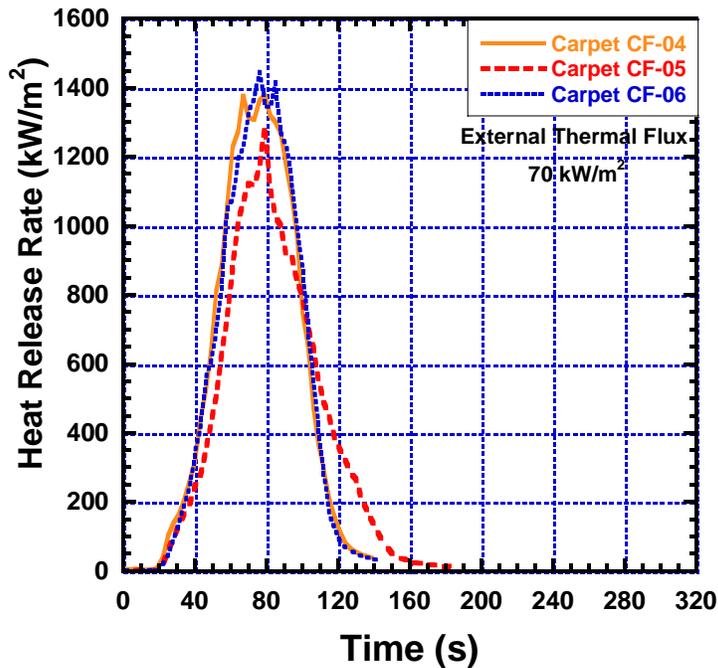


Figure D-23. Heat Release Rate versus Time for Carpet Sample Exposed to 70 kW/m<sup>2</sup> of External Heat Flux (CF). Samples are CF-04, CF-05, and CF-06.

<b>Table D-6 Cone Calorimeter Results for Ceiling Tile, Wood Panels, &amp; Carpet</b>				
<b>Sample ID</b>	<b>External Thermal Flux, kW/m<sup>2</sup></b>	<b>Time to Sustained Ignition, seconds</b>	<b>Time to Peak Heat Release Rate, seconds</b>	<b>Peak Heat Release Rate kW/m<sup>2</sup></b>
CT-01	30	Did not ignite		
CT-02	30	Did not ignite		
CT-03	30	Did not ignite		
CT-04	70	9	21	55
CT-05	70	7	19	56
CT-06	70	8	20	61
<b>Average</b>		<b>8</b>	<b>20</b>	<b>57</b>
WP-01	35	43	126	460
WP-02	35	43	129	439
WP-03	35	37	131	413
<b>Average</b>		<b>41</b>	<b>129</b>	<b>437</b>
WP-04	70	14	84	531
WP-05	70	16	84	543
WP-06	70	14	85	509
<b>Average</b>		<b>15</b>	<b>85</b>	<b>526</b>
CF-01	35	38	221	474
CF-02	35	68	178	718
CF-03	35	40	206	536
<b>Average</b>		<b>54</b>	<b>192</b>	<b>627</b>
CF-04	70	20	79	1378
CF-05	70	19	79	1289
CF-06	70	20	76	1447
<b>Average</b>		<b>20</b>	<b>78</b>	<b>1371</b>

### D.3 SUMMARY TABLES

The materials that were tested and the sample identifiers that were used throughout the cone calorimeter test series are listed in Table D-7. The data that were collected is summarized in Tables D-8 through D-20. The data tables provide the time to sustained ignition, peak heat release rate, time to peak heat release rate, total heat release, 60 s average heat release rate, total mass loss, average mass loss rate, average effective heat of combustion, average smoke yield, average carbon dioxide yield, average carbon monoxide yield, time to ignition, time to flameout, and a number of specimen properties. Each table groups a specific material that was exposed to a specific external heat flux.

<b>Table D-7. Material Identification for Cone Calorimeter Experiments</b>			
Sample ID	Material	Fire Retardant/Non-Retardant	Description
PUF-FR	Polyurethane Foam (Ester)	Fire Retardant	Convolute / Egg Crate Gray Color
PUF-NFR-A	Polyurethane Foam (Ether)	Non-Fire Retardant	Convolute / Egg Crate Gray Color- Lot A
PUF-NFR-B	Polyurethane Foam (Ether)	Non-Fire Retardant	Convolute / Egg Crate Gray Color- Lot B
CT-FR	Ceiling Tile	Fire Retardant	942 B (Commercial Equivalent 755) Textured
WP	Wood Paneling	Non-Fire Retardant	5 mm thick Plywood Substrate Antique Birch Finish
CF	Carpet	Non-Fire Retardant	100% Filament Olefin Color: Pottery (Beige)

**Table D-8. Cone Calorimeter Data for Polyurethane Foam at 35 kW/m<sup>2</sup> (PUF-NFR-A).**

<b>Polyurethane Foam</b>	<b>PUF-NFR- A-01</b>	<b>PUF-NFR- A-2</b>	<b>PUF-NFR- A-3</b>	<b>Average</b>
External Heat Flux 35 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	9.00	7	6	<b>7.3</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	620	676	520	<b>605</b>
Time to Peak Heat Release Rate (s):	32.0	30	28	<b>30.0</b>
Total Heat Release (MJ/m <sup>2</sup> ):	15.6	16.3	15.4	<b>15.8</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	262	268	248	<b>259</b>
Total Mass Loss (g):	6.25	6.2	5.94	<b>6.13</b>
Average Mass Loss Rate (g/s):	0.174	0.148	0.117	<b>0.146</b>
Average Effective Heat of Combustion (MJ/kg):	24.9	26.4	25.9	<b>25.7</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	206	285	235	<b>242</b>
Average CO <sub>2</sub> yield (g/g):	1.56	1.88	2.03	<b>1.8</b>
Average CO yield (g/g):	0.0136	0.0112	0.0129	<b>0.0126</b>
Specimen:				
Initial mass (g):	9.3	9.2	9.8	<b>9.4</b>
Thickness (mm):	25	25	25	<b>25.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100.0</b>
Test start time (s):	123	89	79	<b>97.0</b>
Time to ignition (s):	9	7	6	<b>7.3</b>
Time to flameout (s):	46	48	55	<b>49.7</b>

**Table D-9. Cone Calorimeter Data for Fire Retardant Polyurethane Foam at 20 kW/m<sup>2</sup> (PUF-NFR-B).**

<b>Polyurethane Foam</b>	<b>PUF-NFR- B-13</b>	<b>PUF-NFR- B-14</b>	<b>PUF-NFR- B-15</b>	<b>Average</b>
External Heat Flux 20 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	8	12	22	<b>14.0</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	457	437	456	<b>450</b>
Time to Peak Heat Release Rate (s):	41	44	50	<b>45.0</b>
Total Heat Release (MJ/m <sup>2</sup> ):	9.87	10.33	10.0	<b>10.1</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	206	205	192	<b>201</b>
Total Mass Loss (g):	4.55	4.48	4.05	<b>4.4</b>
Average Mass Loss Rate (g/s):	0.114	0.118	0.11	<b>0.114</b>
Average Effective Heat of Combustion (MJ/kg):	21.7	23.0	24.8	<b>23.2</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	323	343	385	<b>350</b>
Average CO <sub>2</sub> yield (g/g):	0	0	0	<b>0</b>
Average CO yield (g/g):	0.0103	0.012	0.0135	<b>0.0119</b>
Specimen:				
Initial mass (g):	6.7	6.7	6.7	<b>6.7</b>
Thickness (mm):	25	25	25	<b>25.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	82	92	83	<b>85.7</b>
Time to ignition (s):	8	12	22	<b>14.0</b>

**Table D-10a. Cone Calorimeter Data for Polyurethane Foam at 35 kW/m<sup>2</sup> (PUF-NFR-B).  
Data and Averages are continued in Table D-9b.**

<b>Polyurethane Foam</b>	<b>PUF-NFR- B-01</b>	<b>PUF-NFR- B-02</b>	<b>PUF-NFR- B-03</b>	<b>PUF-NFR- B-04</b>
External Heat Flux 36 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	4	5	9	5
Peak Heat Release Rate (kW/m <sup>2</sup> ):	519	532	541	577
Time to Peak Heat Release Rate (s):	26	26	33	32
Total Heat Release (MJ/m <sup>2</sup> ):	11.0	11.2	11.9	10.7
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	213	228	203	213
Total Mass Loss (g):	4.47	4.43	4.31	4.27
Average Mass Loss Rate (g/s):	0.135	0.148	0.13	0.142
Average Effective Heat of Combustion (MJ/kg):	24.7	25.4	27.5	25.0
Average Smoke Extinction Area (m <sup>2</sup> /kg):	354	345	331	379
Average CO <sub>2</sub> yield (g/g):	0.86	0.87	1.3	0.91
Average CO yield (g/g):	0.0064	0.0071	0.0094	0.0111
Specimen:				
Initial mass (g):	9.1	9.3	9.5	9.2
Thickness (mm):	30	30	30	25
Surface area (cm <sup>2</sup> ):	100	100	100	100
Test start time (s):	87	75	74	84
Time to ignition (s):	4	5	9	5
Time to flameout (s):	37	37	44	36

**Table D-10b. Cone Calorimeter Data for Polyurethane Foam at 35 kW/m<sup>2</sup> (PUF-NFR-B).  
Data and Averages are continued from Table D-9a.**

<b>Polyurethane Foam</b>	<b>PUF-NFR- B-05</b>	<b>PUF-NFR- B-06</b>	<b>Average (for PUF-NFR-B -01 through -06)</b>
External Heat Flux 36 kW/m <sup>2</sup>			
Test Results:			
Time to Sustained Ignition (s):	5	5	<b>5.5</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	637	644	<b>575</b>
Time to Peak Heat Release Rate (s):	29	32	<b>29.7</b>
Total Heat Release (MJ/m <sup>2</sup> ):	11.0	10.2	<b>11.0</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	211	211	<b>213</b>
Total Mass Loss (g):	4.43	4.51	<b>4.4</b>
Average Mass Loss Rate (g/s):	0.148	0.15	<b>0.142</b>
Average Effective Heat of Combustion (MJ/kg):	24.8	22.7	<b>25.0</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	489	326	<b>371</b>
Average CO <sub>2</sub> yield (g/g):	0.89	0.69	<b>0.92</b>
Average CO yield (g/g):	0.0103	0.0073	<b>0.0086</b>
Specimen:			
Initial mass (g):	9	9.2	<b>9.2</b>
Thickness (mm):	25	25	<b>27.5</b>
Surface area (cm <sup>2</sup> ):	100	100	<b>100</b>
Test start time (s):	81	78	<b>79.8</b>
Time to ignition (s):	5	5	<b>5.5</b>
Time to flameout (s):	35	36	<b>37.5</b>

**Table D-11. Cone Calorimeter Data for Fire Retardant Polyurethane Foam at 40 kW/m<sup>2</sup> (PUF-NFR-B).**

<b>Polyurethane Foam</b>	<b>PUF-NFR- B-16</b>	<b>PUF-NFR- B-17</b>	<b>PUF-NFR- B-18</b>	<b>Average</b>
External Heat Flux 40 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	4	3	4	<b>3.7</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	706	878	877	<b>820</b>
Time to Peak Heat Release Rate (s):	28	30	29	<b>29</b>
Total Heat Release (MJ/m <sup>2</sup> ):	10.6	8.87	9.78	<b>9.8</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	219	239	242	<b>233</b>
Total Mass Loss (g):	4.67	4.64	4.48	<b>4.6</b>
Average Mass Loss Rate (g/s):	0.156	0.172	0.166	<b>0.165</b>
Average Effective Heat of Combustion (MJ/kg):	22.8	19.1	21.8	<b>21.2</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	264	372	320	<b>319</b>
Average CO <sub>2</sub> yield (g/g):	0.04	0	0	<b>0.01</b>
Average CO yield (g/g):	0.0108	0.007	0.0081	<b>0.0086</b>
Specimen:				
Initial mass (g):	0.7	6.8	6.7	<b>4.7</b>
Thickness (mm):	25	25	25	<b>25</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	81	84	81	<b>82</b>
Time to ignition (s):	4	3	4	<b>3.7</b>

**Table D-12. Cone Calorimeter Data for Fire Retardant Polyurethane Foam at 60 kW/m<sup>2</sup> (PUF-NFR-B).**

<b>Polyurethane Foam</b>	<b>PUF-NFR- B-19</b>	<b>PUF-NFR- B-20</b>	<b>PUF-NFR- B-21</b>	<b>Average</b>
External Heat Flux 60 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	4	3	3	<b>3.3</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	993	1170	1299	<b>1154</b>
Time to Peak Heat Release Rate (s):	24	24	23	<b>24</b>
Total Heat Release (MJ/m <sup>2</sup> ):	11.5	14.5	7.49	<b>11.2</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	252	268	264	<b>261</b>
Total Mass Loss (g):	4.54	4.43	4.28	<b>4.4</b>
Average Mass Loss Rate (g/s):	0.189	0.153	0.225	<b>0.189</b>
Average Effective Heat of Combustion (MJ/kg):	25.2	32.8	17.5	<b>25.2</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	330	342	319	<b>330</b>
Average CO <sub>2</sub> yield (g/g):	0	0.74	0	<b>0.25</b>
Average CO yield (g/g):	0.0118	0.0302	0.0043	<b>0.0154</b>
Specimen:				
Initial mass (g):	6.8	6.8	6.7	<b>6.8</b>
Thickness (mm):	25	25	25	<b>25</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	85	84	96	<b>88</b>
Time to ignition (s):	4	3	3	<b>3.3</b>

**Table D-13a. Cone Calorimeter Data for Polyurethane Foam at 70 kW/m<sup>2</sup> (PUF-NFR-B).  
Data and Averages are continued in Table D-12b.**

<b>Polyurethane Foam</b>	<b>PUF-NFR-B-07</b>	<b>PUF-NFR-B-08</b>	<b>PUF-NFR-B-09</b>
External Heat Flux 71 kW/m <sup>2</sup>			
Test Results:			
Time to Sustained Ignition (s):	4	3	3
Peak Heat Release Rate (kW/m <sup>2</sup> ):	806	820	881
Time to Peak Heat Release Rate (s):	18	20	21
Total Heat Release (MJ/m <sup>2</sup> ):	11.8	11.1	13.0
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	248	257	0.84
Total Mass Loss (g):	3.8	4.39	4.35
Average Mass Loss Rate (g/s):	0.181	0.209	0.181
Average Effective Heat of Combustion (MJ/kg):	31.0	25.3	29.8
Average Smoke Extinction Area (m <sup>2</sup> /kg):	429	318	395
Average CO <sub>2</sub> yield (g/g):	0.64	0.35	0.67
Average CO yield (g/g):	0.0085	0.003	0.0073
Specimen:			
Initial mass (g):	9.2	9.1	9.1
Thickness (mm):	30	30	30
Surface area (cm <sup>2</sup> ):	100	100	100
Test start time (s):	104	78	77
Time to ignition (s):	4	3	3
Time to flameout (s):	25	25	27

**Table D-13b. Cone Calorimeter Data for Polyurethane Foam at 70 kW/m<sup>2</sup> (PUF-NFR-B).  
Data and Averages are continued in Table D-12a.**

<b>Polyurethane Foam</b>	<b>PUF-NFR-B-10</b>	<b>PUF-NFR-B-11</b>	<b>Average (PUF-NFR-B -01 to -11)</b>
External Heat Flux 71 kW/m <sup>2</sup>			
Test Results:			
Time to Sustained Ignition (s):	3	3	<b>3.2</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	1083	1094	<b>937</b>
Time to Peak Heat Release Rate (s):	22	20	<b>20.2</b>
Total Heat Release (MJ/m <sup>2</sup> ):	12.6	11.8	<b>12.0</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	264	243	<b>203</b>
Total Mass Loss (g):	4.66	4.49	<b>4.3</b>
Average Mass Loss Rate (g/s):	0.194	0.214	<b>0.196</b>
Average Effective Heat of Combustion (MJ/kg):	27.1	26.2	<b>27.9</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	410	366	<b>384</b>
Average CO <sub>2</sub> yield (g/g):	0.44	0.35	<b>0.49</b>
Average CO yield (g/g):	0.0076	0.0062	<b>0.0065</b>
Specimen:			
Initial mass (g):	9.1	9	<b>9.1</b>
Thickness (mm):	25	25	<b>28.0</b>
Surface area (cm <sup>2</sup> ):	100	100	<b>100</b>
Test start time (s):	91	87	<b>87.4</b>
Time to ignition (s):	3	3	<b>3.2</b>
Time to flameout (s):	26	23	<b>25.2</b>

**Table D-14. Cone Calorimeter Data for Fire Retardant Polyurethane Foam at 35 kW/m<sup>2</sup> (PUF-FR).**

<b>Polyurethane Foam</b>	<b>PUF-FR-01</b>	<b>PUF-FR-02</b>	<b>PUF-FR-03</b>	<b>Average</b>
External Heat Flux 35 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	11.00	11	16	<b>12.7</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	452	432	476	<b>453</b>
Time to Peak Heat Release Rate (s):	35.0	35	37	<b>35.7</b>
Total Heat Release (MJ/m <sup>2</sup> ):	8.69	8.5	8.58	<b>8.6</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	155	150	151	<b>152</b>
Total Mass Loss (g):	5.95	5.86	5.67	<b>5.83</b>
Average Mass Loss Rate (g/s):	0.198	0.178	0.189	<b>0.188</b>
Average Effective Heat of Combustion (MJ/kg):	14.6	14.5	15.13	<b>14.7</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	539	474	542	<b>518</b>
Average CO <sub>2</sub> yield (g/g):	0.61	0.65	0.66	<b>0.6</b>
Average CO yield (g/g):	0.0618	0.0625	0.0623	<b>0.0622</b>
Specimen:				
Initial mass (g):	8.9	8.7	8.7	<b>8.8</b>
Thickness (mm):	25	25	25	<b>25.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	78	75	76	<b>76.3</b>
Time to ignition (s):	11	11	16	<b>12.7</b>
Time to flameout (s):	42	46	46	<b>44.7</b>

**Table D-15. Cone Calorimeter Data for Wood Paneling at 35 kW/m<sup>2</sup> (WP).**

<b>Wood Paneling</b>	<b>WP-01</b>	<b>WP-02</b>	<b>WP-03</b>	<b>Average</b>
External Heat Flux 35 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	43.0	43	37	<b>41.0</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	460	439	413	<b>437</b>
Time to Peak Heat Release Rate (s):	126	129	131	<b>129</b>
Total Heat Release (MJ/m <sup>2</sup> ):	31.2	30.8	30.9	<b>31.0</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	207	0.52	206	<b>138.1</b>
Total Mass Loss (g):	20.7	21.2	21.6	<b>21.1</b>
Average Mass Loss Rate (g/s):	0.187	0.191	0.189	<b>0.189</b>
Average Effective Heat of Combustion (MJ/kg):	15.0	14.6	14.3	<b>14.7</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	94.1	11.27	111.68	<b>72.4</b>
Average CO <sub>2</sub> yield (g/g):	1.48	1.41	1.36	<b>1.42</b>
Average CO yield (g/g):	0.0054	0.0047	0.0043	<b>0.0048</b>
Specimen:				
Initial mass (g):	28.8	28.8	29.3	<b>29.0</b>
Thickness (mm):	6	6	6	<b>6.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	80	77	84	<b>80.3</b>
Time to ignition (s):	43	43	37	<b>41.0</b>
Time to flameout (s):	154	155	151	<b>153</b>

**Table D-16. Cone Calorimeter Data for Wood Paneling at 70 kW/m<sup>2</sup> (WP).**

<b>Wood Paneling</b>	<b>WP-04</b>	<b>WP-05</b>	<b>WP-06</b>	<b>Average</b>
External Heat Flux 70 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	14.00	16	14	<b>14.7</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	531	542	509	<b>528</b>
Time to Peak Heat Release Rate (s):	84.0	84	85	<b>84.3</b>
Total Heat Release (MJ/m <sup>2</sup> ):	35.4	33.1	34.8	<b>34.4</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	348	368	353	<b>356</b>
Total Mass Loss (g):	23.2	21.7	22.8	<b>22.6</b>
Average Mass Loss Rate (g/s):	0.249	0.259	0.254	<b>0.254</b>
Average Effective Heat of Combustion (MJ/kg):	15.3	15.2	15.2	<b>15.2</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	92.8	93.0	95.1	<b>93.6</b>
Average CO <sub>2</sub> yield (g/g):	1.47	1.43	1.43	<b>1.44</b>
Average CO yield (g/g):	0.0056	0.0055	0.0055	<b>0.0055</b>
Specimen:				
Initial mass (g):	30	28.6	29.5	<b>29.4</b>
Thickness (mm):	6	6	6	<b>6.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	86	83	79	<b>82.7</b>
Time to ignition (s):	14	16	14	<b>14.7</b>
Time to flameout (s):	105	99	104	<b>103</b>

**Table D-17. Cone Calorimeter Data for Ceiling Tile at 35 kW/m<sup>2</sup> (CT).**

<b>Ceiling Tile</b>	<b>CT-01</b>	<b>CF-02</b>	<b>CT-03</b>	<b>Average</b>
External Heat Flux 35 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	Did not ignite	Did not ignite	Did not ignite	
Peak Heat Release Rate (kW/m <sup>2</sup> ):	Did not ignite	Did not ignite	Did not ignite	
Time to Peak Heat Release Rate (s):	Did not ignite	Did not ignite	Did not ignite	
Total Heat Release (MJ/m <sup>2</sup> ):	Did not ignite	Did not ignite	Did not ignite	
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	Did not ignite	Did not ignite	Did not ignite	
Total Mass Loss (g):	Did not ignite	Did not ignite	Did not ignite	
Average Mass Loss Rate (g/s):	Did not ignite	Did not ignite	Did not ignite	
Average Effective Heat of Combustion (MJ/kg):	Did not ignite	Did not ignite	Did not ignite	
Average Smoke Extinction Area (m <sup>2</sup> /kg):	Did not ignite	Did not ignite	Did not ignite	
Average CO <sub>2</sub> yield (g/g):	Did not ignite	Did not ignite	Did not ignite	
Average CO yield (g/g):	Did not ignite	Did not ignite	Did not ignite	
Specimen:				
Initial mass (g):	33.8	33.5	33.5	<b>33.6</b>
Thickness (mm):	15	15	15	<b>15.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100.0</b>
Test start time (s):	83	84	112	<b>93.0</b>
Time to ignition (s):	Did not ignite	Did not ignite	Did not ignite	
Time to flameout (s):	Did not ignite	Did not ignite	Did not ignite	

**Table D-18. Cone Calorimeter Data for Ceiling Tile at 70 kW/m<sup>2</sup> (CT).**

<b>Ceiling Tile</b>	<b>CT-04</b>	<b>CT-05</b>	<b>CT-06</b>	<b>Average</b>
External Heat Flux 70 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	9.00	7	8	<b>8.0</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	55.4	56.4	61.0	<b>57.6</b>
Time to Peak Heat Release Rate (s):	21.0	19	20	<b>20.0</b>
Total Heat Release (MJ/m <sup>2</sup> ):	7.52	7.15	7.79	<b>7.5</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	44.3	44.5	45.2	<b>44.7</b>
Total Mass Loss (g):	6.54	6.68	6.76	<b>6.66</b>
Average Mass Loss Rate (g/s):	0.031	0.036	0.033	<b>0.033</b>
Average Effective Heat of Combustion (MJ/kg):	11.5	10.7	11.5	<b>11.2</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	1.64	0	23.3	<b>8.3</b>
Average CO <sub>2</sub> yield (g/g):	0.00	0	0.0339	<b>0.0113</b>
Average CO yield (g/g):	0.0411	0.0252	0	<b>0.0221</b>
Specimen:				
Initial mass (g):	33.8	34.2	34.1	<b>34.0</b>
Thickness (mm):	15	15	15	<b>15.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	95	91	105	<b>97.0</b>
Time to ignition (s):	9	7	8	<b>8.0</b>
Time to flameout (s):	221	194	213	<b>209</b>

**Table D-19. Cone Calorimeter Data for Carpet Flooring at 35 kW/m<sup>2</sup> (CF).**

<b>Carpet Flooring</b>	<b>CF-01</b>	<b>CF-02</b>	<b>CF-03</b>	<b>Average</b>
External Heat Flux 35 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	38	68	40	<b>48.7</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	474	718	536	<b>576</b>
Time to Peak Heat Release Rate (s):	221	178	206	<b>202</b>
Total Heat Release (MJ/m <sup>2</sup> ):	67.6	71.4	71.8	<b>70.3</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	139	246	111	<b>166</b>
Total Mass Loss (g):	12.2	16.6	18.0	<b>15.6</b>
Average Mass Loss Rate (g/s):	0.052	0.102	0.068	<b>0.074</b>
Average Effective Heat of Combustion (MJ/kg):	55.3	43.1	40.0	<b>46.1</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	1118	792	816	<b>908</b>
Average CO <sub>2</sub> yield (g/g):	3.87	3.07	2.86	<b>3.27</b>
Average CO yield (g/g):	0.0584	0.0437	0.0424	<b>0.0482</b>
Specimen:				
Initial mass (g):	28.7	29.2	30.2	<b>29.4</b>
Thickness (mm):	11	11	11	<b>11.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	111	79	84	<b>91.3</b>
Time to ignition (s):	38	68	40	<b>48.7</b>
Time to flameout (s):	272	229	302	<b>267</b>

**Table D-20. Cone Calorimeter Data for Carpet Flooring at 70 kW/m<sup>2</sup> (CF).**

Carpet Flooring	CF-04	CF-05	CF-06	Average
External Heat Flux 70 kW/m <sup>2</sup>				
Test Results:				
Time to Sustained Ignition (s):	20.0	19	20	<b>19.7</b>
Peak Heat Release Rate (kW/m <sup>2</sup> ):	1378	1288	1447	<b>1371</b>
Time to Peak Heat Release Rate (s):	79.0	79	76	<b>78.0</b>
Total Heat Release (MJ/m <sup>2</sup> ):	74.6	70.0	73.4	<b>72.6</b>
60 s Average Heat Release Rate (kW/m <sup>2</sup> ):	706	548	677	<b>644</b>
Total Mass Loss (g):	17.0	16.6	20.8	<b>18.2</b>
Average Mass Loss Rate (g/s):	0.172	0.132	0.224	<b>0.176</b>
Average Effective Heat of Combustion (MJ/kg):	43.84	41.94	35.28	<b>40.4</b>
Average Smoke Extinction Area (m <sup>2</sup> /kg):	842.12	987.34	768.5	<b>866.0</b>
Average CO <sub>2</sub> yield (g/g):	3.36	3.13	2.6	<b>3.03</b>
Average CO yield (g/g):	0.0581	0.0531	0.0457	<b>0.0523</b>
Specimen:				
Initial mass (g):	28.9	29.7	29.4	<b>29.3</b>
Thickness (mm):	11	11	11	<b>11.0</b>
Surface area (cm <sup>2</sup> ):	100	100	100	<b>100</b>
Test start time (s):	91	91	85	<b>89.0</b>
Time to ignition (s):	20	19	20	<b>19.7</b>
Time to flameout (s):	120	147	112	<b>126</b>

#### **D.4 IGNITION TEMPERATURE TESTS**

Ignition temperatures for polyurethane plastics were required for simulation of the mockup experiments and then for the simulation of the full nightclub. ASTM D 1929 [3] provides a laboratory determination of the spontaneous ignition temperature (SIT) and flash ignition temperature (FIT) for plastics.

Southwest Research Institute (SwRI) was contracted to conduct analyses on PUF-NFR-B samples to determine ignition temperatures. This is the same polyurethane foam that was installed in the full-scale mockup. The results of the SIT tests were used in the computer fire model simulation of the mockup tests.

The report from SwRI included in this appendix describes the test protocol as well as the test results for the foam samples.

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**ASTM D 1929 – 96 (Reapproved 2001)**

**Standard Test Method for  
Determining Ignition Temperature of Plastics**

**Material ID: PUF-NFR-B**

**Final Report**

**SwRI® Project No.: 01.10934.01.602a[1]**

**Consisting of 5 Pages**

**Test Date: October 14, 2004**

**Report Date: June 9, 2005**

**Prepared for:**

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### **Sample Identification and Preparation**

The National Institute of Standards and Testing (NIST), located in Gaithersburg, Maryland, provided a material identified as PUF-NFR-B for testing in accordance with ASTM D 1929. The material was described by the Client as “Polyurethane foam, convoluted, ether non-fire retardant” and was gray in color. Per NIST, the density of the material was 22 kg/m<sup>3</sup>. The material consisted of peaks and valleys with the peaks measuring 29 mm and the valleys measuring 10 mm. The material was received at SwRI on October 11, 2004. Upon receipt, samples were prepared for testing and conditioned in a controlled environment maintained at 23 ± 2°C (73 ± 5°F) and 50 ± 5% relative humidity for not less than 40 hours prior to testing. Tests were conducted October 14, 2004.

Sample preparation was in general accordance with ASTM D 1929. Because the density of the material was less than 100 kg/m<sup>3</sup>, the test samples were prepared according to size instead of the normal 3-g weight. In accordance with ASTM D 1929, each test specimen was cut to 20 × 20 mm. Due to the uneven shape of the material (see Figure 1), the required height of 50 mm could not be achieved by stacking the samples and the 20 × 20-mm samples were left at the 10-29 mm height.

### **Results**

Table 1 contains the results for the material provided by NIST. Test results are accurate to ± 5°C. A complete set of results and observations are presented at the end of this report. These test results relate only to the behavior of test specimens under the particular conditions of the test. They are not intended to be used, and shall not be used, to assess the potential fire hazards of a material in use.

**Table 1. Ignition Temperature Data.**

<b>Material ID</b>	<b>SIT</b>	<b>FIT</b>
PUF-NFR-B	410 °C	370 °C
	770 °F	698 °F

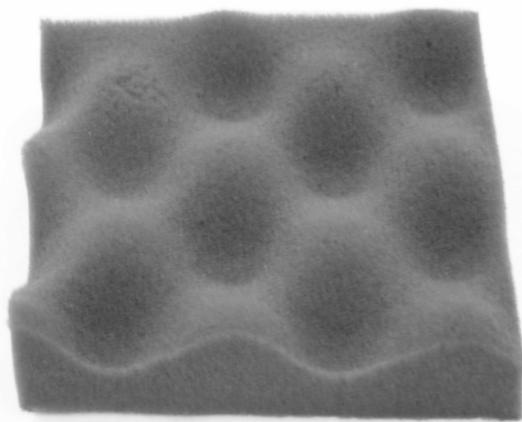


Figure 1. *PUF-NFR-B*.

**SOUTHWEST RESEARCH INSTITUTE**  
**ASTM D 1929 TEST DATA SHEET - SPONTANEOUS IGNITION**

<i>Client:</i> National Institute of Standards and Technology	<i>Ignition Type:</i> Spontaneous
<i>Operator:</i> J. Anderson	<i>Receipt Date:</i> October 11, 2004
<i>Test Date(s):</i> October 14, 2004	<i>Date Prepared by SwRI:</i> October 14, 2004
<i>Material ID*:</i> PUF-NFR-B	<i>Color:</i> Gray
<i>Description*:</i> Polyurethane foam, convoluted, ether, non fire-retardant	<i>Original Thickness:</i> 10 mm -29 mm
	<i>Average Sample Mass:</i> 0.35 g

**SPONTANEOUS IGNITION TEMPERATURE (°C) : 410**

\* Information/instructions provided by the Client

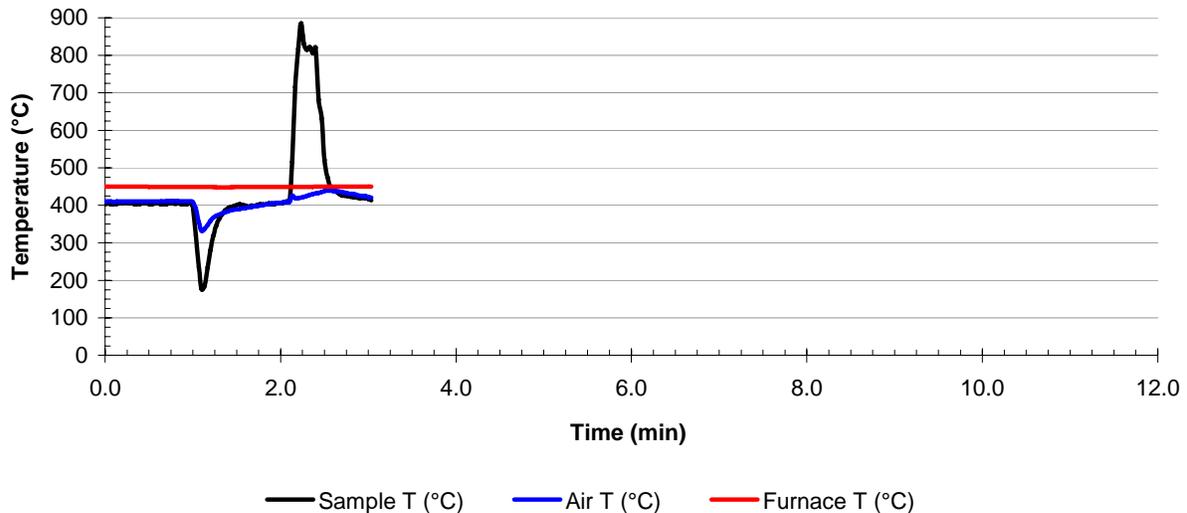
**RESULTS**

Test ID	Initial Mass (g)	Final Mass (g)	Mass Loss (g)	Initial Temperature (°C)			Final Temperature (°C)			Ignition
				Sample	Air	Furnace	Sample	Air	Furnace	
2884-2	0.34	0.07	0.27	347	350	392	345	350	391	No
2884-3	0.35	0.04	0.31	398	400	448	395	402	440	No
2884-4	0.35	0.03	0.32	450	450	494	778	465	494	Yes
2884-5	0.36	0.02	0.34	438	440	483	921	455	483	Yes
2884-6	0.34	0.02	0.32	427	430	469	848	448	470	Yes
2884-7	0.35	0.03	0.32	417	420	461	839	437	462	Yes
2884-8	0.34	0.02	0.32	405	410	450	817	423	449	Yes

**SPONTANEOUS IGNITION OBSERVATIONS**

	Insertion Time (min:sec)	Combustion Time (min:sec)	Observed Soot (min:sec)	Observed Smoke (min:sec)	Observed Foam	Observed Melt	Observed Bubbling	Total Test Time (min:sec)
2884-2	1:20	None	None	1:30	None	None	None	11:20
2884-3	1:10	None	None	1:16	None	None	None	11:10
2884-4	1:11	Flaming at 1:49	1:49	1:13	None	None	None	1:49
2884-5	1:14	Flaming at 2:00	2:01	1:16	None	None	None	2:01
2884-6	1:15	Flaming at 1:59	1:17	1:18	None	None	None	1:59
2884-7	1:10	Flaming at 1:45	1:12	1:14	None	None	None	1:45
2884-8	1:08	Flaming at 2:09	2:12	1:14	None	None	None	3:00

**Test ID 2884-8**



**SOUTHWEST RESEARCH INSTITUTE**  
**ASTM D 1929 TEST DATA SHEET - FLASH IGNITION**

*Client:* National Institute of Standards and Technology  
*Operator:* J. Anderson  
*Test Date(s):* October 14, 2004  
*Material ID\*:* PUF-NFR-B  
*Description\*:* Polyurethane foam, convoluted, ether, non fire-retardant

*Ignition Type:* Flash  
*Receipt Date:* October 11, 2004  
*Date Prepared by SwRI:* October 14, 2004  
*Color:* Gray  
*Original Thickness:* 10 mm -29 mm  
*Average Sample Mass:* 0.35 g

\* Information/instructions provided by the Client

**FLASH IGNITION TEMPERATURE (°C) : 370**

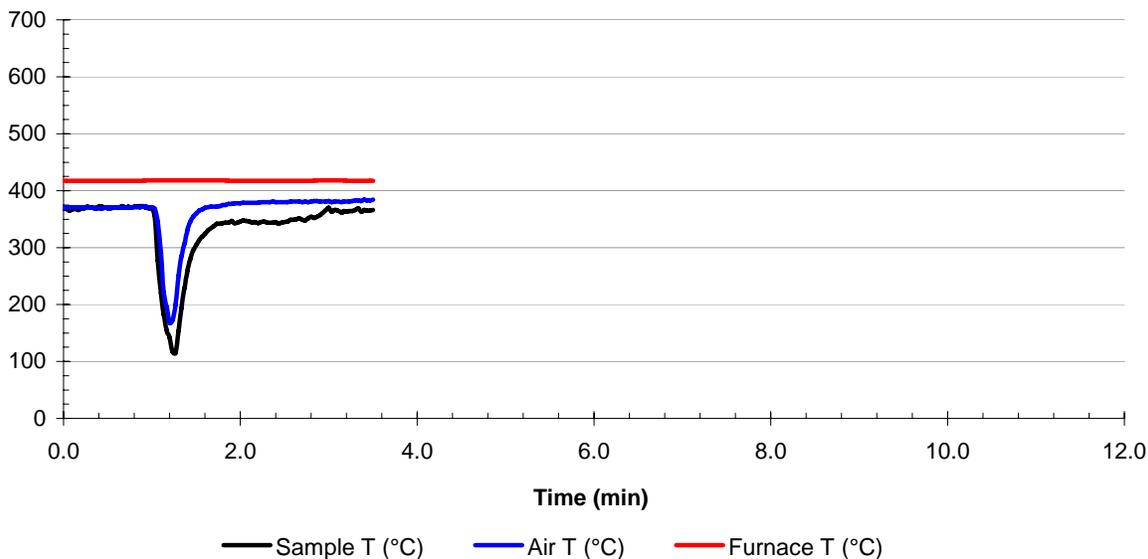
**RESULTS**

Test ID	Initial Mass (g)	Final Mass (g)	Mass Loss (g)	Initial Temperature (°C)			Final Temperature (°C)			Ignition
				Sample	Air	Furnace	Sample	Air	Furnace	
2884-9	0.35	0.06	0.29	349	350	390	356	353	392	No
2884-10	0.36	0.02	0.34	368	<b>370</b>	417	366	381	417	Yes
2884-11	0.34	0.03	0.31	356	360	398	360	362	399	No

**FLASH IGNITION OBSERVATIONS**

	Insertion Time (min:sec)	Combustion Type	Observed Soot (min:sec)	Observed Smoke (min:sec)	Observed Foam (min:sec)	Observed Melt (min:sec)	Observed Bubbling (min:sec)	Total Test Time (min:sec)
2884-9	1:12	None	None	None	None	None	None	11:12
2884-10	1:18	Flaming at 3:02	None	3:10	None	None	None	3:30
2884-11	1:16	None	None	None	None	None	None	11:16

**Test ID 2884-10**



## D.5 SUMMARY OF SMALL SCALE TESTS

The cone calorimeter was used to measure time to ignition and heat release rates for fire retardant and non fire retardant polyurethane foams, wood paneling, carpet flooring, and ceiling tiles. Each of the materials were exposed to a range of different thermal flux rates in order to simulate exposure during early and late stages of fire spread. Some of the data from these tests were incorporated into the computer modeling of the full-scale mockup experiments and the computer simulation of the full nightclub.

The ignition temperatures for polyurethane foam were measured by Southwest Research Institute using a standard ASTM 1929 test protocol. This work measured spontaneous and flash ignition temperatures of 410 °C and 370 °C, respectively. The flash ignition temperature was incorporated into the computer simulations for both the full-scale mockup and full nightclub.

## D.6 REFERENCES FOR APPENDIX D

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- [1] Anderson, M.K., Sleight, R.T., and Torero, J.L., Downward Smolder of Polyurethane Foam: Ignition Signatures, *Fire Safety Journal*, Vol. 35, No. 2, 131-147, 2000.
- [2] Schmitt, C.R., Thermal Degradation and Toxicity Aspects of Various Polymeric Materials, Oak Ridge Y-12, TN, Atomic Energy Commission, Washington DC, Y-1734, 25 p. June 9, 1971.
- [3] Roberts, A.F., Polyurethane Foam: Some Studies Relating to Its Behavior in Fires, *Fire Tech.*, Vol.7, No. 3, 189-200, August 1971.
- [4] Stark, G.W.V., Field, P., and Pitt, A., Hazard From Fires of Small Loads of Flexible Polyurethane Foam, FR Note 1017; Fire Research Station, Borehamwood, England, 29 p. August 1974.
- [5] Lee, T.G., Reproducibility of the Radiant Panel Test Method (ASTM E 162-67) Using Polyurethane Foam, Neoprene, and Hardboard Specimens, NBSIR 77-1222, National Bureau of Standards, Gaithersburg, MD, p 35, March 1977.
- [6] Stone, H., Pcolinsky, M., Jr., and Kapes, M, Polyurethane Foam in the NBS Smoke Chamber: Effect of Variation in Conditions and Formulation, *Journal of Cellular Plastics*, Vol. 23, No.4, 367-382, July/August 1987.
- [7] Jayakody, C., Myers, D., Sorathia, U., and Nelson, G.L., Fire-Retardant Characteristics of Water-Blown Molded Flexible Polyurethane Foam Materials, *Journal of Fire Sciences*, Vol. 18, 2000, 430-455, November/December 2000.
- [8] ASTM E 1354-04a, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, ASTM International, West Conshohocken, PA, 2004.
- [9] Zicherman, J.B., The Fire Incident at “The Station”, Report FCA NO 04-5667, Fire Cause Analysis, 213 W. Cutting Blvd., Richmond, CA 94804, November 10, 2003.
- [10] ASTM D 1929 - *Standard Test Method for Determining Ignition Temperatures of Plastics*, ASTM International, West Conshohocken, PA, 2004.

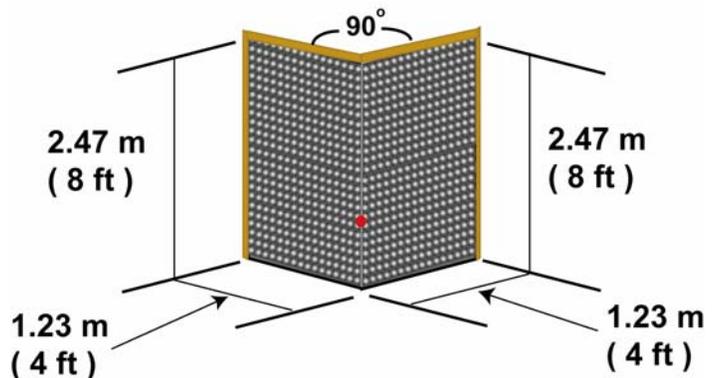


## APPENDIX E. FOAM COVERED WALL PANEL TESTS

### E.1 GEOMETRY

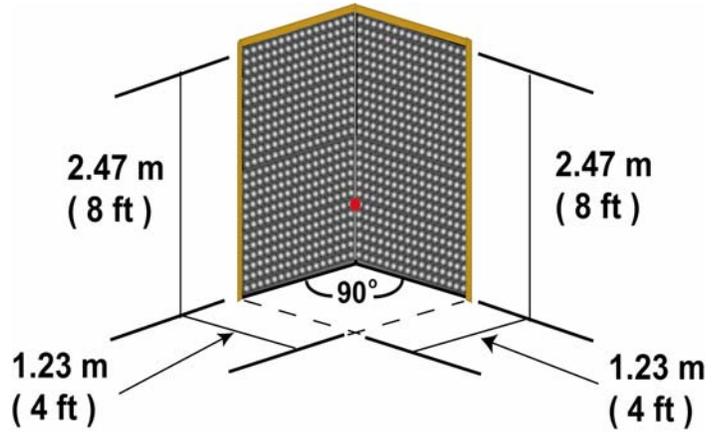
The video taken inside the nightclub demonstrated how quickly the foam ignited and how quickly the fire developed. The cellular structure of the polyurethane foam provides a very low density fuel layer that burns quickly. A series of wall burns were conducted to provide insight into how the geometry impacted the growth and spread of the fire. These data assisted in the design of the mockup experiments and provided guidance for the simulation of the entire nightclub.

Ignition of the foam on the wall of the nightclub by the gerbs occurred at the edge of an exterior corner of the drummers alcove, as described in Chapter 4. During the first 15 seconds of the fire, flames spread quickly upward and less quickly downward and laterally. To simulate this arrangement, two 0.064 m (0.25 in) thick plywood backer board panels, each 1.22 m (4 ft) x 2.44 m (8 ft), were mounted perpendicular to each other to form an external corner as shown in Figure E-1. The panels were supported on 2 x 4 studs and covered with a full sheet of non-fire retardant polyurethane foam (1.22 m x 2.44 m x 0.025 m) from lot A. The plywood was screwed to the studs and the foam was mounted to the plywood using staples and adhesive.



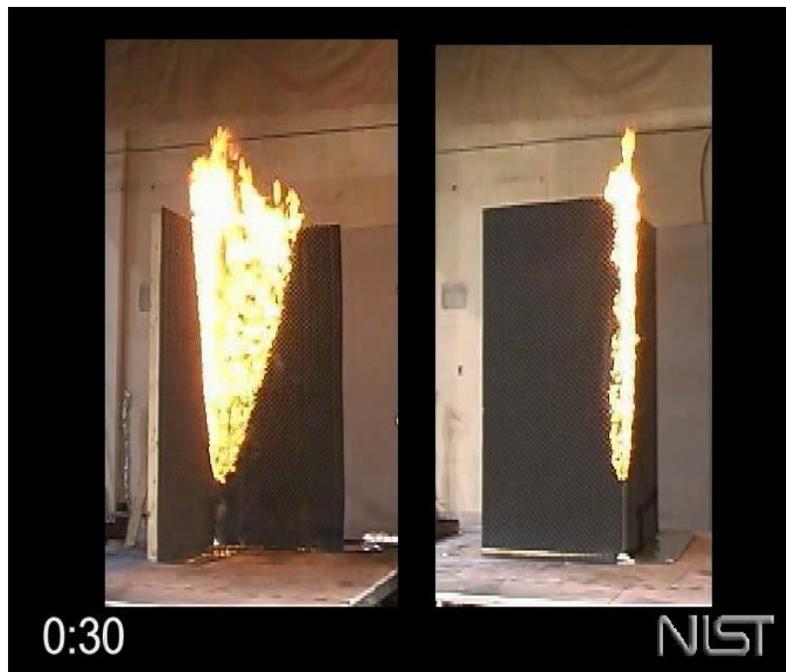
**Figure E-1. Photograph and Dimensioned Diagram of External Corner**

A second experiment used the identical 1.22 m (4 ft) x 2.44 m (8 ft) panels (0.025 m thick non-fire retarded lot A polyurethane foam on 0.064 m (0.25 in) thick plywood backer board, supported on 2 x 4 studs), but arranged to simulate an internal corner. (See Figure E-2.) An internal corner leads to faster flame spread than an external corner since in the former arrangement each surface is exposed to radiant heating from the adjacent wall. In both the mock-up and the actual nightclub fire, flame spread was enhanced further by the presence of the hot layer that built up at the ceiling. The corner arrangements examined here were open to the environment at the top (no ceiling); hence, the flame spread did not continue to accelerate.



**Figure E-2. Photograph and Dimensioned Diagram of Internal Corner**

A propane torch was used to ignite the corner of the foam at 0.61 m (24 in) above the floor. While this was lower than the point of ignition in the nightclub, the purpose of these experiments was not to duplicate the fire growth, but to provide a controlled environment in which flame spread measurements (upward, downward, and lateral) could be accurately determined. The fire was videotaped from two directions, and the radiant heat flux and total heat release rate were measured. Figure E-3 includes a video of the external corner burn and internal corner burn, side by side, with a clock.



**Figure E-3. Video of External and Internal Corner Burns**

## E.2 DESCRIPTION OF THE FIRES AND HEAT RELEASE RATES

### E.2.1 External Corner Configuration

Figures E-3 (right video) and E-5 show the progression of fire in the external corner configuration for the first 610 seconds of the test. The flame spread can be broken into four distinct phases. In the first phase, the fire spreads upward rapidly, with flames reaching the top of the panel before they have had much chance to spread downward or laterally. Once the flames have reached the top of the panel, lateral spread occurs in the second phase, resulting in a vee-shaped flame with the vertex at the corner slightly below the point of ignition. The polyurethane melts and flows down the corner in the third phase, rapidly causing the flame to extend to the ground and to create a small pool fire. In the fourth phase, the flame extends from the floor to the upper edge of the panel, forming a line fire which spread laterally along the bottom and top edges. The flame on the upper horizontal edge reaches the vertical extent of the panel first, at which time the fire spreads downward until all of the foam is consumed. By the end of the test, the plywood backing can be seen to be burning near the initial point of ignition.

Since the wall panels were burned under an instrumented calorimetry hood, it was possible to utilize oxygen depletion measurements to calculate the heat release rate. The results for the external corner are plotted as the blue line in Fig. E-4. The heat release rate reached a peak value of 200 kW between 160 and 180 seconds after ignition. From the photos in Fig. E-3 taken 120 and 180 seconds into the burn, one can attribute this peak to the pool fire enhanced burning during the third phase of flame spread. The heat release rate included the energy released by all the fuel. Initially, the burning of the foam contributed most of the energy released by the fire while the wood contributed more energy as the foam was consumed. During phase 4, the heat release rate gradually reduces to about half its maximum value until

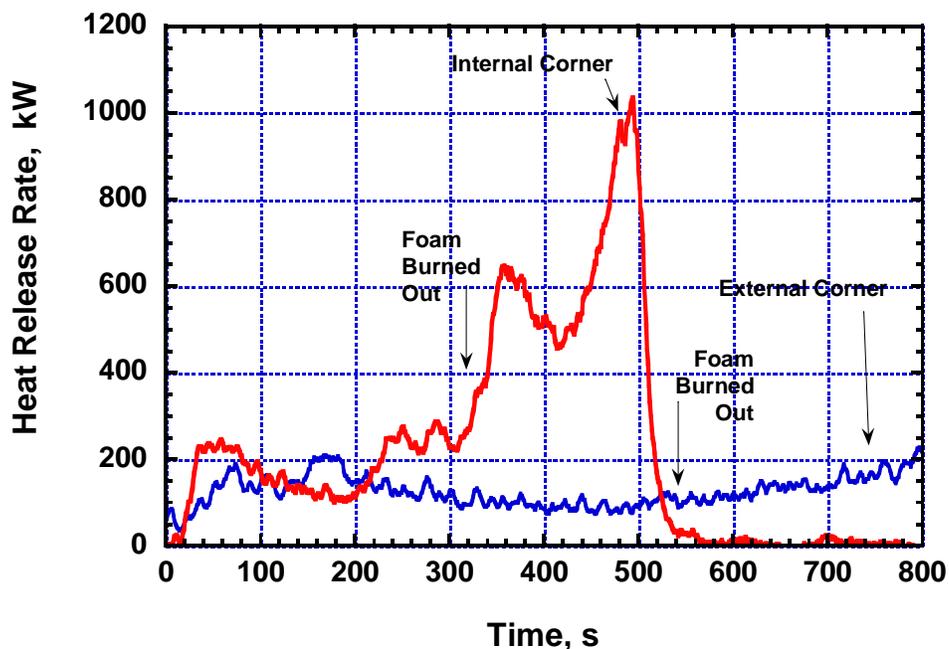
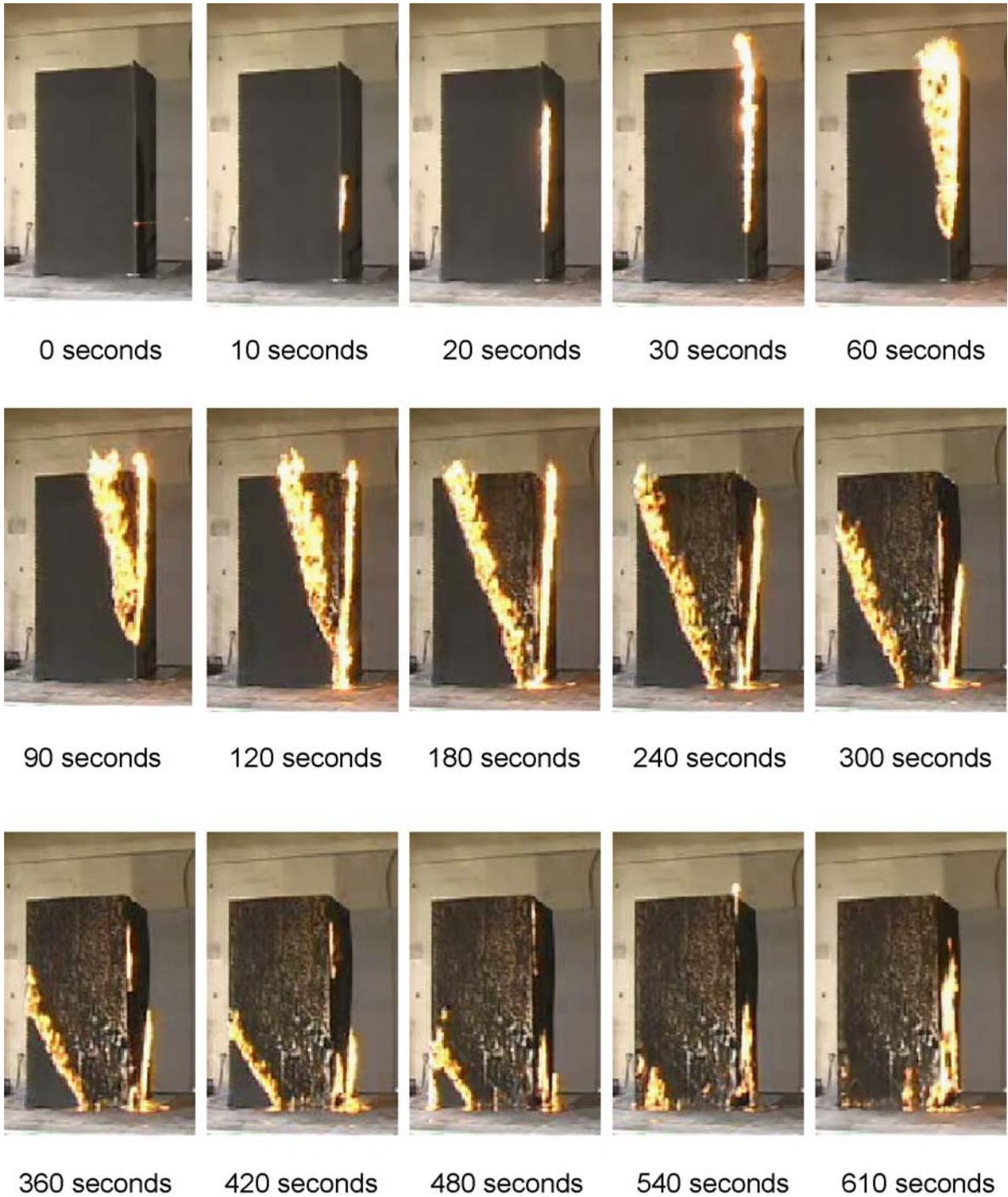


Figure E-4. Heat release rate versus time for external and internal corner configurations of foam covered wall panels.



**Figure E-5. Flame spread over polyurethane foam covered panels, external corner configuration.**

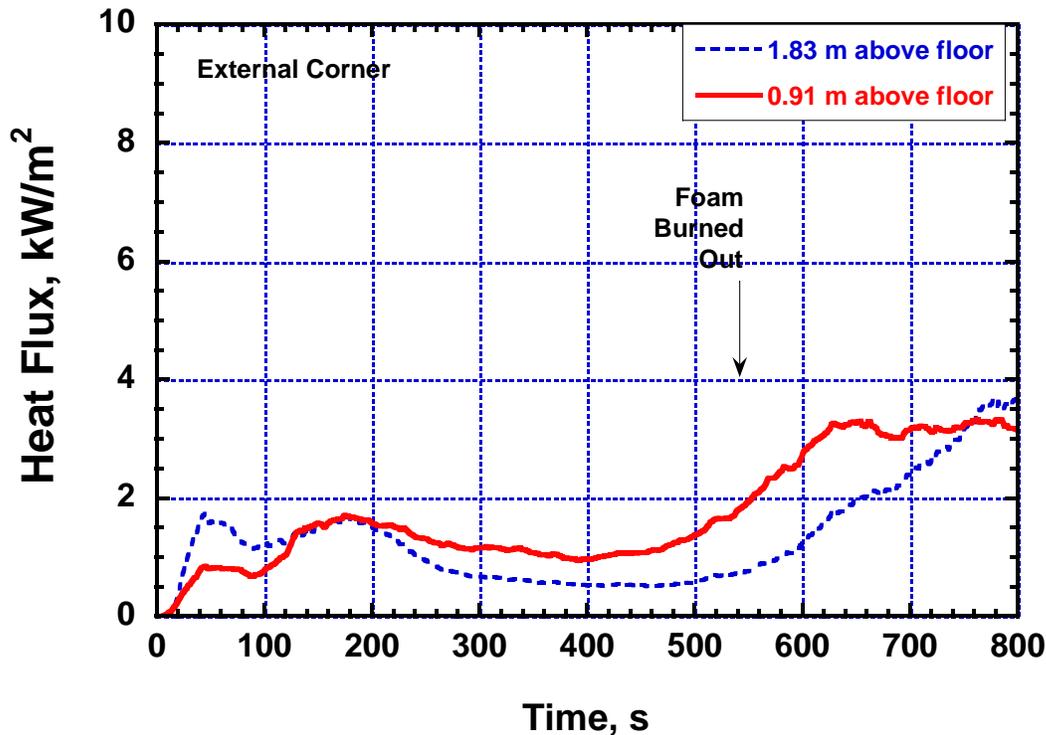


Figure E-6. Heat flux versus time for external corner burn.

almost all of the foam has been consumed at 540 seconds. The increase in heat release rate seen in Fig. E-4 after this point in time is due to the burning of the plywood panel. The irradiation perpendicular to and 2 m from the burning surface mirrors the heat release rate, as shown in Fig. E-6, attaining a value slightly above and below  $1 \text{ kW/m}^2$  from measurements 0.91 m and 1.83 m, respectively, above the bottom of the panel.

The total energy contributed by the foam to the fire can be estimated from the area under the blue curve in Fig. E-4 to be 60 MJ to 70 MJ. This compares to any energy content of about 95 MJ for two 1.22 m x 2.44 m x 0.025 m thick panels of foam, using a heat release per unit area of  $15.8 \text{ MJ/m}^2$  as measured in the cone calorimeter with an incident flux of  $35 \text{ kW/m}^2$ . The difference in total energy may be attributable to residual foam on the panel, liquid fuel that remained unburned on the floor, or less complete combustion of the panels as compared to the cone calorimeter sample irradiated at  $35 \text{ kW/m}^2$ .

### E.2.2 Internal Corner Configuration

The internal corner test was conducted in the same manner as the test described above. Figure E-8 captures the fire during the first 400 seconds of the test. The same four phases of fire growth can be seen in Fig. E-5, however the rate of growth is considerably faster than occurred in the external corner configuration (compare left and right videos in Fig. E-3), as would be expected due to the enhanced feedback from the adjacent panel. The third phase, in which the melting foam forms a pool at the corner

and rapidly drives the downward spread to the floor, occurs around 40 seconds into the internal corner test, as compared to some time around 120 seconds in the external corner test. The pool fire continues to burn and grow while the line fire associated with the fourth phase is established. By 400 seconds, the plywood backing is fully involved. A careful inspection of Fig. E-5 reveals what appears to be a continuously burning melt pool along the bottom edge of the panels as late as 400 seconds into the test.

The heat release rate from the internal corner test is plotted as the red line in Fig. E-4. The irradiation measured perpendicular to and 2 m away from the panel is plotted in Fig. E-7. The shapes of the first 200 seconds for both plots are similar to what was found during the first 500 seconds of the external corner test, although the magnitudes are larger for the internal corner fire; that is, a peak heat release rate in excess of 200 kW, corresponding to the phase 3 burning, occurs early, followed by a gradual decrease to about half the peak heat release rate, and the heat flux from the surface during this period is a bit over 1 kW/m<sup>2</sup>. Beyond 200 seconds, the internal corner test undergoes a more complicated behavior, as the pool fire at the base of the panel grows. The vertical arrow at 310 seconds marks the time when no more foam was visible on the wall panels. The pool fire from the melted foam reached a maximum heat release rate of 650 kW about 360 seconds into the burn. The increase in the fire size after 420 seconds is caused by the burning plywood along the vertical corner. The fire was extinguished at 490 seconds. [Note that while the shape of the flame seen in Fig. E-8 at 400 seconds is reminiscent of the M-shaped pyrolysis region reported by Qian et al.[1], inspection of the panels following their extinguishment revealed that the dark region seen in the photo along the vertical corner was due to complete burnout of the thin plywood panel.]

The total energy released by the fire can be estimated by integrating the area under the red curve in Fig. E-4. There is a substantial uncertainty in how much of the power to attribute to the foam and how much to the wood for times longer than 300 seconds. If one assumes that that the measured heat release rate between 310 and 410 seconds is due primarily to the liquid fuel at the base of the wood panels, then the total energy released by the foam would be about 106 MJ, which is greater than the 95 MJ of energy

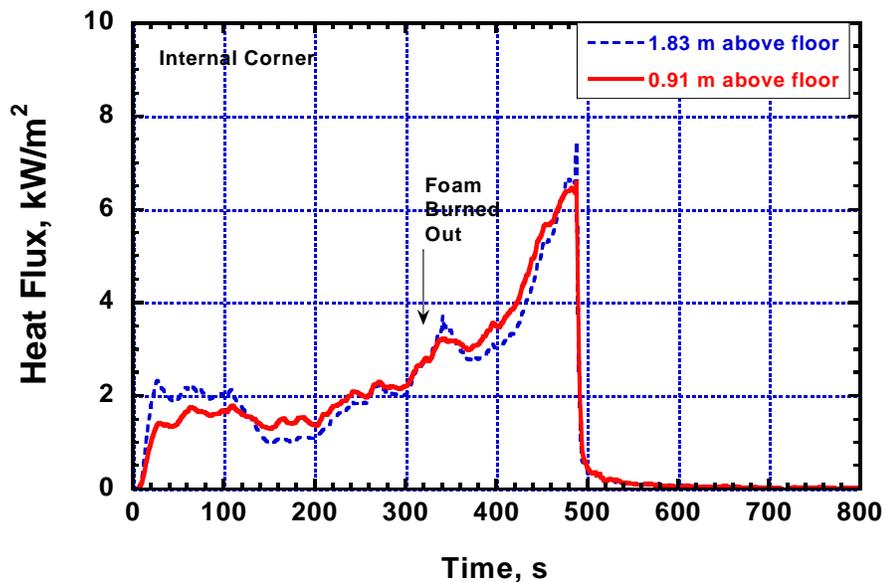


Figure E-7. Heat flux versus time for external corner burn.



**0 seconds**

**5 seconds**

**10 seconds**

**20 seconds**

**30 seconds**



**40 seconds**

**60 seconds**

**90 seconds**

**120 seconds**

**150 seconds**



**180 seconds**

**240 seconds**

**290 seconds**

**350 seconds**

**400 seconds**

**Figure E-8. Flame spread over polyurethane foam covered panels, internal corner configuration.**

estimated to be in the two foam panels. The burning wood accounts for much of this discrepancy, although it is also likely that the internal corner would produce more complete combustion than the external corner due to the enhanced radiant interchange between the two adjacent panels.

### E.3 FLAME SPREAD RATES

#### E3.1 External Corner Configuration

The speed at which the flames travel across the foam surface during each of the four phases of the fire can be estimated from the video record. While it is not possible to see through the flame to the pyrolysis zone during the first phase, when upward flame spread is dominant, the brightest portion of the flame can be used as a marker of the pyrolysis zone to roughly estimate the upward flame spread rate. The position of the leading edge of the flame in countercurrent regions provides a more accurate measure of the movement of the bulk of the pyrolysis zone as long as the time required to burn through the thickness of the foam is much less than the time for the flame to move across the surface. This is a reasonable assumption for a relatively thin sheet of low density, highly porous material like polyurethane foam, and is confirmed by inspection of the burned out regions behind the countercurrent flames.

Figure E-9 is a plot of the position of the flame along the boundaries of the panel as a function of time, showing the upward, downward (initially on the right of the panel, and later along the left edge), and lateral flame spread (along the top and bottom, respectively) as a function of time and position. The dotted lines in the figure are drawn to represent the approximately steady region of flame spread, and their

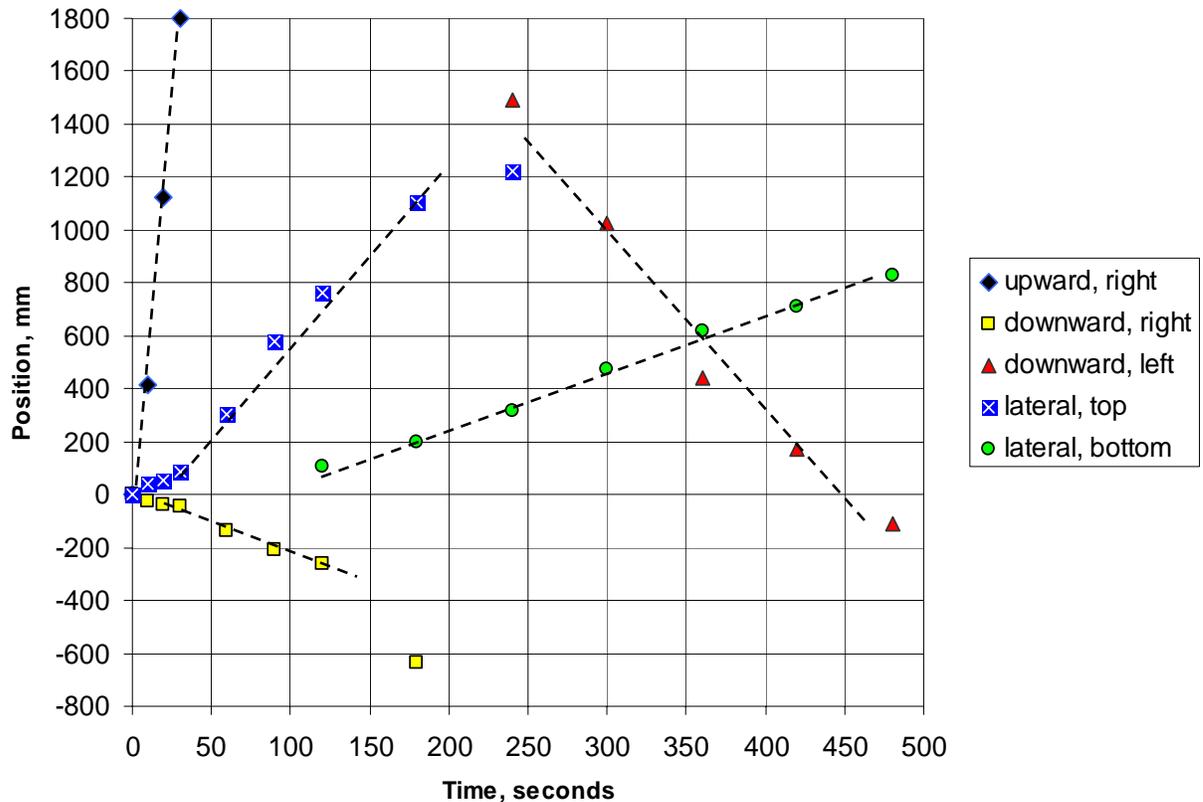
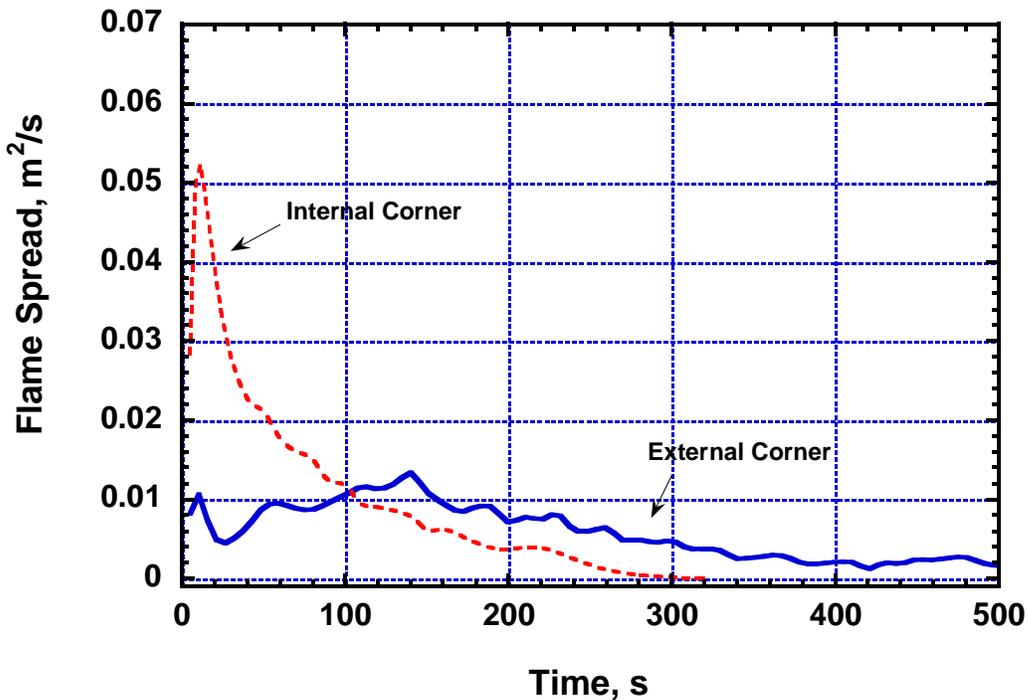


Figure E9. Flame position relative to ignition point on external corner configuration

**Table E-1. Approximate flame spread rates over flexible polyurethane foam panels configured as vertical corners**

Burning Phase	Direction of Spread	External Corner	Internal Corner
I	Upward (co-current)	63 mm/s	135 mm/s
II	Downward (counter-current)	2.3 mm/s	6.4 mm/s
II - IV	Lateral, top (counter-current)	6.8 mm/s	24 mm/s
IV	Lateral, bottom (counter-current)	2.2 mm/s	4.4 mm/s
IV	Downward (counter-current)	7.0 mm/s	14 mm/s
II, IV	Normal (counter-current)	7.2 - 7.3 mm/s	15 - 25 mm/s

slopes correspond to the respective spread rates. Table E-1 provides a summary of the estimated spread rates for the external corner configuration. The last row is the normal flame speed (the vector sum of the horizontal and vertical components) during the later phases of burning. The flame speed decreases from a maximum of 63 mm/s in the upward direction to just over 2 mm/s in the downward and lateral direction along the bottom edge of the panel. The normal flames speed during the steady burning period is 7.2 to 7.3 mm/s.



**Figure E-10. Flame spread across foam covered wall panel (m²/s).**

The video images were processed to track the unburned portion of the panel not covered by flames to provide an estimate of the surface area burning rate. The result is shown as the blue line in Fig. E-10. Following a small spurt during the initial rapid upward flame spread, the area burning rate drops and then slowly increases in the second and third phases to reach a peak of 0.013 m<sup>2</sup>/s about 140 seconds into the fire. The area burning rate gradually declines over the phase 4 period as the line of fire shortens about linearly with time. From the estimated downward and lateral flame speeds listed in Table E-1 and assuming the shape of the unburned foam remains approximately congruent to a triangle formed by the edges and diagonal of the panel, the area burning rate can be expressed as  $(X_0 v_y + Y_0 v_x)/2 - v_x v_y (t - t_0)$ , where  $X_0$  and  $Y_0$  are the lengths of the sides of the panel,  $v_x$  and  $v_y$  are the components of the normal flame velocity, and  $t_0$  is the time when the flame begins moving downward along the outer edge of the panel. Using this formulation the area burning rate diminishes from 0.0070 m<sup>2</sup>/s at 200 seconds to 0.0024 m<sup>2</sup>/s at 500 seconds, consistent with the more accurate calculation represented by Fig. E-10.

### **E.3.2 Internal Corner**

A similar analysis was conducted for the flame spreading over the polyurethane foam panels in the internal corner configuration. Figure E-11 shows the position of the flame, relative to the initial ignition point, as a function time. The same flame spread regions can be identified as with the external corner test. The time axis in Fig. E-11 has been expanded by a factor of two over Fig. E-9, indicative of the faster flame spread associated with the internal corner.

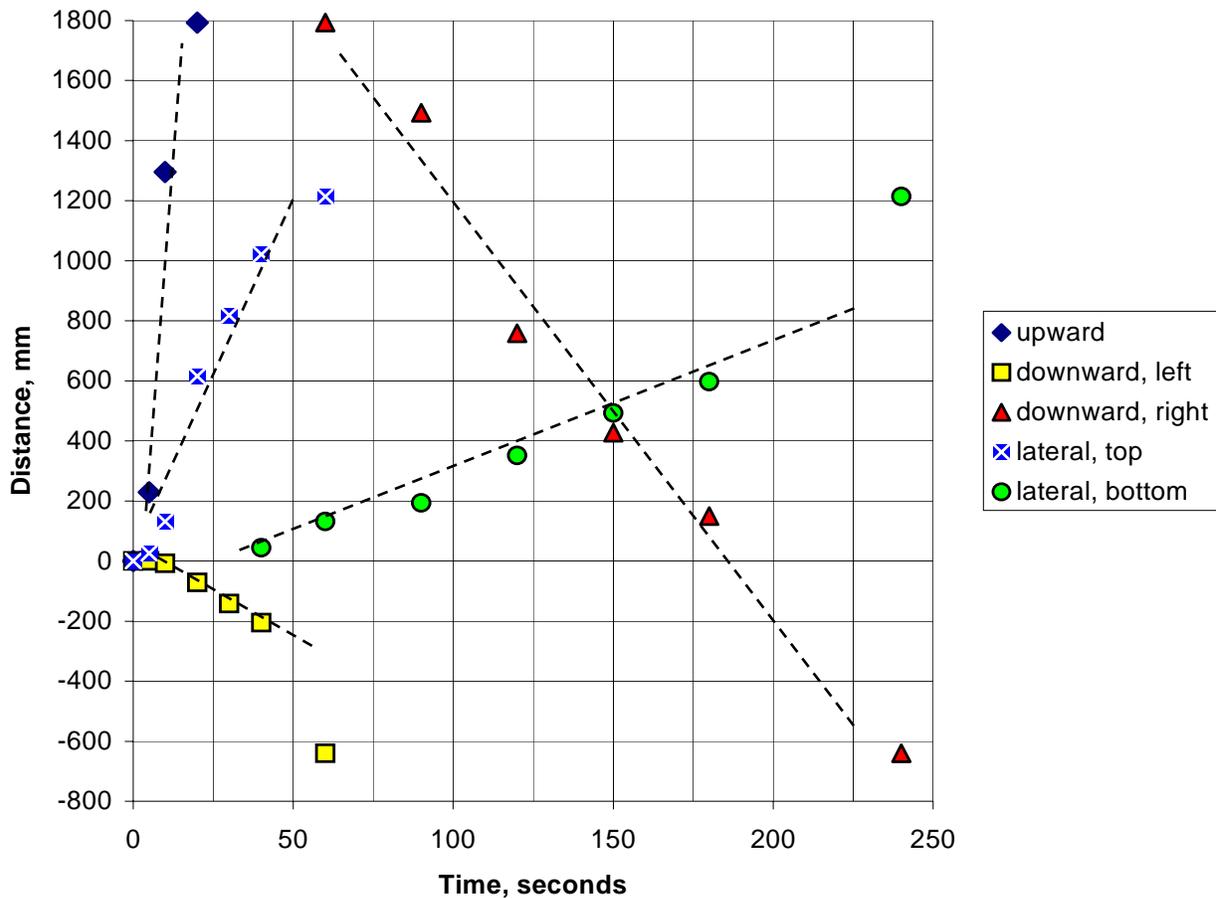
The last column in Table E-1 lists the flame spread rates, taken from the slopes of the curves in Fig. E-11, for different directions throughout the duration of the test. The table entries are two to three times faster than for the external corner, with the biggest difference being the lateral spread across the top of the panels (compare 24 mm/s to 6.8 mm/s). This is the region which is exposed to the largest flames and the highest view factor to enhance the surface irradiation.

The red line in Fig. E-10 is a plot of the area burning rate determine by processing the video images such as those seen in Fig. E-3 and E-8. The initial peak exceeds 0.05 m<sup>2</sup>/s, which undoubtedly is an over estimate since the quickly growing flames conceal a portion of the foam panel that has not had time to be completely consumed. Applying the same formulation  $[(X_0 v_y + Y_0 v_x)/2 - v_x v_y (t - t_0)]$  developed in section E.3.1 for the area burning rate, a lateral flame speed of 4.4 m/s, and a downward flame speed of 14 mm/s, the flame spread can be estimated to decrease from 0.014 m<sup>2</sup>/s at 90 seconds to 0.001 m<sup>2</sup>/s at 300 seconds, again consistent with Fig. E-10.

## **E.4 COMPARISON OF RESULTS TO MOCK-UP AND OTHER STUDIES**

### **E.4.1 Fire Spread in Platform Area Mock-up Experiment**

The geometry of the foam panels used in the full-scale mock-up of the drummer's alcove and the area around the platform was considerably more complex than the simple corners used in the flame spread experiments described above. The most significant complication comes from the ceiling, which produces horizontal edges and three-dimensional corners that affect the heat feedback and the flame spread mechanisms. The second significant effect of the ceiling is that it traps the combustion products and heat, leading to a vitiated environment and a rapidly increasing source of thermal radiation, either of which can greatly alter the flame spread rate.



**Figure E-11. Flame position relative to ignition point on internal corner configuration**

If the video of the fire spread across the face of the east wall along the back of the platform is analyzed in the same manner as the fire spread across the corner panels, the following estimates of flame spread can be achieved:

- upward spread rate (0-10 seconds): 60 mm/s to 100 mm/s
- downward spread rate (0-20 seconds): 4 mm/s to 5 mm/s
- lateral spread rate (10 - 25 seconds): 11 mm/s to 26 mm/s

The lateral spread rate was computed from the increase in the full width of the fire plume, and then reduced by a factor of two to make it comparable to the flame spread in one direction from the corner panel experiments. The lateral flame speed was also determined by tracking the time it took for the thermal wave to reach thermocouples mounted in the foam 300 mm below the ceiling, every 300 mm along the back wall. Fifteen seconds after ignition, the lateral flame spread rate was 11 mm/s; by 45 seconds after ignition the lateral spread rate had increased to 18 mm/s, in agreement with the video record.

One would expect the flame spread during the initial portion of the fire to be closer to the external corner panel experiments; however, the results for the mock-up in the upward, downward, and lateral flame

spread rates lie between those measured in the internal and external corners. It should be noted that the non-fire retarded polyurethane foam used in the mock-up was from lot B, while the foam used in the corner panel experiments was from lot A. While the mass per unit area of the lot A foam was 50 % greater than the lot B foam, cone calorimeter measurements of the peak heat release rates and times to ignition with an irradiation of  $35 \text{ kW/m}^2$  were within 5 % of each other.

Dripping of the melted foam along the external corners of the alcove occurred about 25 seconds after ignition. Because the initial point of ignition was much higher in the mock-up than in the corner panel experiments, phase II burning that became prevalent in the latter did not play a roll in the spreading the fire to the floor of the platform.

The lateral flame spread in the northerly direction along the east wall at the back of the platform stalled around 30 seconds after ignition. This appeared to be due to the high rate of air being entrained into the vigorously burning alcove, and the resulting high air velocity running counter to the flame along the back wall. Because the mass loading was less with the lot B foam, the stalled flame allowed the fuel to be consumed without spreading. Thus, the lateral spread mechanism observed in the panel tests did not contribute much to the fire development along the back wall of the platform in the mock-up for more than 30 seconds into the test.

Between 40 seconds and 60 seconds after ignition, most of the action occurred in the alcove, where the heat was transferred effectively to the foam due to intense radiation and high gas temperatures. The hot upper layer developed quickly between 60 seconds and 75 seconds, reaching close to  $600 \text{ }^\circ\text{C}$  almost everywhere throughout the room. Radiant heat fluxes were measured in excess of  $40 \text{ kW/m}^2$  during this period, much higher than imposed by the spreading flame in the corner panel experiments, and above the flux necessary for ignition within a few seconds.

#### **E.4.2 Comparison to Previous Flame Spread Studies**

Flame spread is a classic problem for fire science that has been investigated for decades, both theoretically and experimentally. The orientation of the fuel, the direction of the flame spread relative to the air flow, the geometry and properties of the fuel, and the temperature and composition of the environment all play a significant role. For the present discussion, we are interested primarily in counter-current flame spread over vertical walls, with fuels similar to polyurethane.

Quinterre and Harkleroad [2] focused on a method for measuring lateral flame spread over a wide variety of materials. They examined several foams, designated as (1) polyurethane S353M, (2) 25 mm flexible foam, and (3) 25 mm rigid foam. Lateral spread rates of the rigid foam, measured in the LIFT apparatus [4], increased from under 2 mm/s with irradiance levels below  $10 \text{ kW/m}^2$  to over 10 mm/s with irradiance levels around  $15 \text{ kW/m}^2$ . The minimum heat flux necessary for unpiloted ignition was  $20 \text{ kW/m}^2$ . At this flux level the ignition delay time was around 5 seconds, dropping to about a second at  $30 \text{ kW/m}^2$ . The 25 mm flexible foam had a much greater lateral spread rate, exceeding a value of 25 mm/s for incident fluxes less than  $10 \text{ kW/m}^2$ . There is no indication in the report of chemical composition or either the rigid or flexible foams. The one material specifically identified as polyurethane (S353M) was not identified as either rigid or flexible, although it behaved more like the undesignated flexible foam.

Cleary and Quintiere [3] performed additional experiments on foam plastics using several different flammability test methods. For one non-fire retarded polyurethane foam tested in the LIFT apparatus, they measured a maximum flame spread rate of over 40 mm/s with an incident flux of about  $10 \text{ kW/m}^2$ , the highest flame spread rate at that flux level of all the materials evaluated.

In both of the above studies, the flame spread velocity ( $v_L$ ) is assumed to be inversely proportional to the product of the effective thermal conductivity ( $k$ ), density ( $\rho$ ) and specific heat ( $c$ ) of the foam according to the relationship [2]

$$v_L = \Phi h^2 / (k\rho c) / (q''_{ig} - q''_e)^2$$

where  $h$  is the heat transfer coefficient to the surface,  $q''_{ig}$  is the heat flux necessary to ignite the material in a finite period of time,  $q''_e$  is the imposed heat flux, and  $\Phi$  is a flame heating parameter.

An effective value is used for  $(k\rho c)$  because the properties change with temperature and the extent of pyrolysis. The ignition delay time measured in the cone calorimeter,  $t_{ig}$ , can be used to estimate  $(k\rho c)$  from the following relationship [2]:

$$k\rho c = 4/\pi [q''_e / (T_{ig} - T_s)]^2 t_{ig}$$

where  $(T_{ig} - T_s)$  is the difference between the ignition temperature and the initial surface temperature of the material. For the PUF-NFR-B, at  $35 \text{ kW/m}^2$  the time to sustained ignition was 6 seconds. Using an ignition temperature of  $370 \text{ }^\circ\text{C}$  as measured by Southwest Research Institute for this foam,  $k\rho c$  is calculated to be  $0.075 \text{ (kW/m}^2\text{-}^\circ\text{C)}^2\text{-s}$ . This compares to  $0.001 \text{ (kW/m}^2\text{-}^\circ\text{C)}^2\text{-s}$  computed from the reference values in Table 4.1, and to  $0.036 \text{ (kW/m}^2\text{-}^\circ\text{C)}^2\text{-s}$  as tabulated by Cleary and Quintiere [3] for their non-fire retarded polyurethane foam. For this same foam they found  $\Phi$  to be equal to  $3.1 \text{ kW}^2/\text{m}^3$  and  $q''_{ig}$  to be  $14.5 \text{ kW/m}^2$ ; for other polyurethanes  $\Phi$  may be twice as high. With these values, and a natural convection coefficient taken as  $0.015 \text{ kW/m}^2\text{-}^\circ\text{C}$ , the lateral flame speed (mm/s) can be related to the irradiation ( $\text{kW/m}^2$ ) by  $v_L = 124 / (14.5 - q''_e)^2$ . To the extent this relationship approximately holds for the PUF-NFR-A material studied in the corner panel configuration, to achieve the lateral spread rate observed in the external corner test ( $6.8 \text{ mm/s}$ ) would require a radiant flux from the flame to the surface of about  $10 \text{ kW/m}^2$ . The internal corner test produced a lateral spread rate of  $24 \text{ mm/s}$ , corresponding to  $33 \text{ kW/m}^2$ . If a value for  $\Phi$  were increased to  $6 \text{ kW}^2/\text{m}^3$ , the required heat flux from the flame to sustain a  $24 \text{ mm/s}$  lateral flame spread would decrease to  $24 \text{ kW/m}^2$ .

## E.5 REFERENCES FOR APPENDIX E

- [1] Qian, C., Ishida, H., and Saito, K., "Upward Flame Spread along PMMA Vertical Corner Walls Part II: Mechanism of "M" Shape Pyrolysis Front Formation," *Combustion and Flame* 99: 331-338 (1994).
- [2] Quintiere, J., and Harkleroad, M., "New Concepts for Measuring Flame Spread Properties," NBSIR 84-2943, National Bureau of Standards, November 1984.
- [3] Cleary, T., and Quintiere, J., "Flammability Characterization of Foam Plastics," NISTIR 4664, National Institute of Standards and Technology, October 1991.
- [4] ASTM E 1321-97a, *Standard Test Method for Determining Material Ignition and Flame Spread Properties*, ASTM International, West Conshohocken, PA, 2004.



## APPENDIX F. PYROTECHNIC DEVICE TEST SERIES

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### F.1 PYROTECHNIC GERBS

A series of full-scale experiments was conducted to document the thermal characteristics of a discharging pyrotechnic device like those that were ignited on stage in the nightclub on Feb. 20, 2003. At the beginning of the show, four separate pyrotechnic devices, or gerbs, were discharged on the platform in front of the alcove. Two gerbs, which had been positioned on the floor of the platform, discharged vertically along the centerline of the alcove opening. Two additional pyrotechnic gerbs, which were located near the other two gerbs on the platform floor, sprayed white “sparks” at a 45 degree angle to both the left and right sides of the alcove. The WPRI-TV video of the nightclub interior showed that glowing particles or “sparks” ignited the foam on both sides of the alcove in approximately 10 seconds.

The throw, or distance the hot particles traveled, the period of “spark” discharge, and the white appearance of hot particles, were consistent with a pyrotechnic device called a Silver 15 x 15 Stage Gerb. Forty silver 15 x 15 gerbs were purchased from a commercial manufacturer of stage pyrotechnics. Each gerb consisted of a cardboard tube approximately 0.022 m (0.88 in) in diameter and 015 m (6 in) long (Figure F-1)

The gerbs were constructed and ignited as described in the following manner. A non-combustible material was placed inside the tube filling up the upper 0.1 m (4 in) of the gerb. The non-combustible material formed a solid plug near the bottom center of the tube, but provided a hollowed-out cavity for the upper part of the gerb. The hollowed out portion of plug was filled with a mixture of energetic materials and metal compounds. When the energetic materials were ignited, the non-combustible material prevented the hot material from discharging out the bottom or through the walls of the gerb. The hot gases and metallic compounds were sprayed out the upper end of the gerb. The duration of the discharge was determined by the amount of the energetic material placed in the tube. The color of the sparks was determined by the type of metal compound that was mixed in with the energetic materials. Titanium particles were added to provide a white- or silver-colored sparks. The inclusion of ferro-titanium particles would produce yellow- or gold-colored sparks.

Once the gerbs were positioned on the platform, an electrical match was inserted through the cap at the top end of the tube. An electric match consisted of a short section of resistance wire coated with a flammable chemical. When a current was passed through the wire, it heated up and ignited the coating, which in turn ignited the energetic materials in the gerb. The initial combustion generated enough gas pressure to pop the plastic cap off the end of the cardboard tube and to spray hot gases and sparks to approximately 15 ft (4.5 m) for a period of approximately 15 seconds (hence the term 15 x 15)

For the NIST tests, each gerb or pair of gerbs was discharged either along or against a gypsum board wall. The wall had been painted black to enhance the contrast with the white sparks. A grid of 0.3 m (1 ft) squares was painted on the wall. Gerbs were discharged in a plane parallel to the wall at an angle of either 45 degrees (Figure F-2) or 90 degrees (Figure F-3) from the horizon. Gerbs were also discharged against the wall in a plane perpendicular to the wall (Figure F-4). Heat flux gauges and thermocouples were embedded in the gypsum wall to monitor the heat flux and gas temperatures. In Figures F-5, F-6, and F-7, one can see how the instrumentation was positioned so that the spark discharge was centered

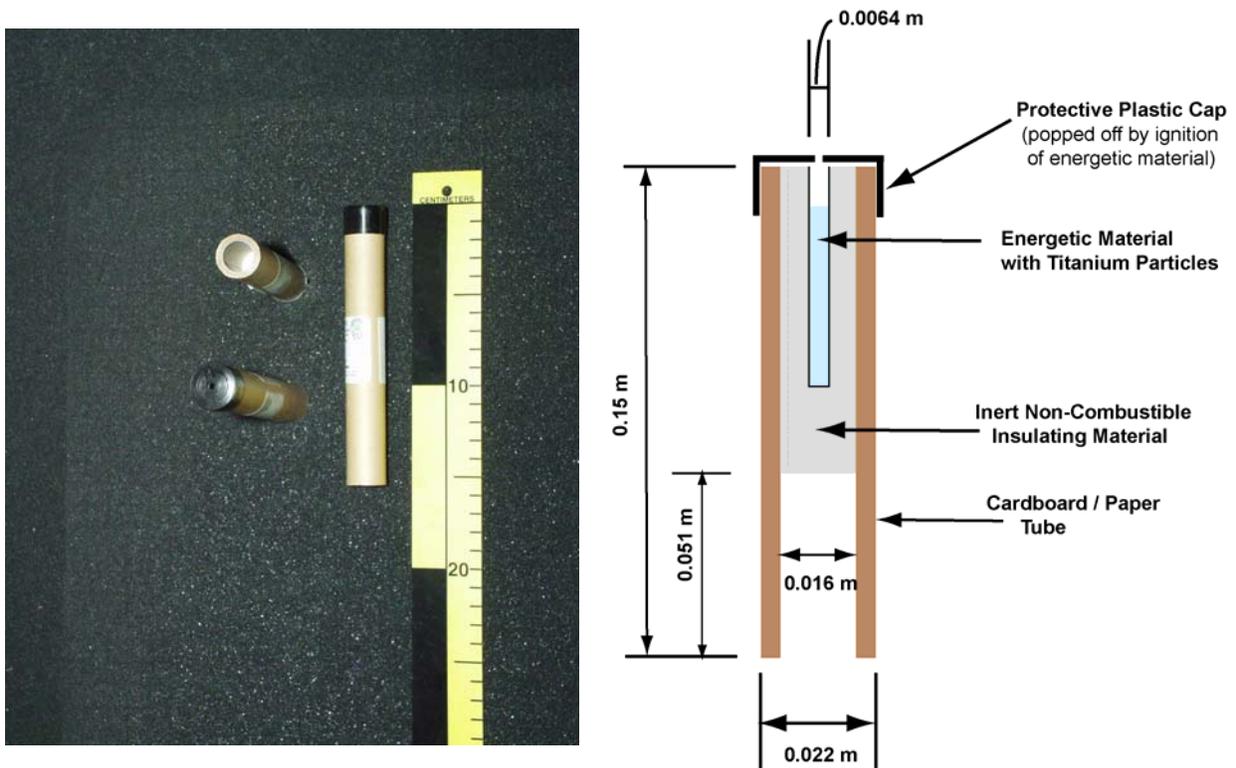


Figure F-1. Photograph of Silver 15 x 15 Stage Gerb and Cross-Sectional Schematic.

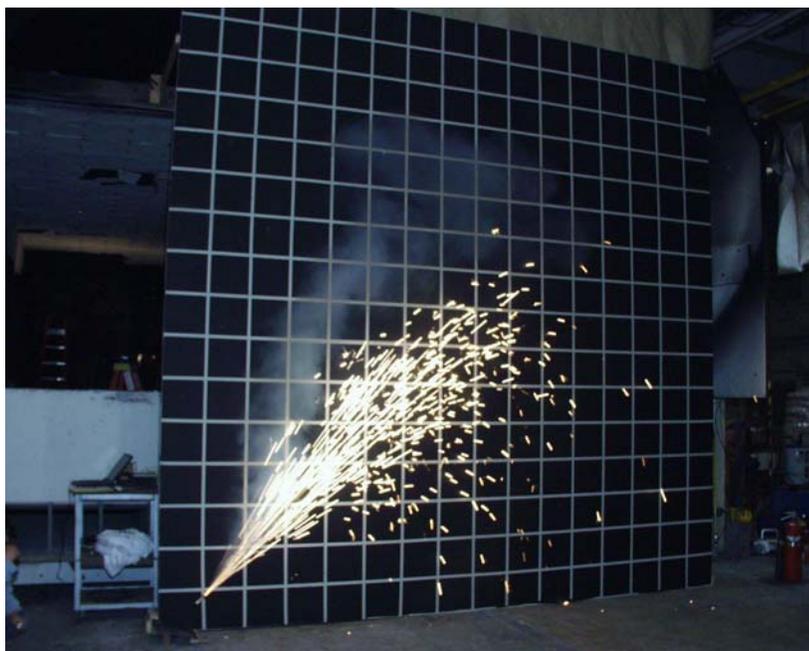


Figure F-2. Single Gerb at 45 Degrees and in Plane Parallel to Wall .



**Figure F-3. Two Gerbs at 90 degrees and in Plane Parallel to Wall.**



**Figure F-4. Single Gerb at 45 degrees and in a Plane Perpendicular to Wall.**

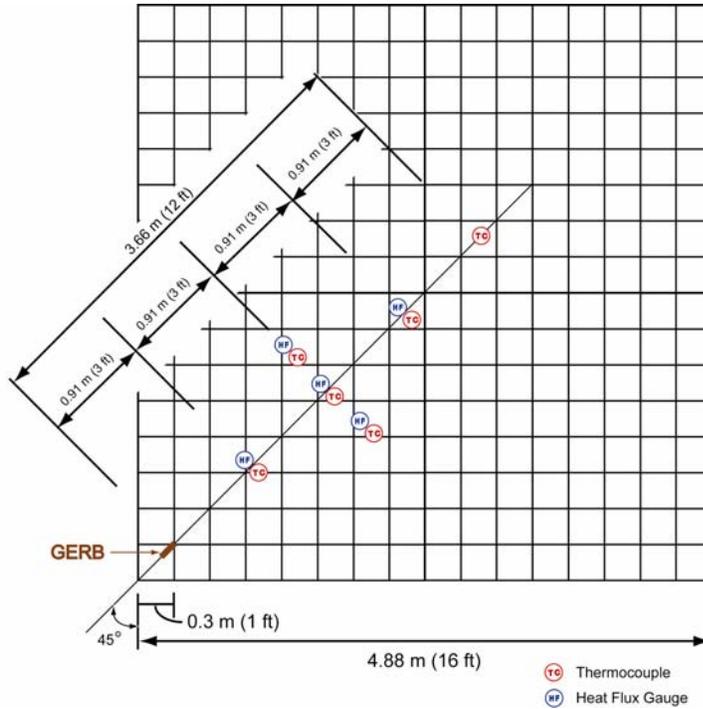


Figure F-5. Instrumentation Diagram for a Single Gerb at 45 Degrees and in Plane Parallel to Wall .

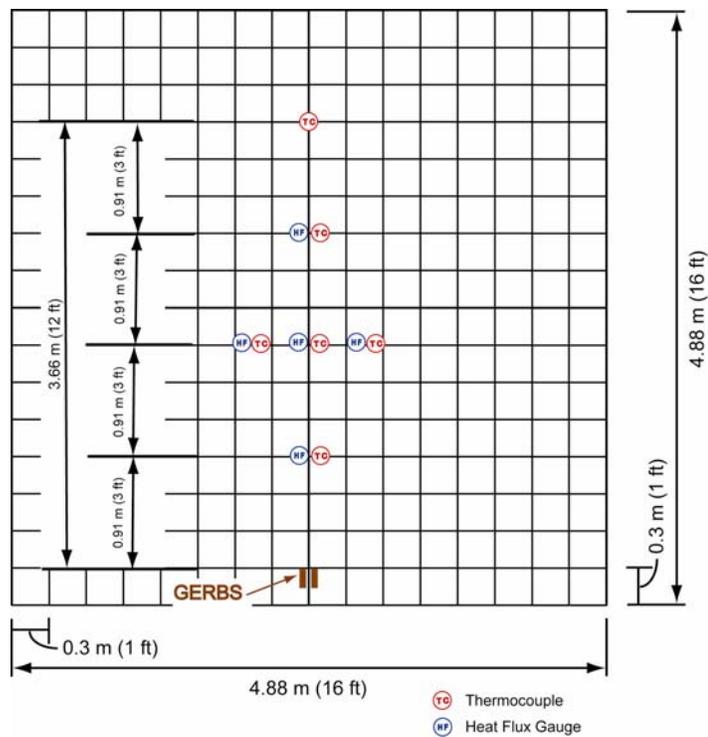


Figure F-6. Instrumentation Diagram for Two Gerbs at 90 degrees and in Plane Parallel to Wall.

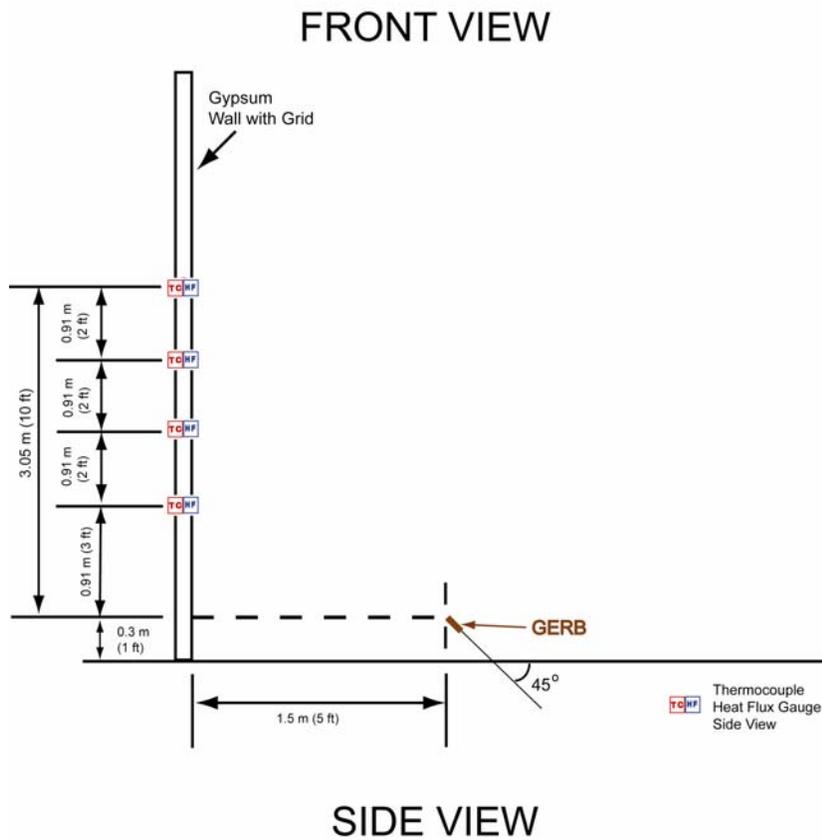
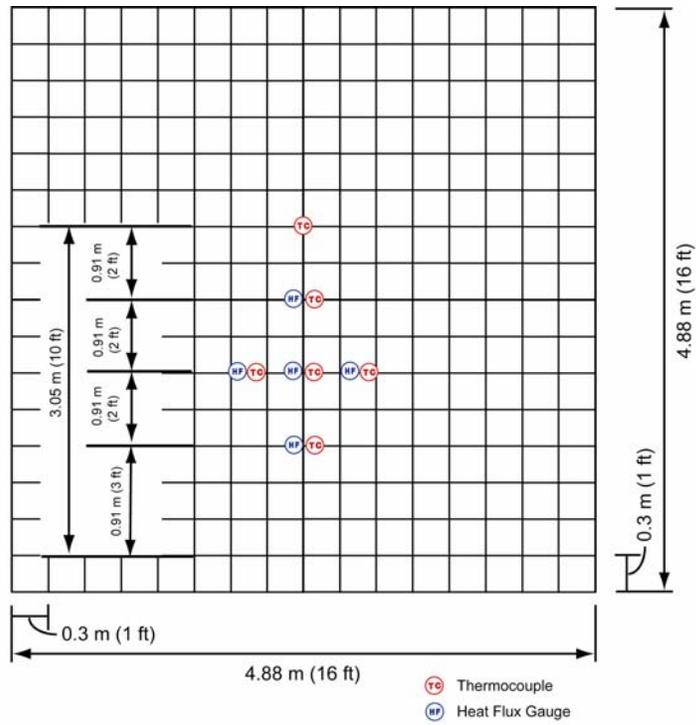


Figure F-7. Instrumentation Diagram for a Single Gerb at 45 degrees and in a Plane Perpendicular to Wall.

over the flux gauges and thermocouples. Electric matches were used to ignite the gerbs. Each discharge was video taped using a standard mini-DV digital video camera and an infrared camera. The infrared camera utilized a barium-strontium-titanate solid-state detector with a spectral response of 8  $\mu\text{m}$  to 14  $\mu\text{m}$ . The IR camera was included in these experiments to provide a qualitative image of the hot gas plume as well as the spray of the white sparks.

## F.2 45 DEGREE DISCHARGE TESTS

As seen in Figs. F-2 and F-4, tests were conducted with gerbs discharged at an angle of 45 degrees to the horizon, either parallel to or perpendicular to the wall. Each discharge was recorded using a standard video camera and an infrared camera. For a 45 degree discharge in a plane parallel to the wall, pairs of visible and infrared images are shown for 0s, 2 seconds, 5 seconds, 14 seconds, 15 seconds, and 16 seconds in Figures F-8 to F-13.

The visible images show that each gerb discharged a spray of white sparks for at least 14.5 seconds, but no more than 16 s. While most of the sparks were thrown less than 2.74 m (9 ft), a limited number of sparks traveled in excess of 4.6 m (15 ft) from the tip of the gerb. The infrared images show a central core of hot gases, a plume of warm gases that does not travel as far as the hot metallic particles. The buoyant hot gases developed a vertical trajectory within 1.2 m (4 ft) of the gerb tip. Temperatures and heat fluxes in the plume are plotted in Figs. F-14 and F-15.

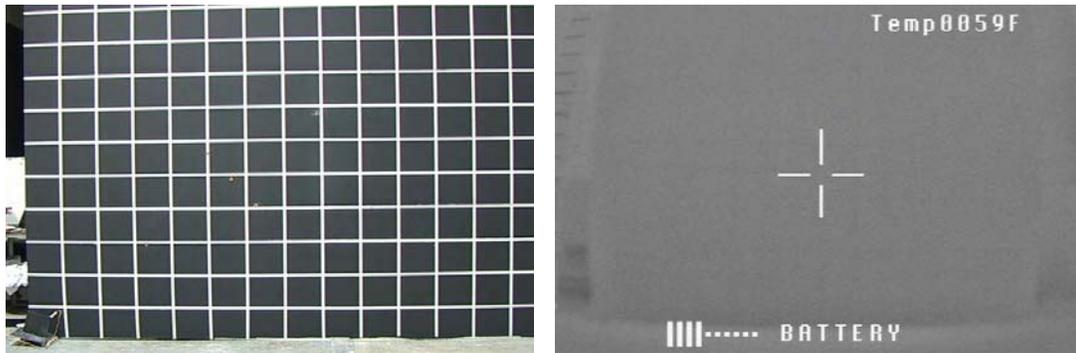


Figure F-8. Standard Video and Infrared Video Images of Gerb Discharge at 0 s.

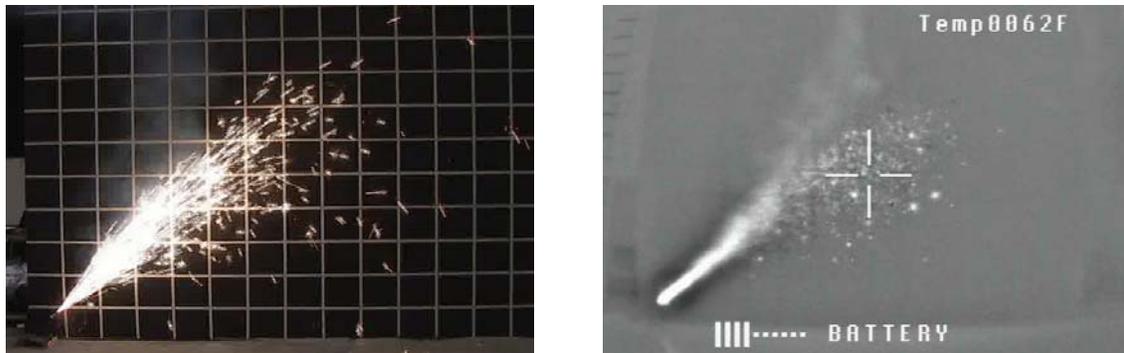


Figure F-9. Standard Video and Infrared Video Images of Gerb Discharge at 2 s.

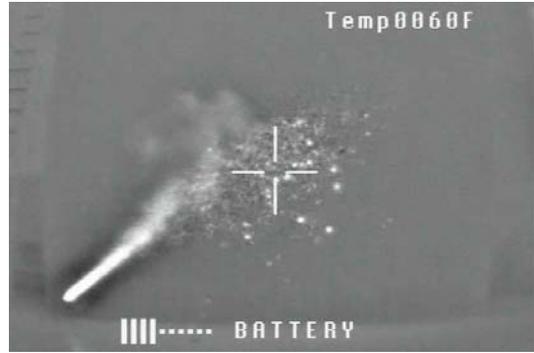
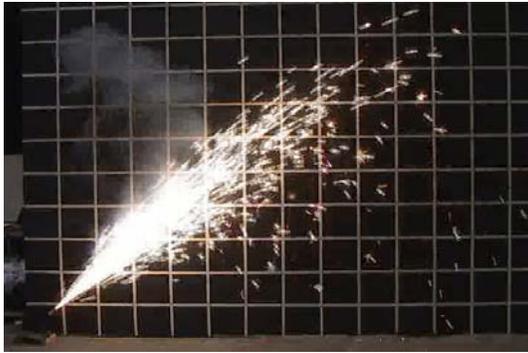


Figure F-10. Standard Video and Infrared Video Images of Gerb Discharge at 5 s.

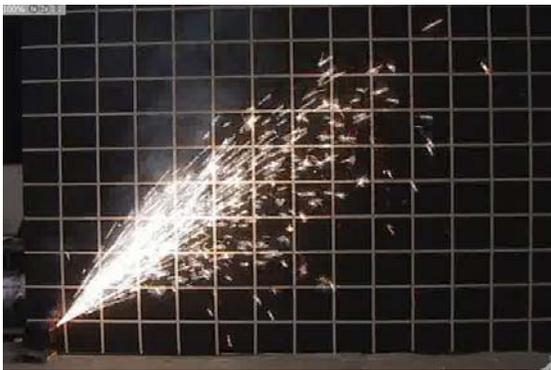


Figure F-11. Standard Video and Infrared Video Images of Gerb Discharge at 14 s.

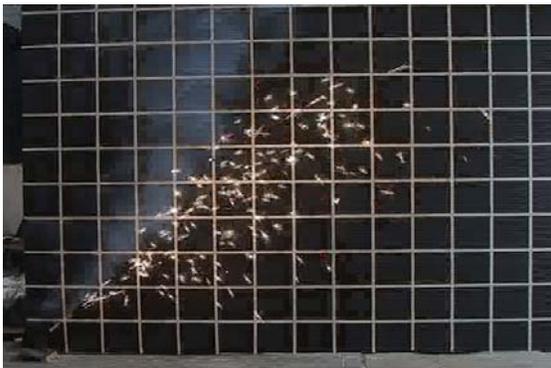


Figure F-12. Standard Video and Infrared Video Images of Gerb Discharge at 15 s.

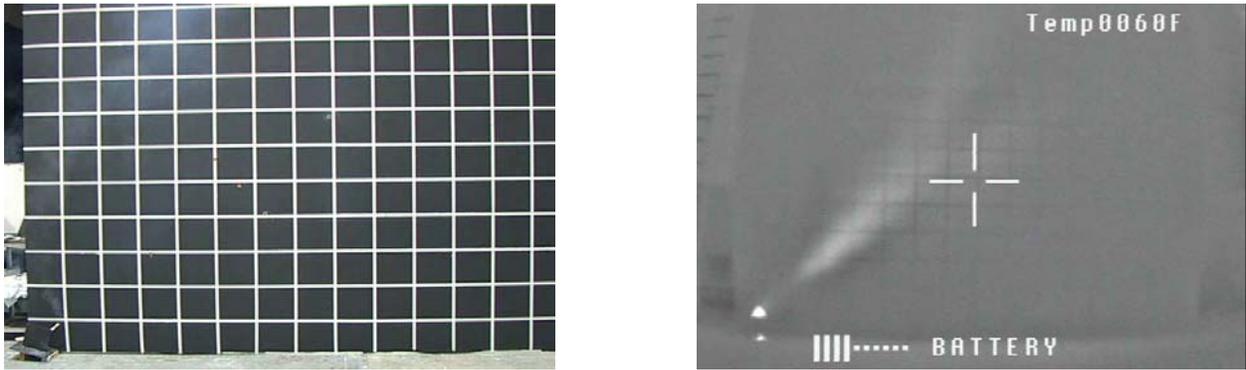


Figure F-13. Standard Video and Infrared Video Images of Gerb Discharge. Time is 16 seconds after ignition.

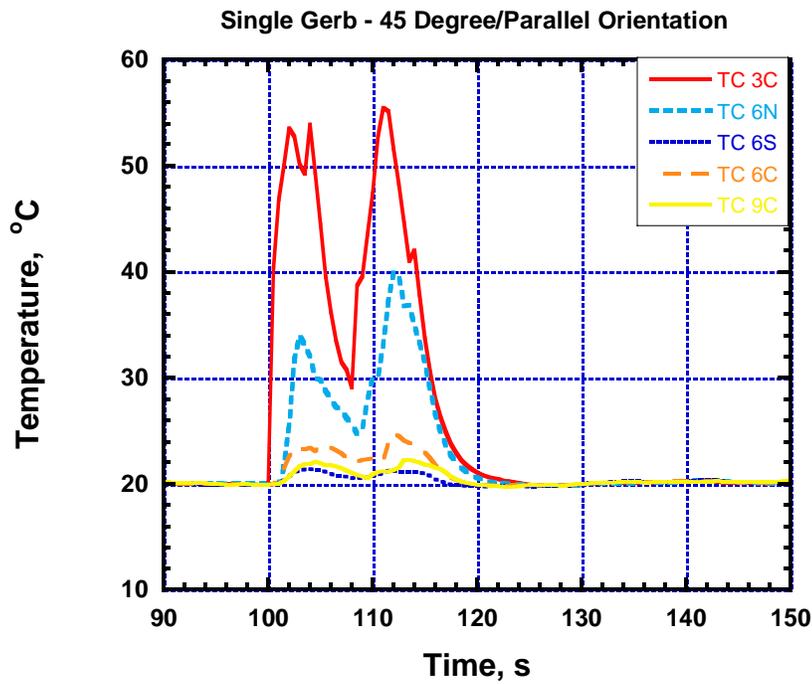
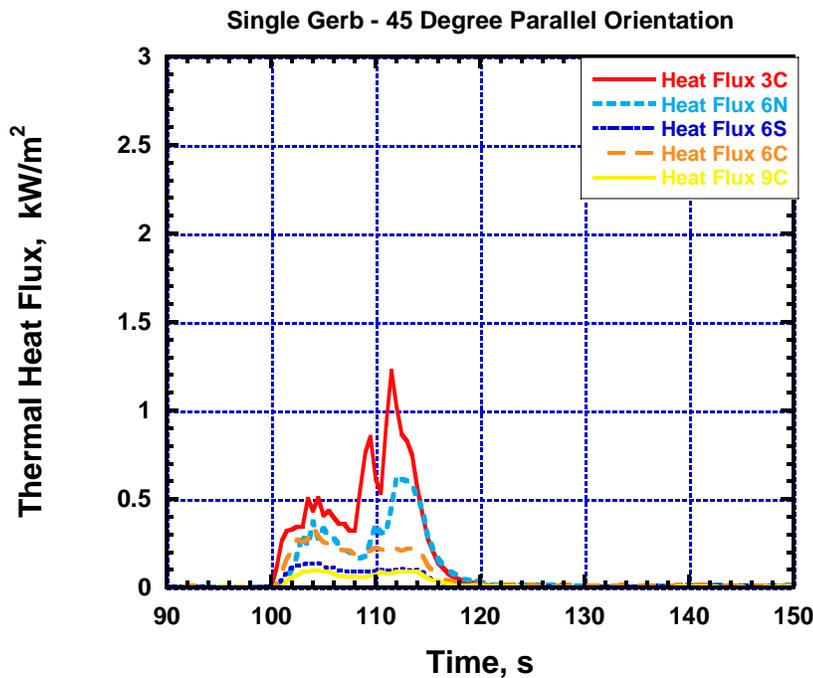


Figure F-14. Temperatures versus Time for Single Gerb Discharged at 45 Degrees in Plane Parallel to Wall.



**Figure F-15. Temperatures versus Time for Single Gerb Discharged at 45 Degrees in Plane Parallel to Wall.**

Testing also was done with a gerb discharging at a 45 degree angle from the horizon and in a plane perpendicular to the wall. The wall was either gypsum board, plywood, non-fire retarded polyurethane covered plywood, or fire retarded polyurethane covered plywood. The results of these tests are presented in Chapter 4, section 4.5. The temperatures measured in the plume for the one case that led to burning of the wall, the non-fire retarded polyurethane foam, are plotted in Fig. F-16a and F-16b. The high temperatures reached 20 seconds into the test (120 seconds on the figure since ignition of the gerb occurred at 100 seconds) are clearly indicative of flaming combustion. Fig. F-16b shows the temperature scale greatly expanded, with the centerline temperature peaking 7 seconds after ignition, followed by a rapid increase in temperature elsewhere in the plume even as the centerline cools due to the end of the discharge from the gerb.

Since the alcove in the nightclub was 3.0 m (10 ft) wide and the gerbs were positioned at the center of the alcove opening, white sparks would have easily reached both sides of the alcove. The plume of hot gases would probably not have directly impinged on the side walls of the alcove. The hot gases would instead have traveled diagonally across the alcove opening and as the plume approached the side walls, the plume would have moved vertically to impinge on the wall above the alcove opening.

Polyurethane Foam - One Gerb - 45 °/Perpendicular Orientation

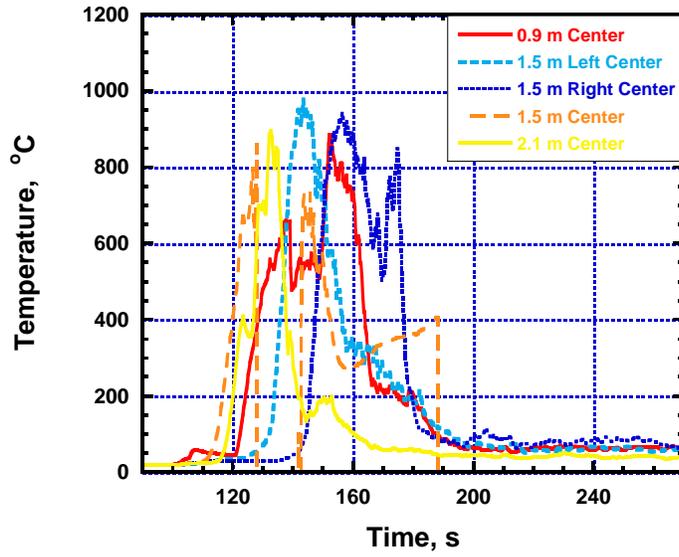


Figure F-16a. Temperatures versus Time for Single Gerb Discharged at 45 Degrees in Plane Perpendicular to Wall.

Polyurethane Foam - One Gerb - 45 °/Perpendicular Orientation

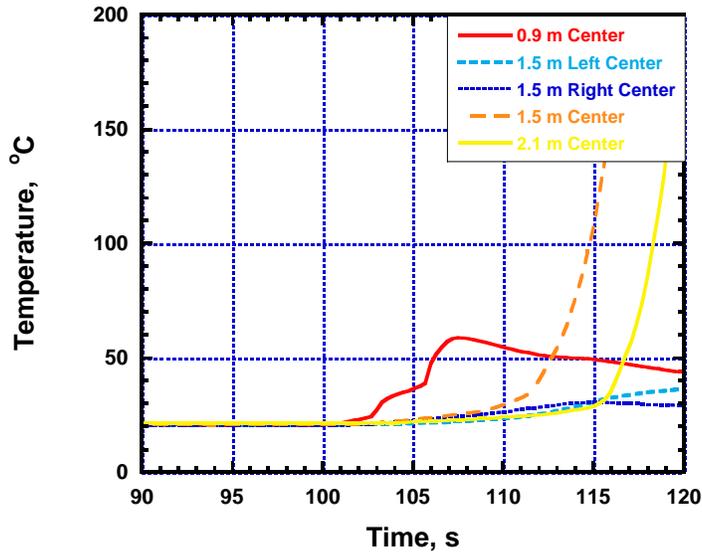


Figure F-16b. Temperatures versus Time for Single Gerb Discharged at 45 Degrees in Plane Perpendicular to Wall.

### F.3 90 DEGREE DISCHARGE TESTS

A pair of gerbs was positioned to discharge in a direction 90 degrees from the horizon and parallel to the wall (see Fig. F-17). Visible and infrared images are shown 2 seconds, 5 seconds, 14 seconds, 15 seconds, and 16 seconds after ignition of the gerbs in Figure F-18 to F-22.

The visible images demonstrate that both gerbs discharged for at least 14.5 seconds, but no more than 16 s. The spray pattern of sparks appeared similar to that of the gerbs, which had been positioned at 45 degrees. Most of the sparks traveled less than 2.74 m (9 ft), but some hot sparks were thrown in excess of 4.6 m (15 ft). The infrared images again demonstrate a central core of hot gases; in this vertical configuration, the plume of combustion gases is aligned with the trajectory of the hot sparks. The temperatures and heat fluxes are plotted in Figures F-23 and F-24.

Since the alcove in the nightclub was 2.0 m (6.5 ft) tall and the gerbs were positioned at the center of the alcove opening, white sparks would have easily reached the top of the alcove. The plume of hot gases would have directly impinged on the foam at the top of the alcove opening. (It is worth noting that the pair of gerbs directed vertically on the platform of the nightclub on Feb. 20, 2003, did not ignite the foam at the top of the alcove.)

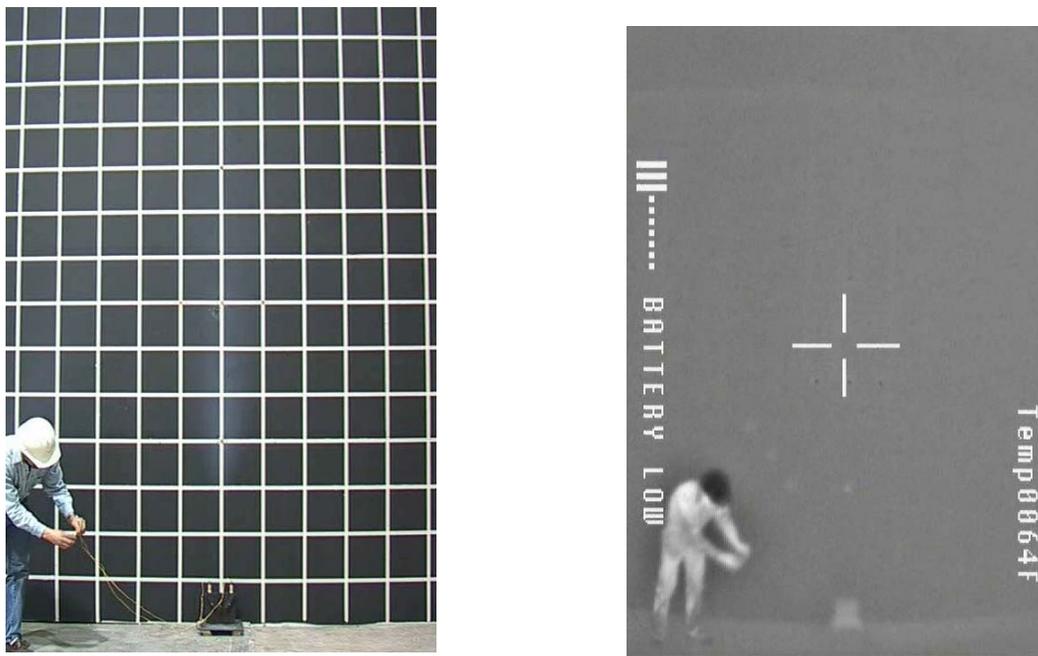


Figure F-17. Standard Video and Infrared Video Images of Gerb Discharge at 0 s.

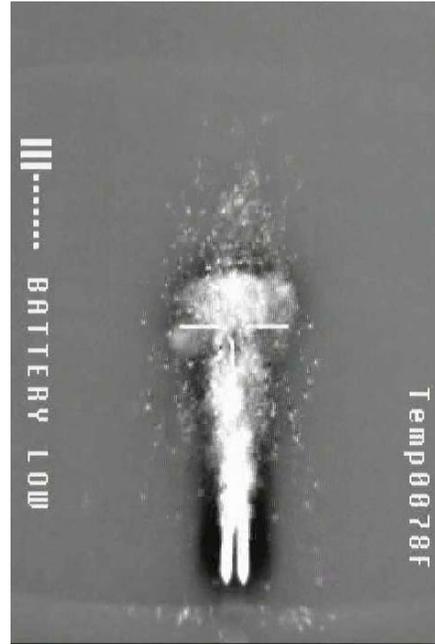
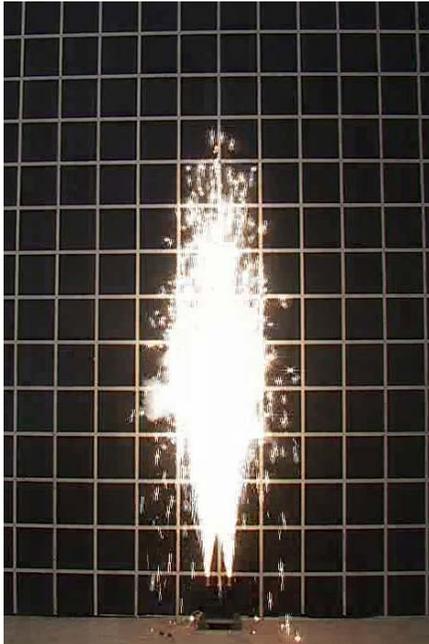


Figure F-18. Standard Video and Infrared Video Images of Gerb Discharge at 2 seconds.

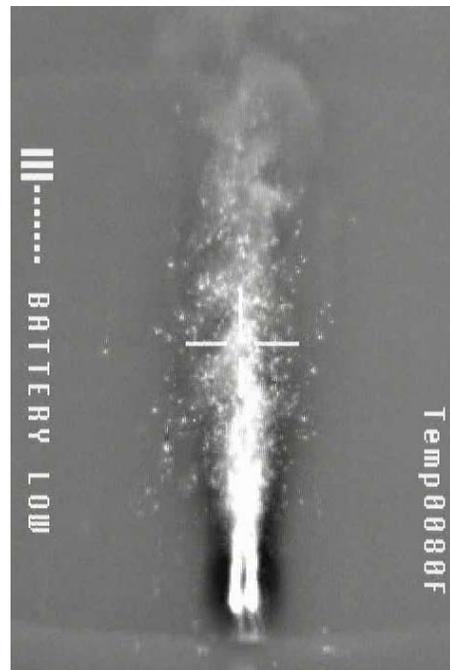
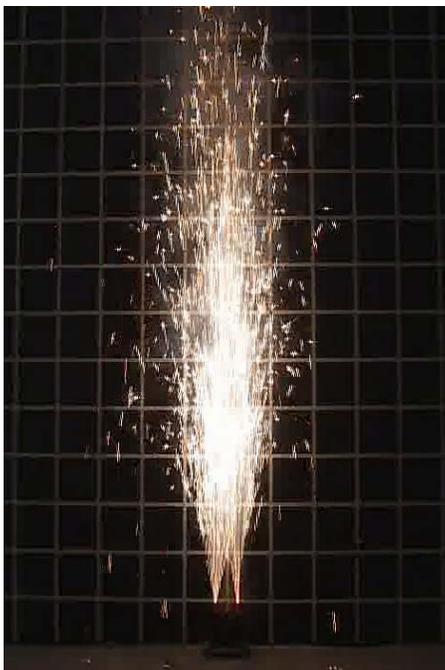


Figure F-19. Standard Video and Infrared Video Images of Gerb Discharge at 5 seconds.

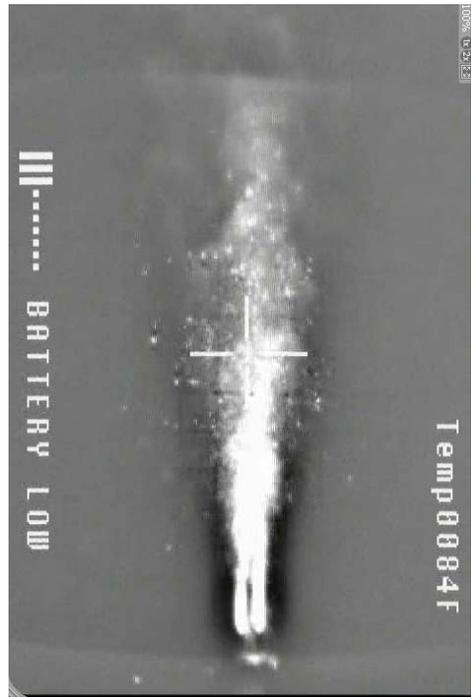
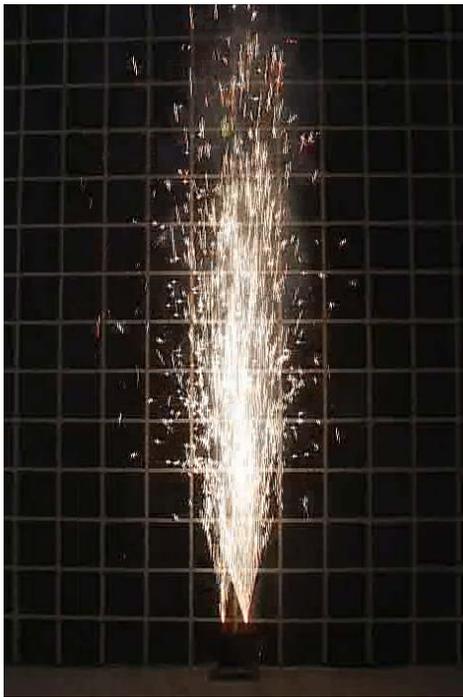


Figure F-20. Standard Video and Infrared Video Images of Gerb Discharge at 14 seconds.

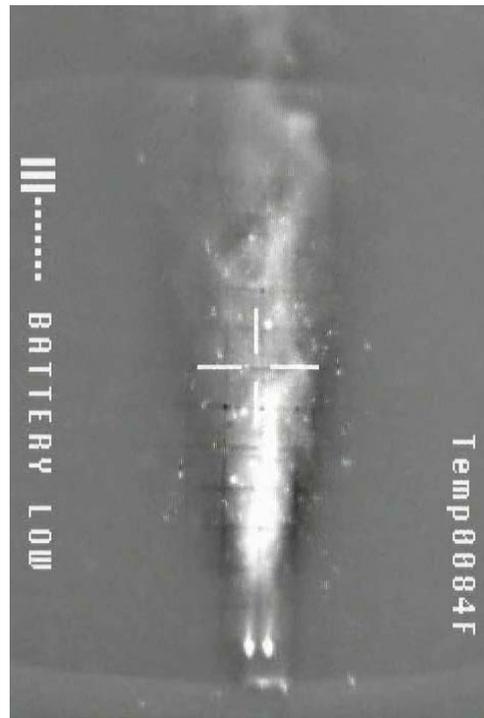
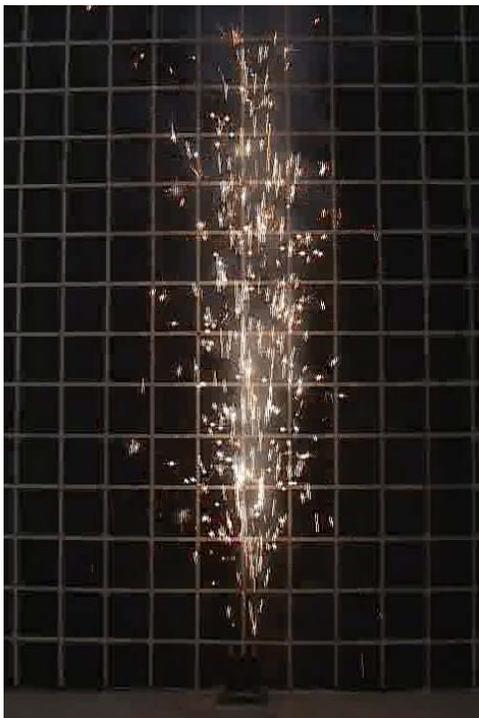


Figure F-21. Standard Video and Infrared Video Images of Gerb Discharge at 15 seconds.

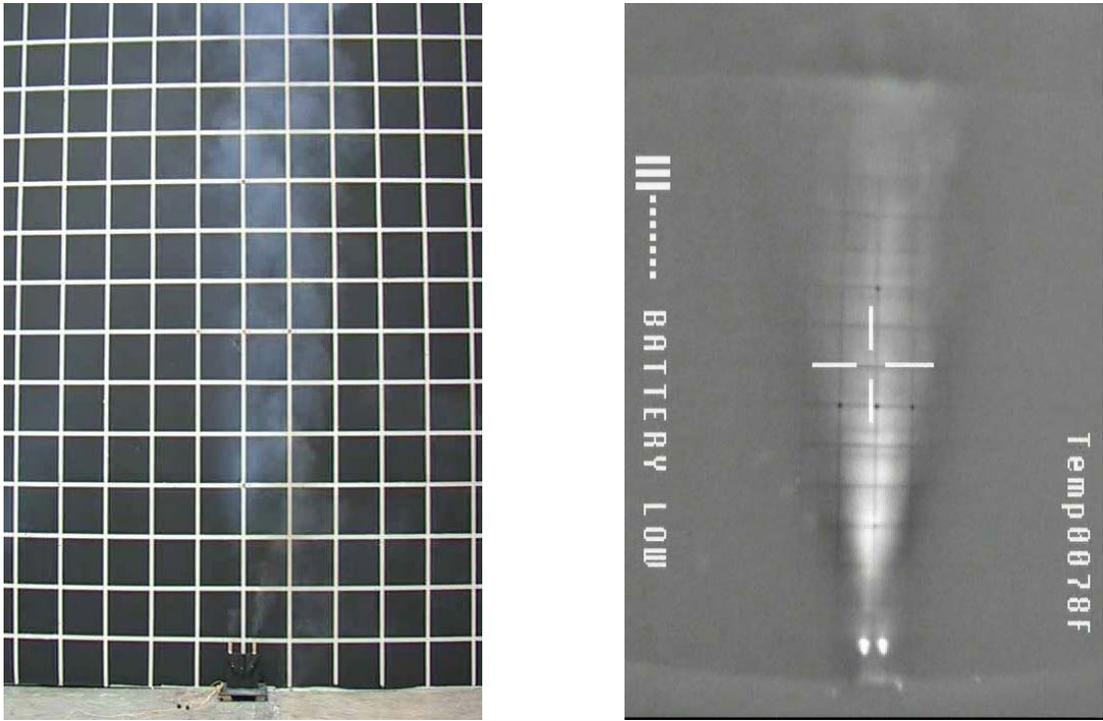


Figure F-22. Standard Video and Infrared Video Images of Gerb Discharge at 16 seconds.

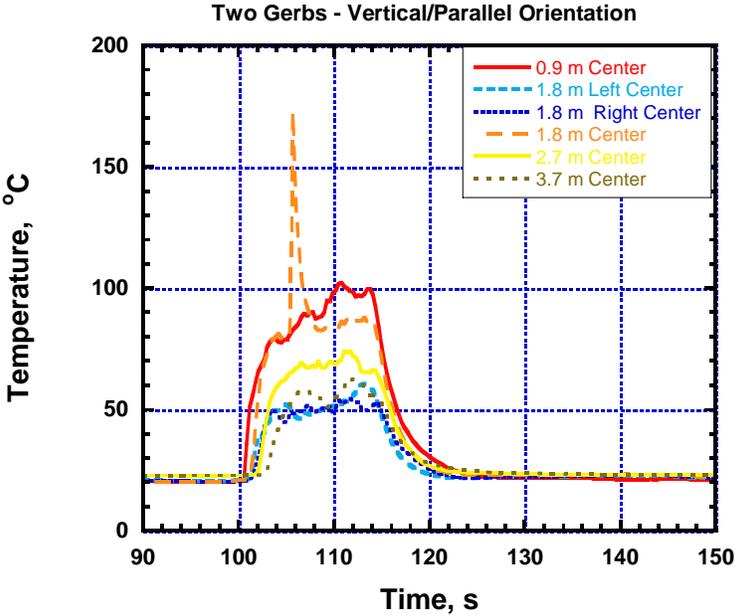
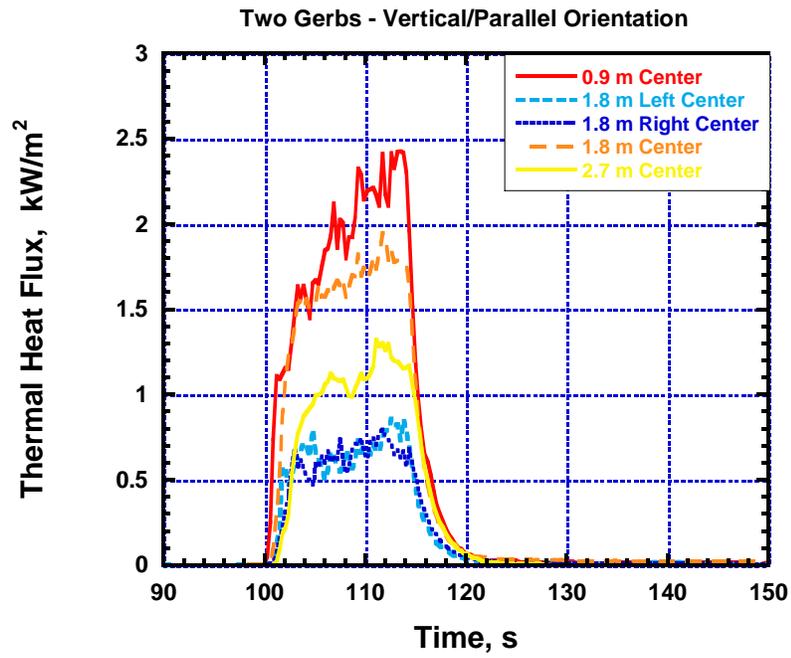


Figure F-23. Temperatures versus Time for Two Gerbs Discharged at 90 Degrees in Plane Parallel to Wall..



**Figure F-24. Heat Fluxes versus Time for Two Gerbs Discharged at 90 Degrees in Plane Parallel to Wall.**



# APPENDIX G. REAL-SCALE PLATFORM AREA MOCK-UP EXPERIMENTS

This appendix contains additional data on the fire growth in the full-scale mock-up fire tests described in Chapter 4, and is compiled here for reference. Some material from Chapter 4 is repeated for the benefit of the reader. In order to allow the combustion gases to be exhausted into an instrumented hood, the full-scale mock-up experiments were conducted with the platform section oriented to the east of the dance floor. In the actual nightclub, the platform section was **west** of the dance floor. In order to be consistent, the mock-up data will be presented using the orientation of the actual nightclub.

## G.1 INSTRUMENTATION AND EXPERIMENTAL PROCEDURE

The test room was equipped with thermocouples, video cameras, heat flux gauges, bi-directional probes, and gas extraction probes to measure carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), oxygen (O<sub>2</sub>), and hydrogen cyanide (HCN). In addition, fixed temperature and rate-of-rise heat detectors were installed, as were sprinklers. In one test, the sprinklers were not supplied with water but were monitored for time to activation. Figure G-1 is a schematic floor plan of the instrumentation positions.

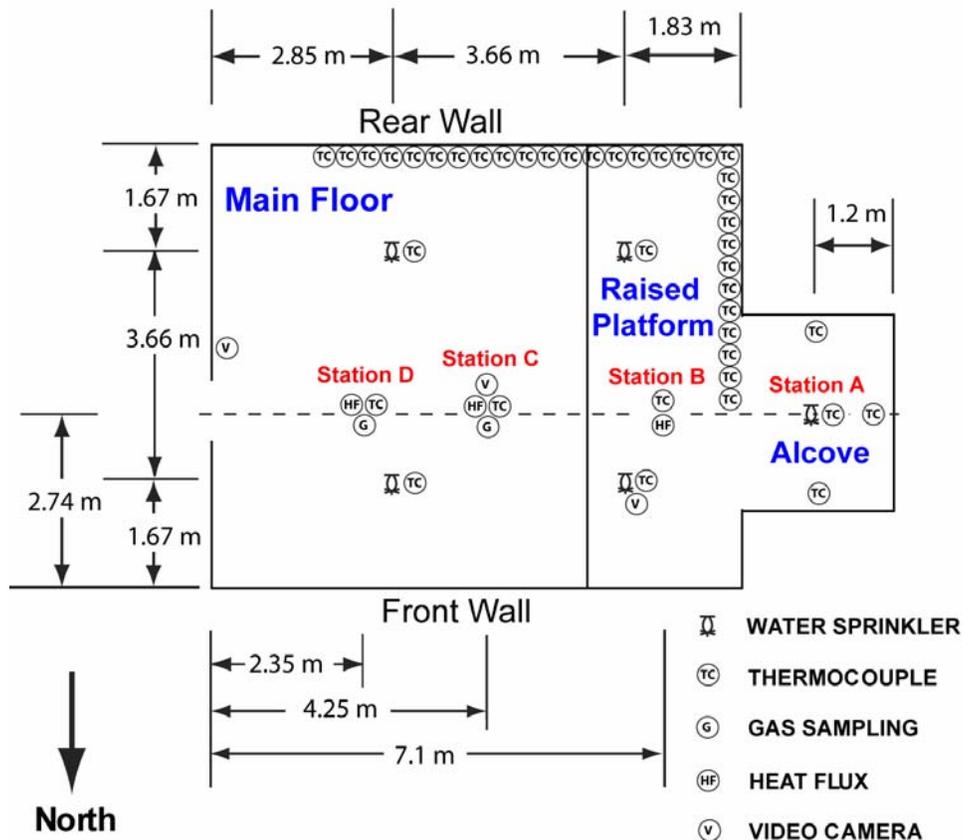
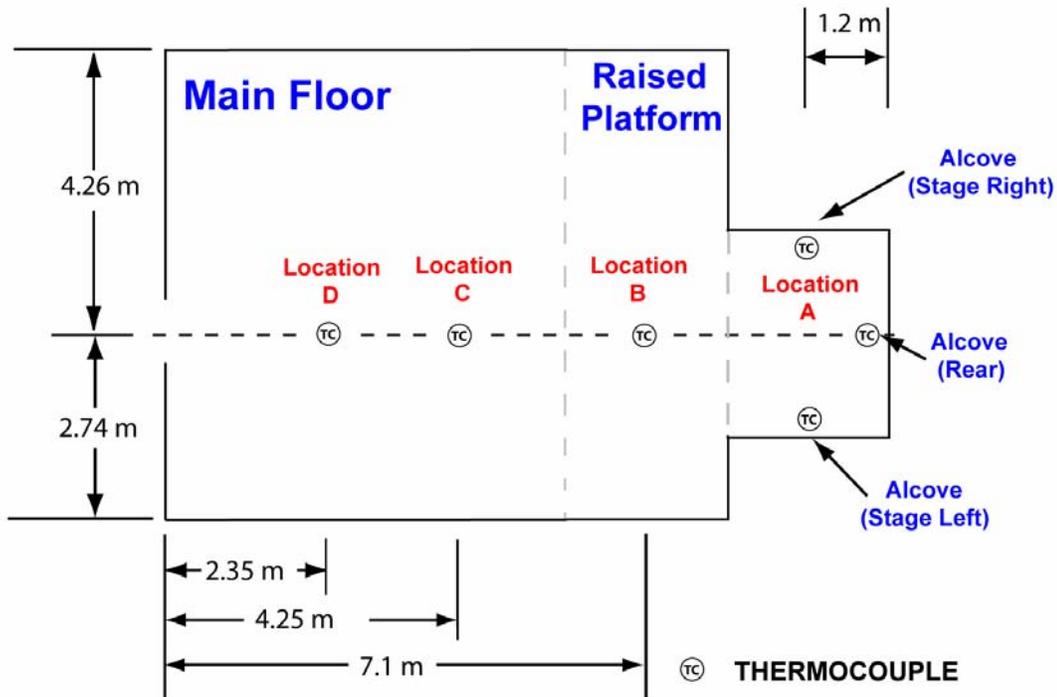


Figure G-1. Schematic floor plan with instrumentation positions.

Two full-scale experiments were conducted: one with and one without sprinklers. Prior to ignition, each of the analyzers was zeroed and calibrated and the data acquisition system and videos were started to collect background data. Data for 194 channels were recorded at one second intervals. Ignition of the foam was initiated with electric matches simultaneously at two locations on the outer corners of the alcove, 1.8 m above the raised floor area. The fire gases that emerged from the open door on the south end of the test room were captured in the hood of the oxygen depletion calorimeter. The data were reduced and plotted versus time for each of the channels.

## G.2 TEMPERATURE MEASUREMENTS

The temperatures were measured with 0.51 mm nominal diameter bare bead, Type K thermocouples. The thermocouple array over the platform floor area had a thermocouple located at 0.025 m, 0.30 m, 0.61 m, 0.91 m, 1.22 m, 1.52 m, 1.83 m, 2.13 m, 2.44 m, 2.74 m, 3.05 m, 3.35 m, and 3.66 m below the ceiling.



**Figure G-2. Schematic floor plan with thermocouple positions.**

For the platform floor thermocouple array, the thermocouple that was located 3.66 m below the ceiling, was positioned on the platform floor. The two-thermocouple arrays on the main floor also had a thermocouple located at 3.66 m below the ceiling, but in each case, the thermocouple was positioned 0.15 m above the main floor. Vertical thermocouple arrays were installed in the center of each wall of the alcove. Each array had a thermocouple located at 0.30 m, 0.61 m, 0.91 m, 1.22 m, 1.52 m, and 1.83 m below the ceiling of the alcove. A horizontal thermocouple array was installed 0.30 m below the ceiling. The array began at the centerline of the alcove opening and continued north along the rear wall, and then followed the platform wall west for 6.1 m. The thermocouples were spaced approximately 0.30 m apart.

In addition, thermocouples were located adjacent to the sprinklers. Temperatures versus time are plotted in Figures 4-22 through 4-28.

Thermocouples were installed near the ignition points on both sides of the alcove opening, 1.8 m above the floor of the platform. As shown in Figure G-3, in the unsprinklered compartment burn, the temperatures near the ignition point stage-left began to increase rapidly in less than 10 seconds and it then dropped to about 100 °C. After about 30 seconds, both stage-right and stage-left thermocouples began to increase to temperatures in excess of 600 °C. The initial peak and subsequent drop and then rapid increase were probably due to movement of the flame sheet or thermal plume. If the thin flame sheet was near the thermocouple bead, a high temperature would be recorded, but if the plume of hot gases moved and caused the bead to be in the fuel rich interior of the plume, lower temperatures could have been recorded.

Slightly different temperature behavior was recorded in the sprinklered test (Figure G-4). Initially both stage-left and stage-right temperatures increased rapidly as the stage-left thermocouple had in the unsprinklered test, but as sprinklered burn temperatures dropped back to about 100 °C, the sprinklers activated and caused the temperatures to decrease to near ambient temperatures.

Three thermocouple arrays were installed in the alcove, stage-right wall, stage-left wall, and rear wall of the alcove (Figures G-5, G-7, and G-9). The temperatures recorded by each of three thermocouple arrays were similar. In the unsprinklered test burns, the temperatures began to increase within 30 seconds after ignition. By 60 seconds to 70 seconds after ignition, temperatures exceeded 800 °C. In the sprinklered compartment burns (Figures G-6, G-8, and G-10), the temperatures also began to increase in approximately 30 seconds, but the temperatures had only increased to about 40 °C to 60 °C before the sprinklers activated and the temperature gradually decreased to ambient temperatures.

One thermocouple array was installed from ceiling to floor on the platform, Location B. For the unsprinklered case (Figure 4-22), the temperature at the ceiling began to increase within 10 seconds and continued to increase to over 800 °C in approximately 50 s. As the hot gases began to form an upper layer, the layer began to descend and in just over 110 seconds, the temperature at the floor of the platform had increased to over 600 °C. In less than 60 seconds, the temperature had exceeded 50 °C at the 1.4 m (4.5 ft) above the floor (2.4 m below the ceiling) elevation. For the sprinklered test burn (Figure 4-25), the ceiling thermocouple recorded temperatures in excess of 360 °C in less than 25 seconds, but had decreased to ambient in less than 40 seconds. The activation of the sprinklers caused the other thermocouples at lower elevations to record near ambient temperatures throughout the test burn.

The thermocouple array at Location C was installed 6.7 m from the foam covered platform wall. Location C thermocouples were an additional 3 m further away from the platform wall than the thermocouples at Location B. Since the thermocouples at Location C were further away from the fire source than the thermocouples at Location B, the temperatures might be expected to increase more slowly than at Location B. For the unsprinklered thermocouples (Figure 4-23), the temperatures did require slightly longer to begin to increase, about 15 seconds, and required approximately 70 seconds to reach peak temperatures of 800 °C. The temperatures at 3.6 m below the ceiling did not begin to increase until 60 seconds after ignition and then the temperatures reached peak values of approximately 100 °C in 90 s. The temperatures near the floor at Location C were significantly lower than the values recorded at the floor on the platform, Location B. In less than 70 seconds, the temperature had exceeded 50 °C at the 1.4 m (4.5 ft) above the floor (2.4 m below the ceiling) elevation. For the sprinklered test burn (Figure 4-26), the ceiling temperatures reached a peak temperature of 170 °C in about 20 seconds and declined to

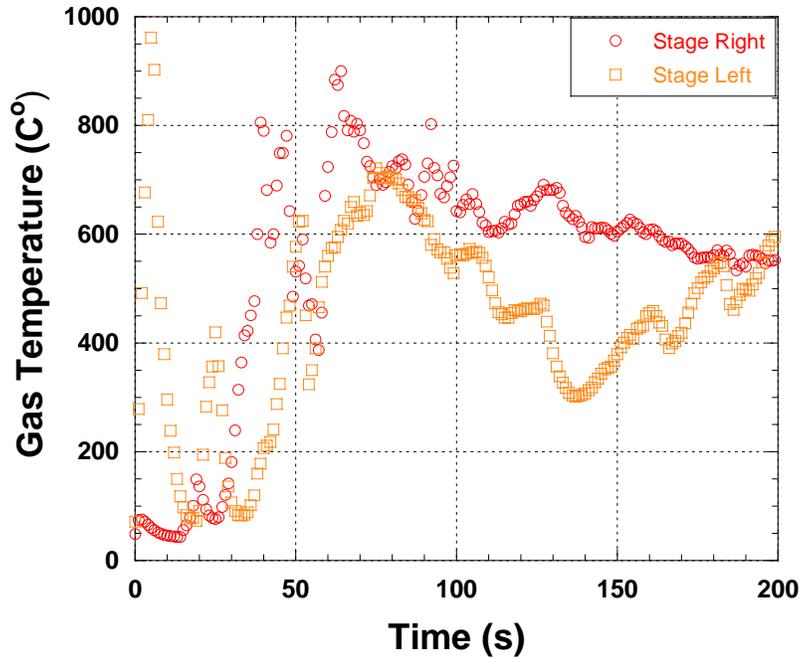


Figure G-3. Temperatures versus Time for Unsprinklered Mockup Test. Thermocouples positioned on right and left side of alcove opening 1.8 m (5.1 ft) above platform floor at ignition points.

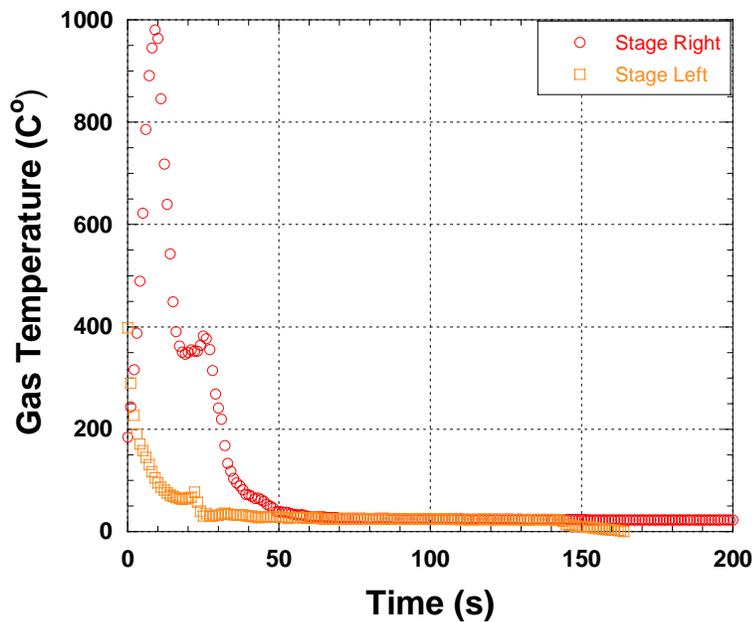


Figure G-4. Temperatures versus Time for Sprinklered Mockup Test. Thermocouples positioned on right and left side of alcove opening 1.8 m (5.5 ft) above platform floor at ignition points.

near ambient temperatures within 60 seconds. Thermocouples at lower elevations appeared to remain at near ambient temperatures throughout the test.

The thermocouple array at Location D was installed 8.5 m from the foam covered platform wall. Location D thermocouples were an additional 1.8 m further away from the platform wall than the thermocouples at Location C. Again, as the distance between the thermocouple array and the fire increased, the temperatures were expected to increase more slowly than the arrays that were located closer to the fire. For the unsprinklered thermocouples (Figure 4-24), the temperatures did require slightly longer to begin to increase, about 20 seconds, and required approximately 80 seconds to reach peak temperatures of 700 °C. The temperatures at 3.6 m below the ceiling did not begin to increase until 70 seconds after ignition and then the temperatures reached peak values of approximately 100 °C in 90 s. The temperatures near the floor at Location D were about the same as that the values recorded at the floor on the platform, Location C. In less than 70 seconds, the temperature had exceeded 50 °C at the 1.4 m (4.5 ft) above the floor (2.4 m below the ceiling) elevation. For the sprinklered test burn (Figure 4-27), the ceiling temperatures reached a peak temperature of 130 °C in about 20 seconds and declined to near ambient temperatures within 60 seconds. Thermocouples at lower elevations appeared to remain at near ambient temperatures throughout the test.

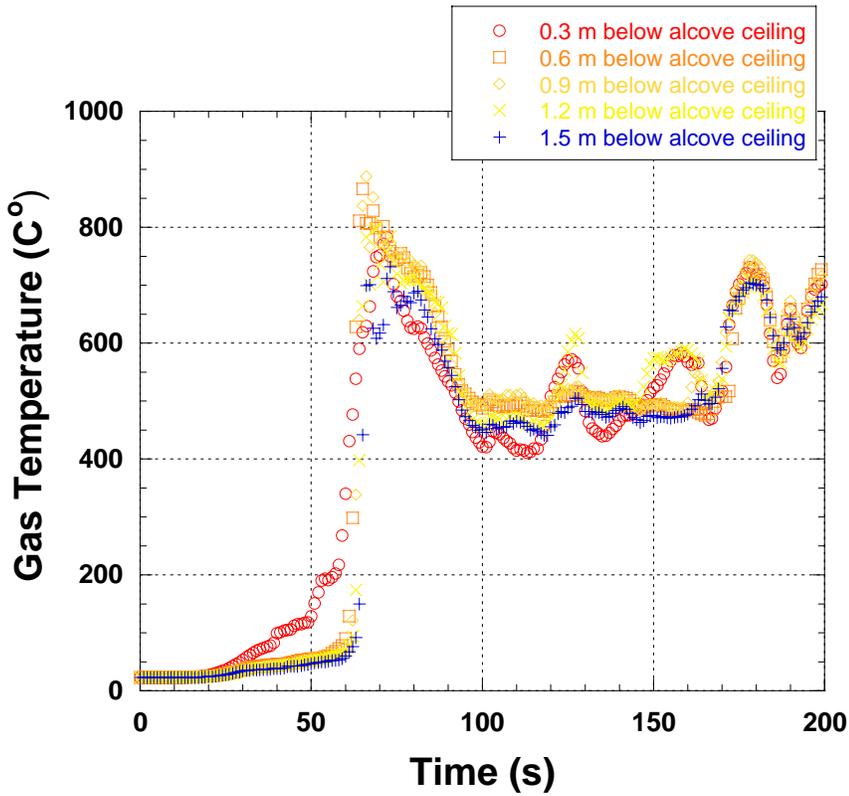


Figure G-5. Temperatures versus Time for Unsprinklered Mockup Test. Thermocouples positioned in Alcove (A-SR) on wall (stage-right).

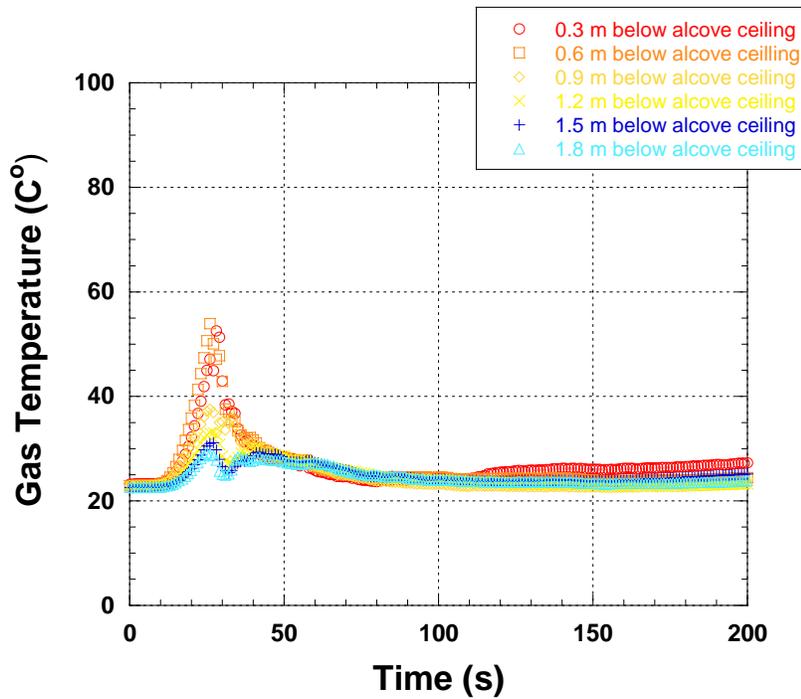


Figure G-6. Temperatures versus Time for Sprinklered Mockup Test. Thermocouples positioned in Alcove (A-SR) on wall (stage-right).

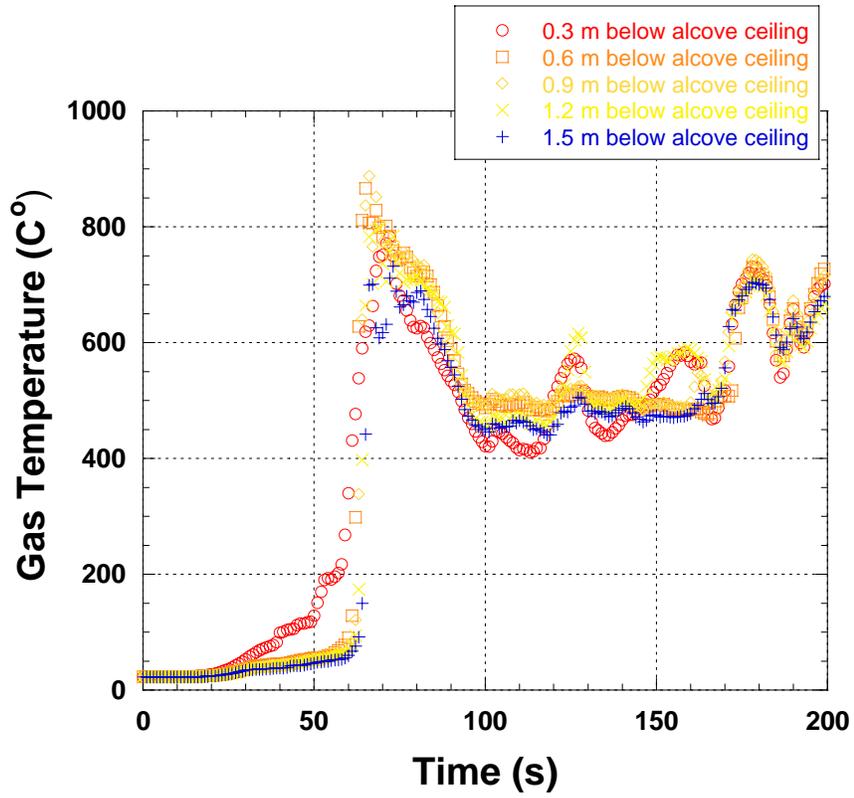


Figure G-7. Unsprinklered Mockup Test. Alcove (A-SB) on rear wall .

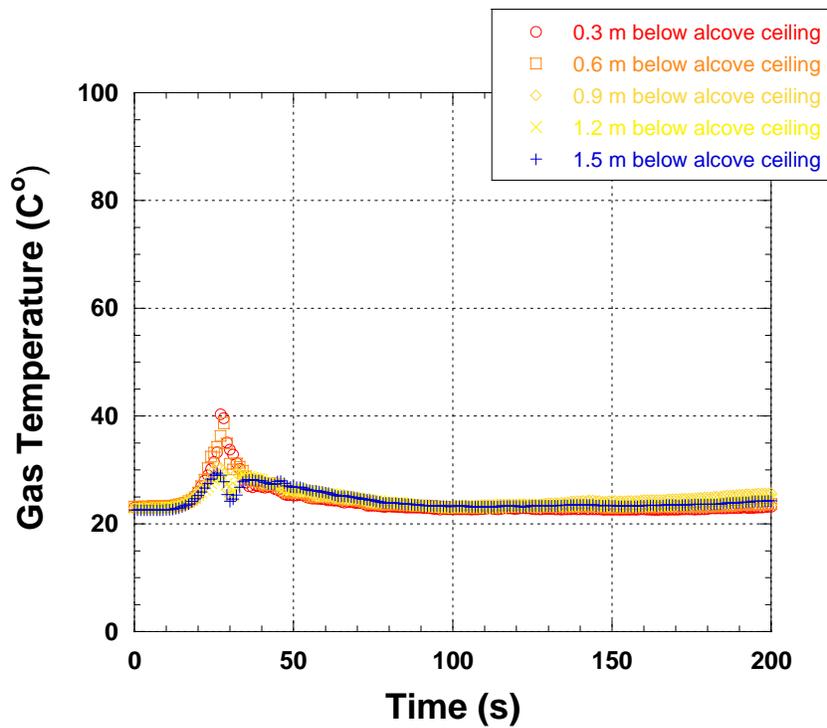


Figure G-8. Sprinklered Mockup Test. Alcove (A-SB) on rear wall.

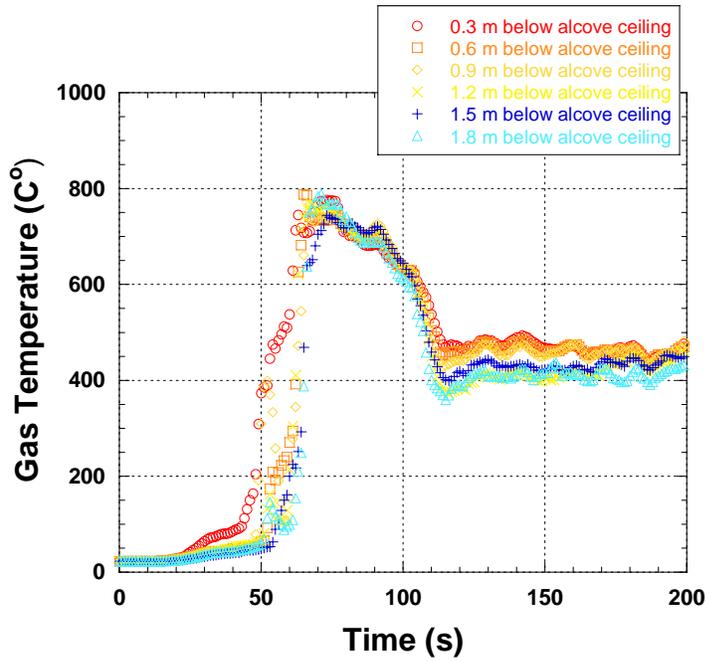


Figure G-9. Temperatures versus Time for Unsprinklered Mockup Test. Thermocouples positioned in Alcove (A-SL) on wall (stage-left).

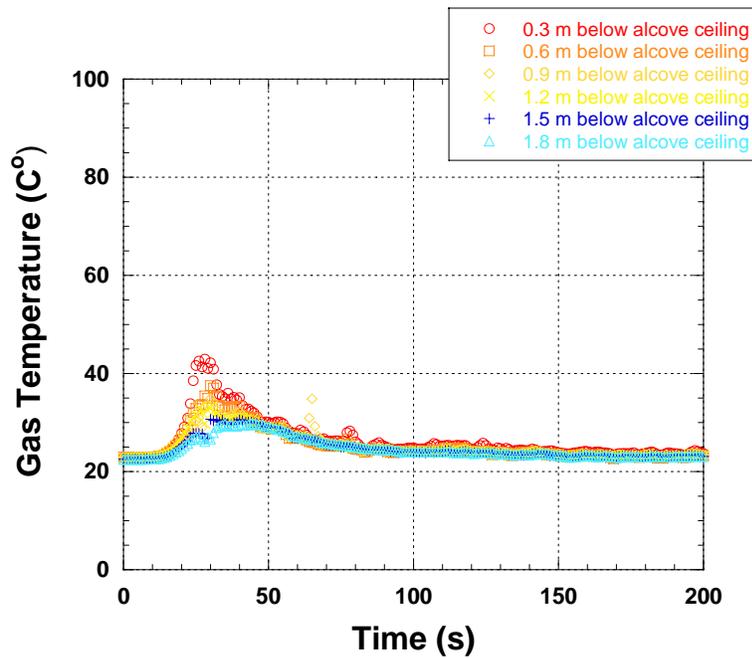


Figure G-10. Temperatures versus Time for Sprinklered Mockup Test. Thermocouples positioned in Alcove (A-SL) on wall (stage-left).

### **G.3 GAS MEASUREMENTS**

The gas sampling ports were co-located with the heat flux sensors on the main floor area (Figure 4-63). The gases were pulled through 9.4 mm ID tubing to chemical analyzers after passing through moisture and particulate filters. Carbon monoxide and carbon dioxide concentrations were monitored using non-dispersive infrared gas analyzers while the oxygen concentrations were measured using paramagnetic analyzers. Hydrogen cyanide concentrations were monitored using impingers and real-time gas analyzers, which utilized an off-the-shelf cyanide combination electrode. Each impinger utilized 0.1 M KOH as the trapping solution and samples were analyzed according to NIOSH Method 7904 [1]

During the sampling process, the gas sample for the oxygen, carbon monoxide, and carbon dioxide analysis was drawn through a cold trap which removed the water vapor. The oxygen, carbon monoxide, and carbon dioxide concentrations were recorded by each analyser on a dry or Orsat basis. The hydrogen cyanide sample gas utilized a different sampling train and did not pass through a cold trap. Since the hydrogen cyanide samples were monitored on a wet basis, the oxygen, carbon monoxide, and carbon dioxide concentrations were corrected for the water removed by the cold trap. For complete combustion of low methane, two moles of water are generated for each mole of carbon dioxide produced. For larger hydrocarbon molecules, the ratio of moles of water produced for each mole of carbon dioxide decreases to a 1:1 ratio, assuming the carbon to hydrogen ratio approaches 1:2. It was assumed that for every mole of carbon dioxide or carbon monoxide generated that a mole of water was also generated. This assumption was used to correct the dry or Orsat basis analyzer data to a wet basis. By adding the water vapor back into the gas sample, the concentrations of oxygen, carbon monoxide, and carbon dioxide decreased. The relative uncertainty in the volume fraction measurement is estimated to be +/- 20 %.

Carbon dioxide gas concentrations versus time are plotted in Figures G-12 and G-13. For the unsprinklered tests, carbon dioxide concentrations at both Locations C and D began to increase 80 seconds after ignition and reached peak values of 12 % approximately 100 seconds after ignition. The fluctuations that were observed in the oxygen concentrations were also seen in the carbon dioxide concentrations. For the sprinklered compartment experiments, the carbon dioxide concentrations did not appear to increase above ambient concentrations.

### **G.4 HEAT FLUX MEASUREMENTS AND HEAT DETECTOR RESPONSE**

Three elliptical radiometers were installed in the ceiling of the test cell viewing downward at Location B, C, and D (Figure G-14). In addition to the radiometer at Location B, a total heat flux gauge with an upward view was installed flush with the platform floor. At Locations C and D, two additional total heat flux gauges were installed 1.5 m above the floor. One total heat flux gauge was positioned to have an upward view, while the other gauge had a view of the alcove. The heat flux sensors were water-cooled Schmidt-Boelter type transducers. Heat flux versus time is plotted in Figure G-15 through Figure G-23. The uncertainty in the heat flux values reported is estimated to be +/- 20 %.

The three radiometers were plotted together in Figure G-15. As the distance between the radiometer and the fire source increased, the peak radiation flux decreased. For Locations B, C, and D, peak radiation levels were approximately 60 kW/m<sup>2</sup>, 50 kW/m<sup>2</sup>, and 20 kW/m<sup>2</sup>, respectively.

Unsprinklered and sprinklered radiation and total heat fluxes are plotted in Figures G-16 through G-23. In each sprinklered test at Locations C and D, neither radiation nor total heat flux reached significantly higher fluxes than background. Only at Location B, was there a slight increase in radiation or total heat flux at about 20 s.

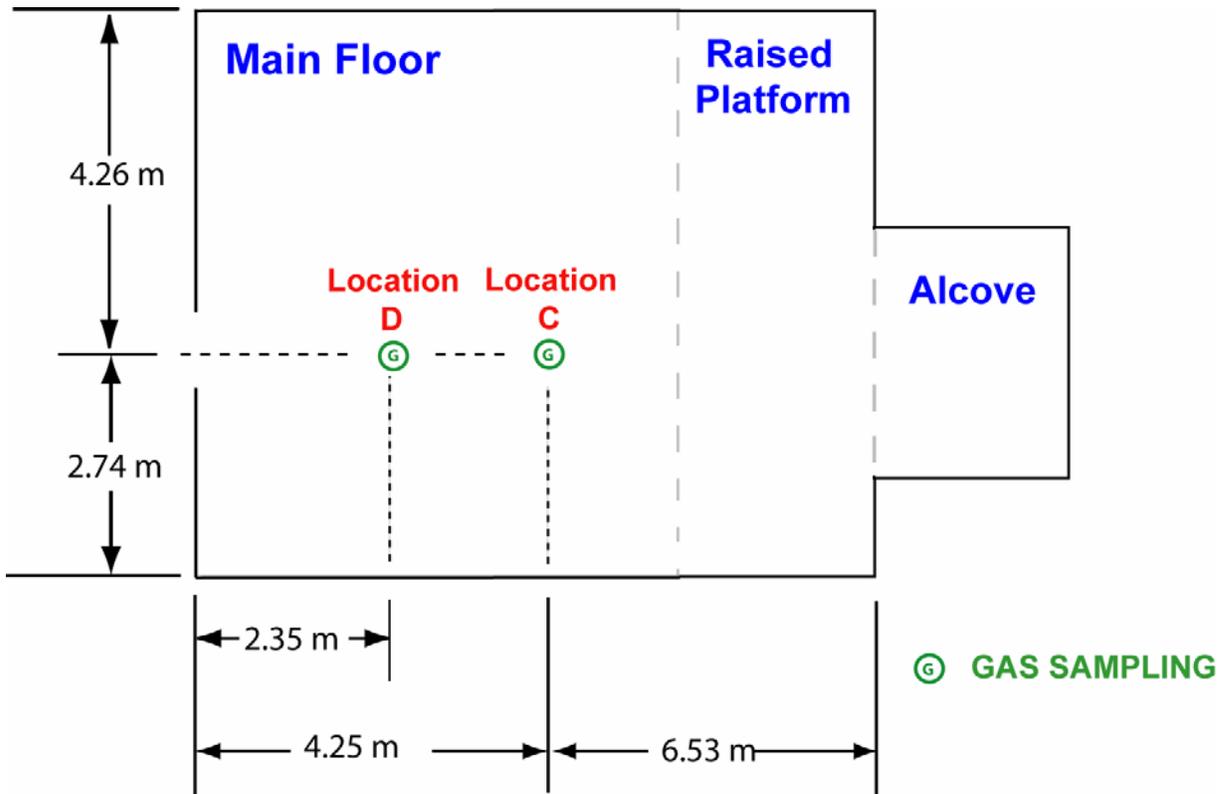


Figure G-11. Schematic floor plan with gas sampling locations.

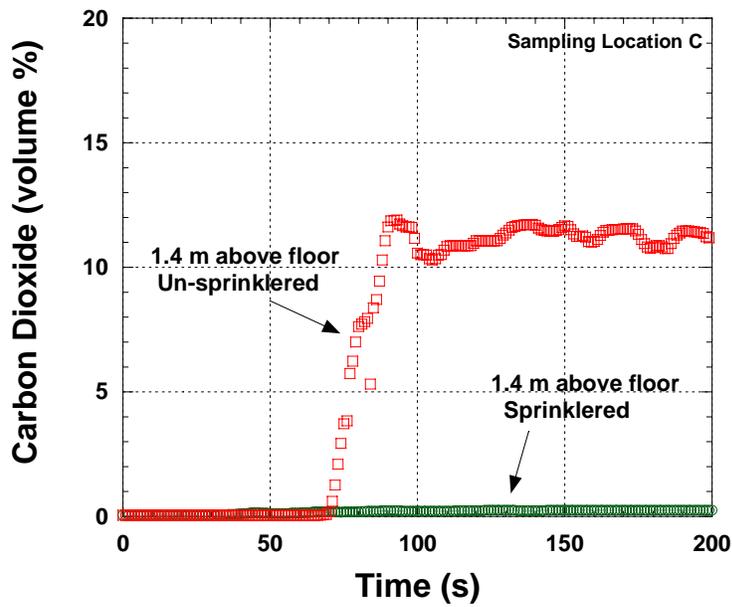


Figure G-12. Carbon dioxide volume fraction versus time for unsprinklered and sprinklered mockup test. Gas sampling probe positioned on main floor (Location C) at 1.4 m (4.5 ft) above floor.

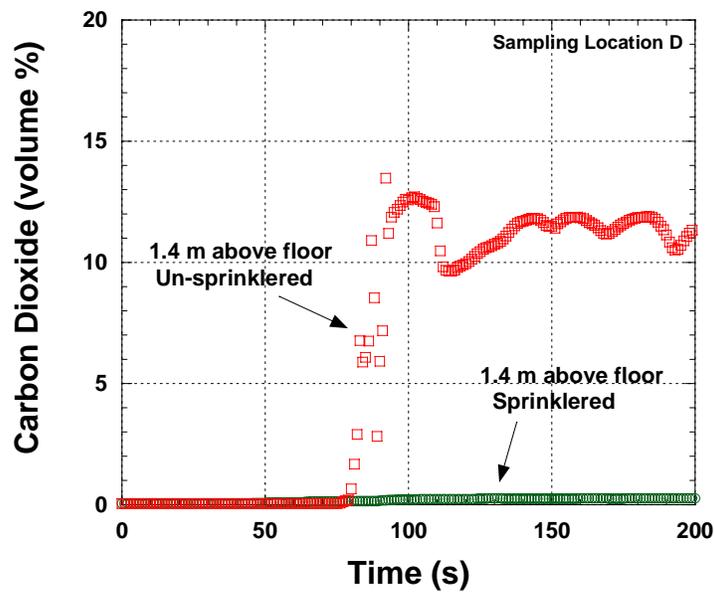


Figure G-13. Carbon dioxide volume fraction versus time for unsprinklered and sprinklered mockup test. Gas sampling probe positioned on main floor (Location D) at 1.4 m (4.5 ft) above floor.

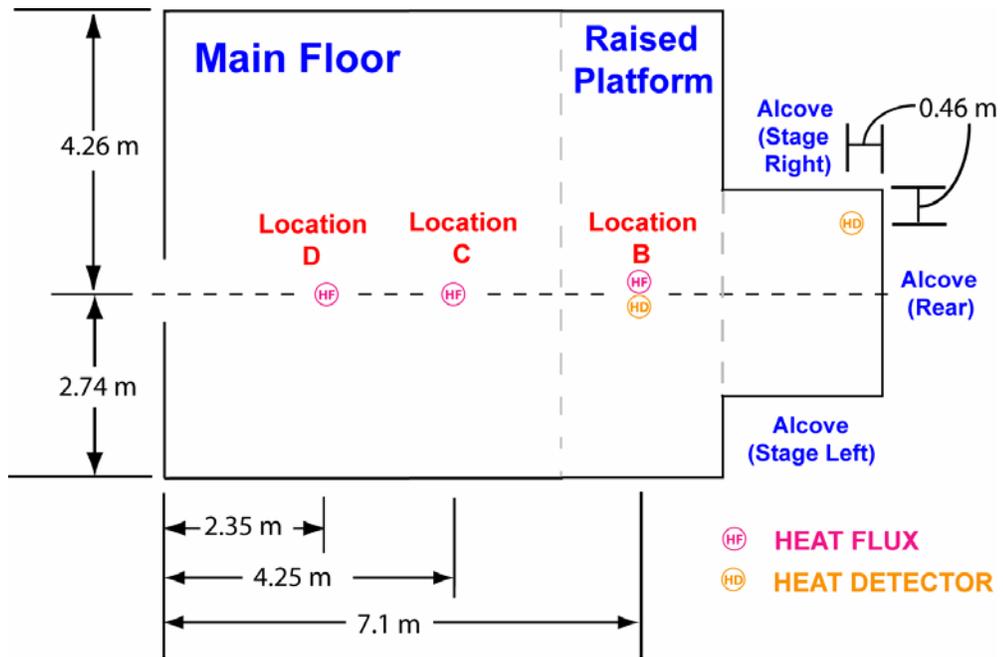


Figure G-14. Schematic floor plan with heat flux and heat detector locations.

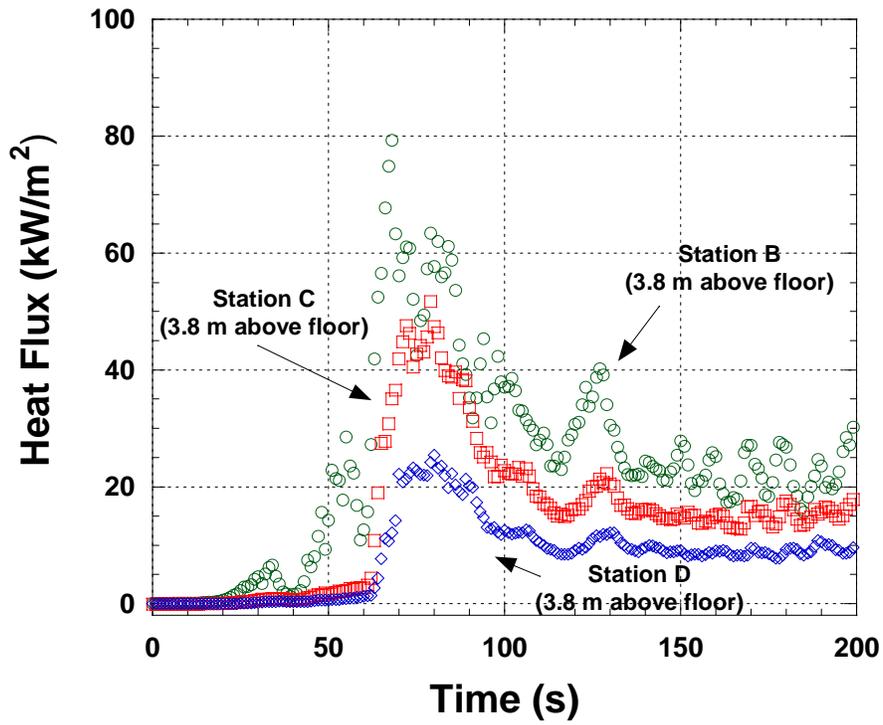


Figure G-15. Radiation fluxes versus time for un-sprinklered mockup test. Gauges positioned flush with ceiling (3.8 m above floor) at locations B, C, and D.

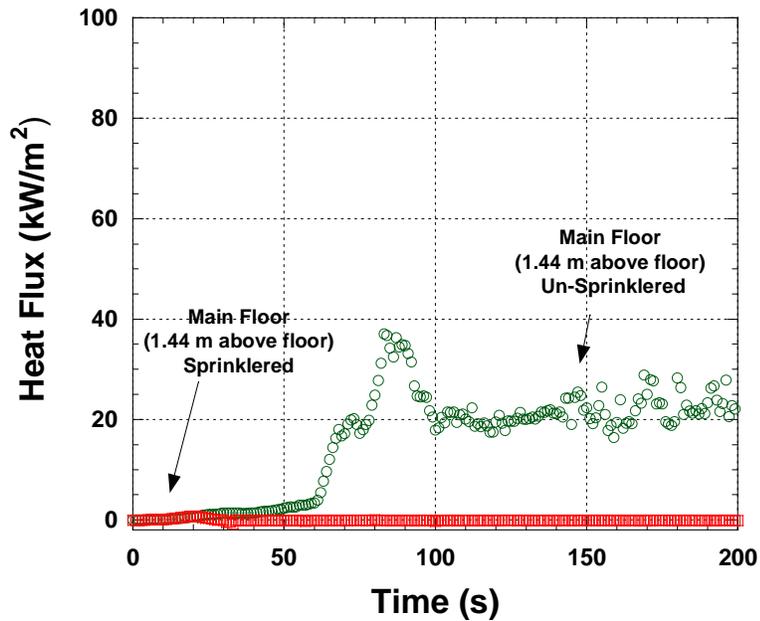


Figure G-16. Heat Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned facing alcove (1.44 m above floor) at location C.

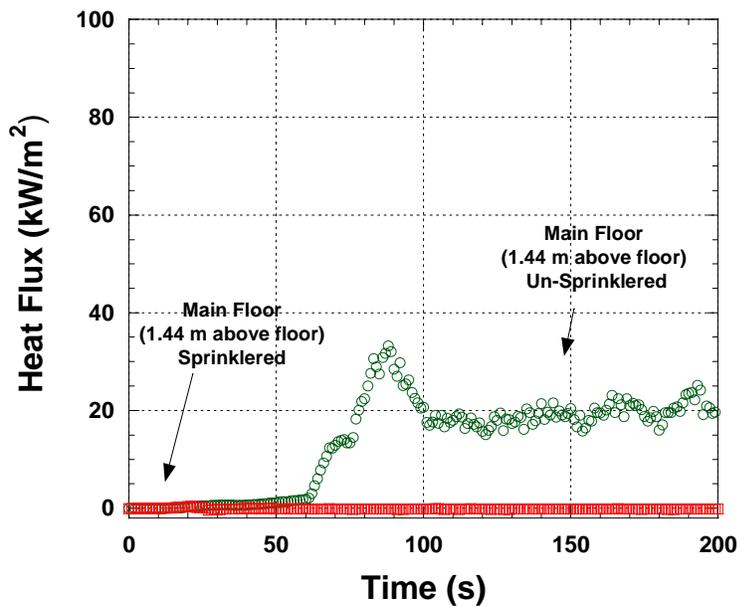


Figure G-17. Heat Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned facing alcove (1.44 m above floor) at location D.

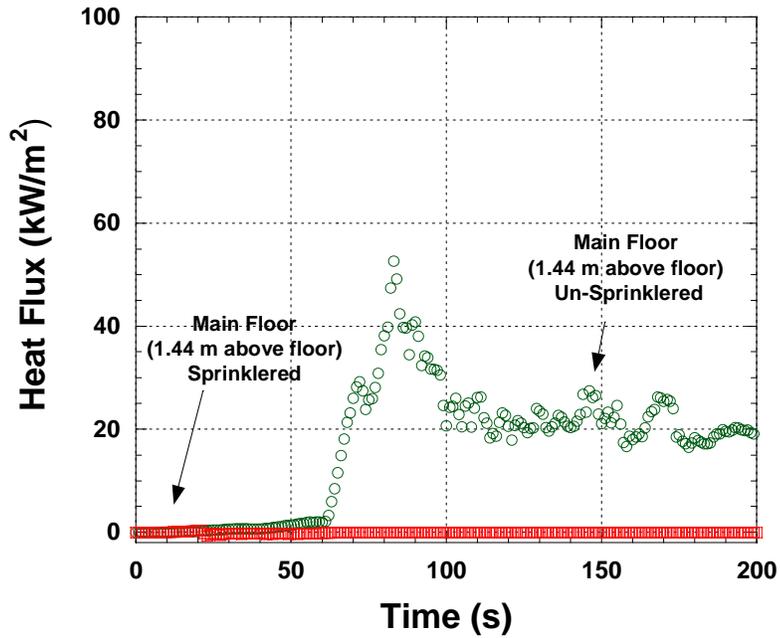


Figure G-18. Heat Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned facing ceiling (1.44 m above floor) at location C.

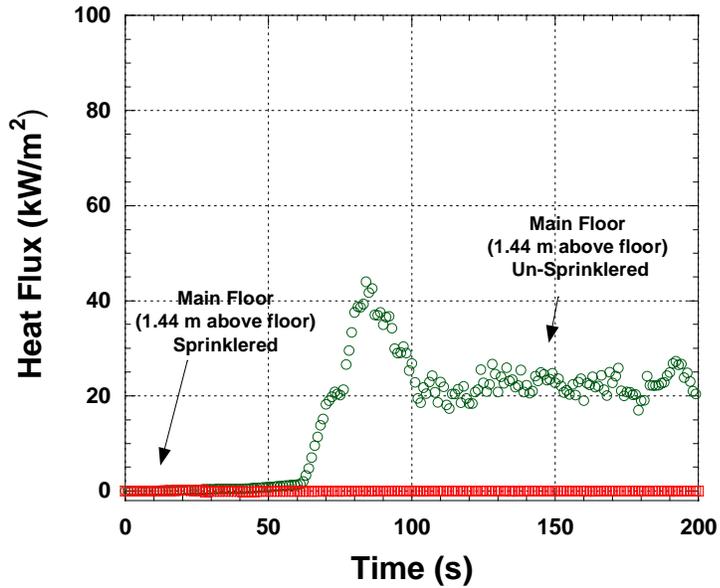


Figure G-19. Heat Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned facing ceiling (1.44 m above floor) at location D.

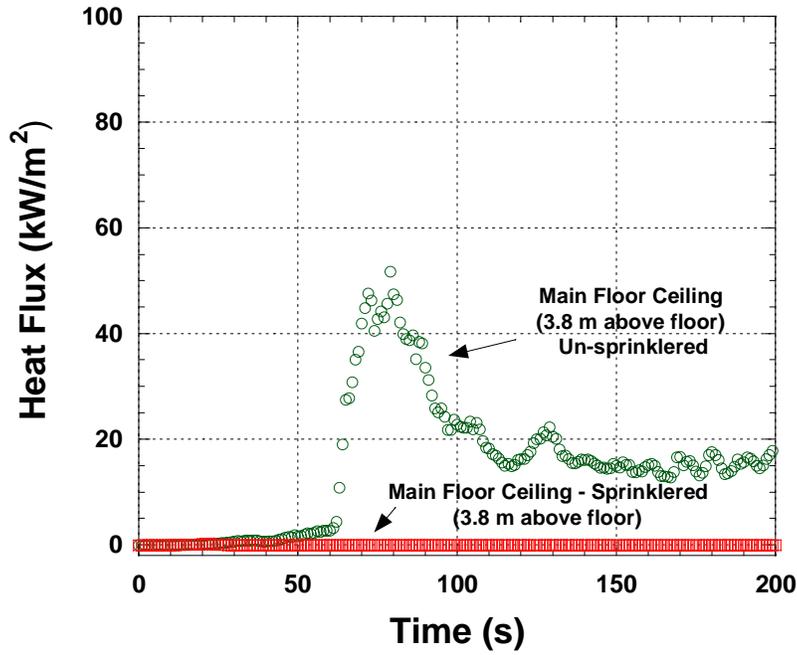


Figure G-20. Radiation Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned flush with ceiling, facing down (3.8 m above floor) at location C.

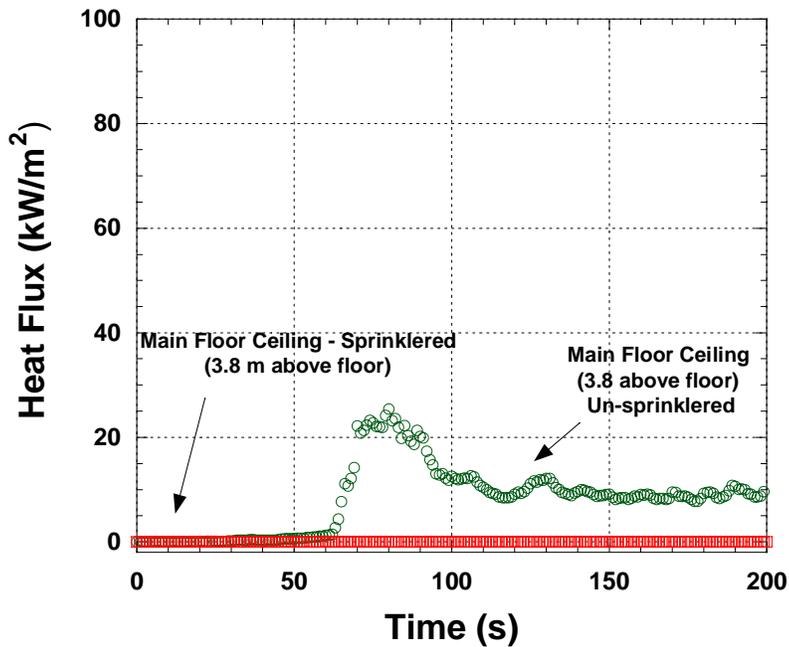


Figure G-21. Radiation Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned flush with ceiling, facing down (3.8 m above floor) at location D.

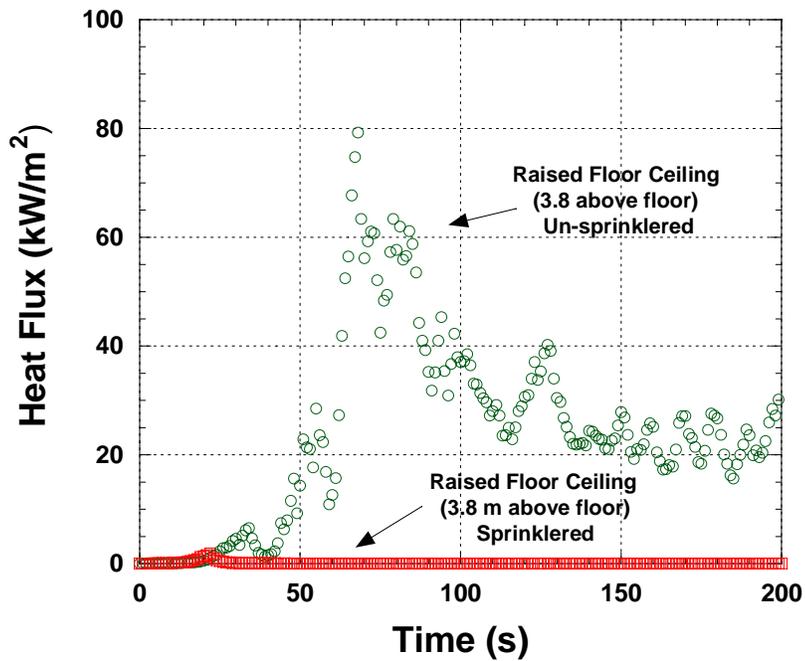


Figure G-22. Radiation Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned flush with ceiling, facing down (3.8 m above floor) at location B.

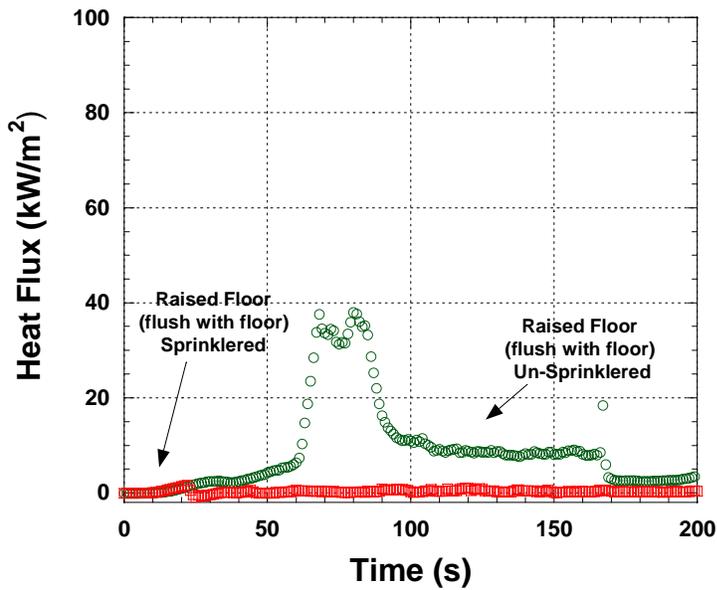


Figure G-23. Heat Fluxes versus Time for Unsprinklered and Sprinklered Mockup. Gauges positioned flush with raised floor of platform, facing up at location B.

#### **G.4 References for Appendix G**

- [1] "Cyanides, Aerosol and Gas, Method 7904," *NIOSH Manual of Analytical Methods*, Fourth Edition, 8/15/94.



# APPENDIX H. POLYURETHANE FOAM – CHEMISTRY

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## H.1 POLYURETHANE PLASTICS

Polyurethane refers to a large category of materials including surface coatings, elastomers, and foams, rigid or flexible, and thermoplastic or thermosetting [1,2]. While large quantities of polyurethanes are used to manufacture adhesives and protective coatings, the foam type of polyurethane is widely used in the production of upholstered furniture, bedding, sponges, toys, wearing apparel, and medical dressings. Rigid urethane foams are used for insulation in building constructions. Flexible polyurethane foams are used in packaging materials and acoustical insulation panels.

The urethane linkage, which all polyurethanes have in common, involves the reaction of an isocyanate group with a hydroxyl-containing group. Common hydroxyl-bearing groups include polyether alcohols, polyester alcohols, carboxylic acids, and amines. The chemical structure, such as the length and side branching, of the hydroxyl-bearing group plays an important role in the properties of the final foam product. In general, short chain length compounds with tri- and trifunctional-alcohols, are used to produce more rigid foams while longer chain length compounds with trifunctional-alcohols are used to generate more flexible foams [3]. However, additional hydroxyl-containing compounds including glycerol, castor oil, raw sugar, sorbitol, isocyanate, and phenols can be incorporated to produce plastics with increased flexibility, increased rigidity, and increased heat resistance. If a polyether alcohol was selected as the primary hydroxyl-containing group, the resulting foam may be referred to as polyether polyurethane foam. Choosing a polyester alcohol as the hydroxyl bearing reactant will generate polyester polyurethane foam.

Although the flammability of polyurethanes might be expected to be lower than those of many other polymers owing to their significant nitrogen content and the cross-linking usually present, in practice the fire performance of polyurethane-based materials is often poor due to the thin-walled structure and low density of the plastic foam [4]. The flame resistance properties of polyurethane foams can be improved by either incorporating additives into the foam or by careful selection of the hydroxyl-containing reactant.

Flame retardant additives may be inorganic, such as diammonium phosphate, or organic compounds containing chlorine, bromine or phosphorus. The fire-retardants typically work either by vaporizing when heated and displacing the oxygen or by releasing moisture that absorbs energy and delays ignition. These additives can be mixed in with the product as it is manufactured or applied to the surface after production. But, the low degree of permanency and the adverse impact on the physical properties of the foam, stimulated development of a second method of improving flame resistance. The second method involves choosing the hydroxyl-bearing reactant to contain flame resistant groups such as chlorine, bromine, or phosphorus, or to contain copolymers that contain heat resistant groups such as isocyanurates, cyclic imides, or other nitrogen heterocycles [5]. The second method incorporates the flame retardant groups into the polymer structure itself, insuring even distribution and more permanence of the flame retardant compounds.

## H.2 POLYURETHANE CHEMISTRY

As a group of plastics, polyurethane encompasses a large number of materials including foams, elastomers, and surface coatings. The final properties of polyurethane, such as flexible, semi-flexible, or

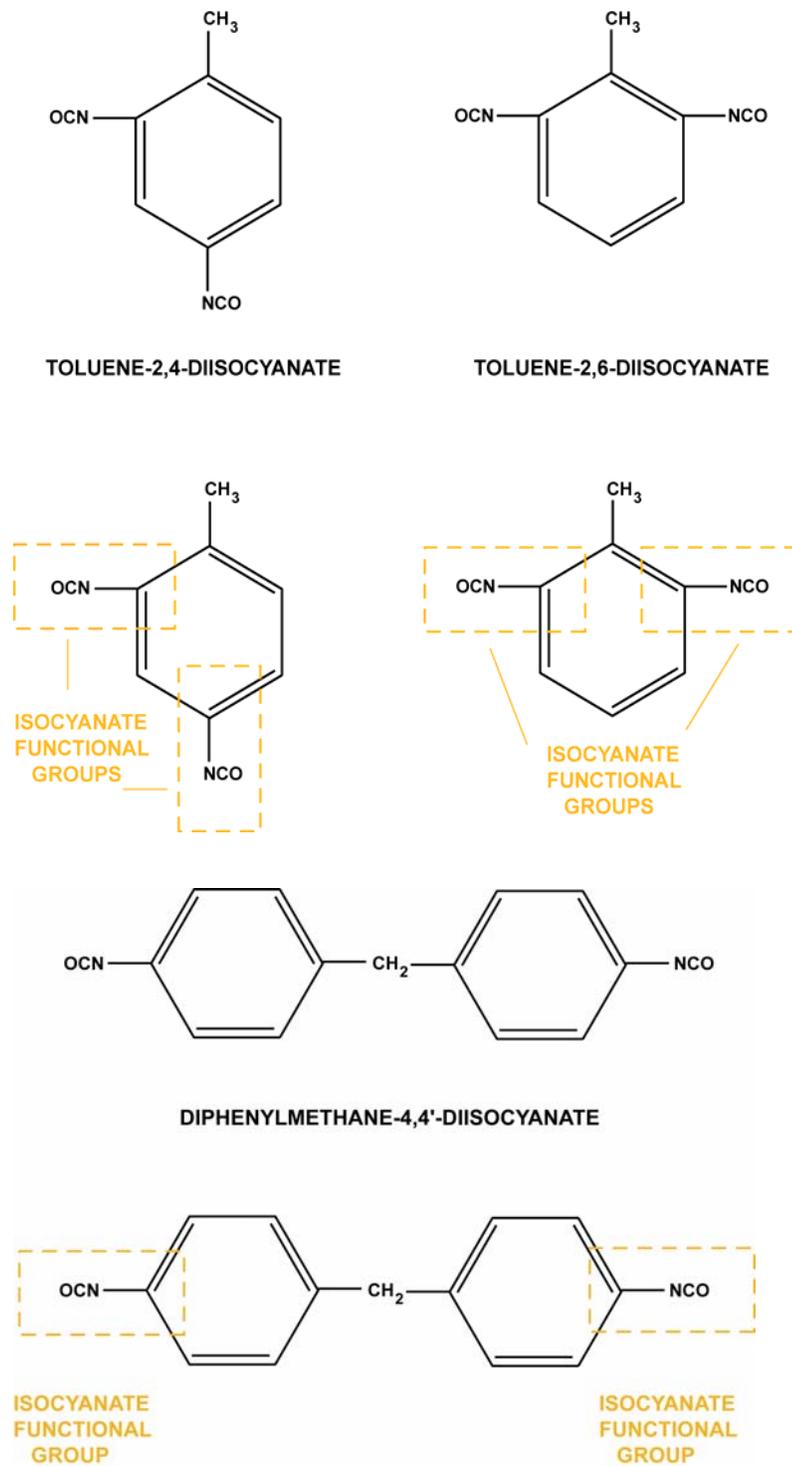
rigid, thermoplastic or thermosetting, and closed cell or open cell, is determined by the starting materials, how the polymer is processed or produced, extent of crosslinking, and additives.

Polyurethane is typically produced by reacting an isocyanate component with a polyol. Examples of three common isocyanate compounds, toluene-2,4-diisocyanate, toluene-2,6-diisocyanate, and diphenylmethane-4,4'-diisocyanate (Figure H-1). The isocyanate functional groups are also highlighted for each compound. A polyol is a hydrocarbon with a number of alcohol functional groups. Simple alcohols such as ethyl alcohol (Figure H-2) may have only one alcohol functional group, but longer chain alcohols may have multiple alcohol groups (Figure H-2). As the isocyanate functional group reacts with an alcohol group (Figure H-3), the urethane linkage is formed.

The chemical structure of the isocyanate and polyol components help determine the type and properties of the polyurethane. In addition to alcohol functional groups, polyols also incorporate other functional groups including ether and ester linkages. Examples of ether and ester functional groups are shown in Figure H-4.

If the polyol incorporates multiple ether groups, such as polyethylene oxide or polypropylene oxide, then the resulting polyurethane will have a number of ether linkages and is typically referred to as a polyether polyurethane. Short carbon chain polyether alcohols with tri- and multi-functional groups; result in more rigid polyurethane foam. Long chain hydrocarbons with trifunctional groups are used to create more flexible foams. If the polyol incorporates multiple ester groups, then the resulting polyurethane will have a number of ester linkages and is termed as polyester polyurethane foam.

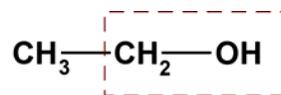
Other polyols, including glycerol, sorbitol, raw sugar, and modified castor oils can be incorporated in the polyurethane making process to effect the degree of crosslinking, length of chains, increase elasticity, and increase heat resistance. If additional isocyanate is added and allowed to react with other isocyanate functional groups, isocyanurate rings can be formed. These rings produce a more stable chemical structure that can increase rigidity, improve thermal stability, and decrease flammability. If additional isocyanate is added along with water or carboxylic acid, the resulting reaction will release carbon dioxide during the reaction. The gaseous carbon dioxide will act as a blowing agent and create the open-cell structure that is characteristic of foams.



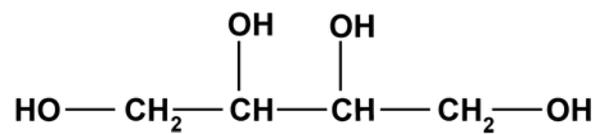
**Figure H-1. Isocyanate Compounds used in Polyurethane Production.**



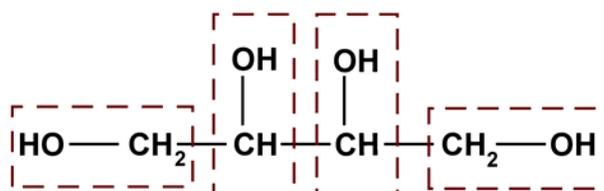
ETHYL ALCOHOL



ALCOHOL  
FUNCTIONAL  
GROUP



POLYOL



4 ALCOHOL GROUPS

Figure H-2. Example of Alcohol Functional Groups.

TOLUENE-2,6-DIISOCYANATE

POLYOL

TOLUENE-2,4-DIISOCYANATE

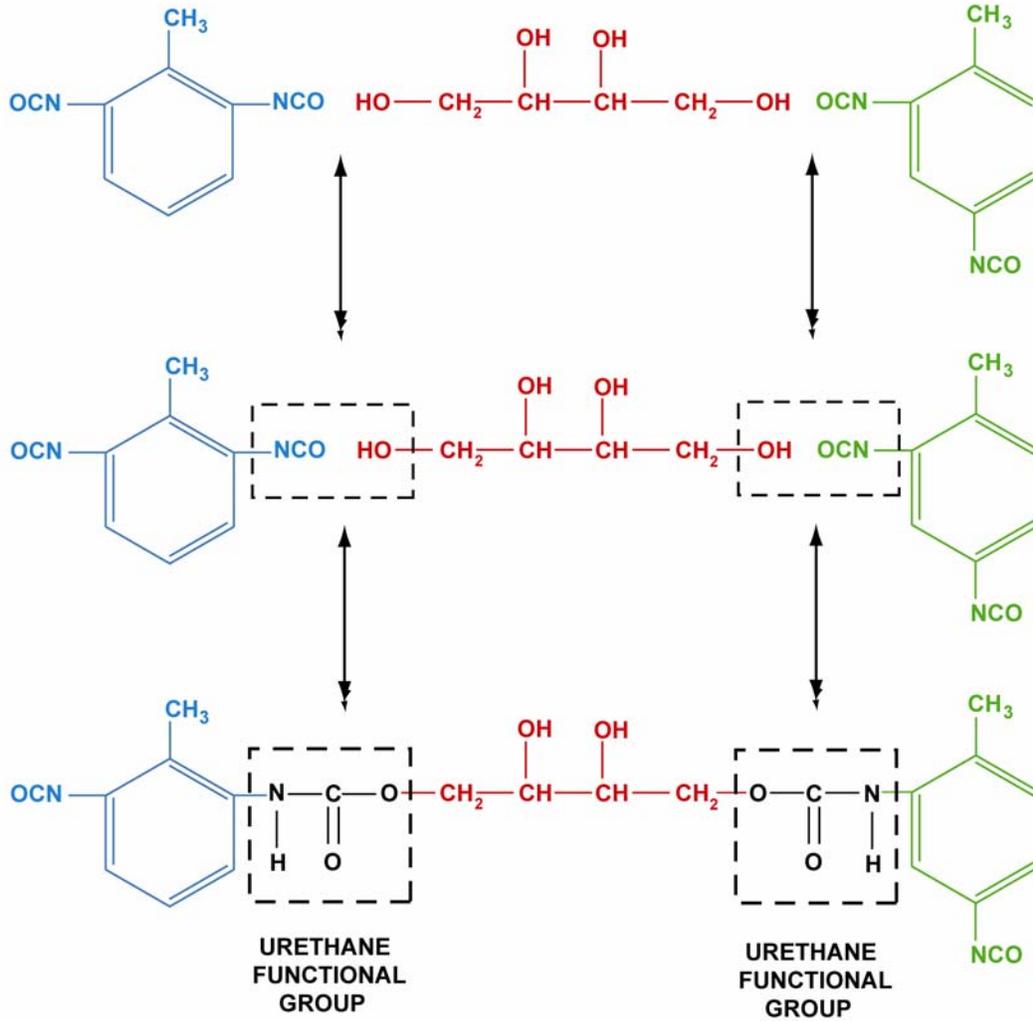
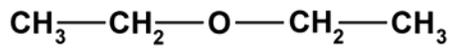
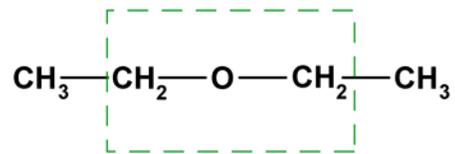


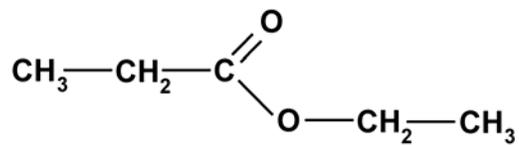
Figure H-3. Reacting Isocyanate Compounds with Polyols to Form Polyurethane.



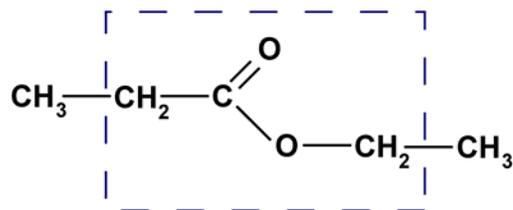
ETHYL ETHER



ETHER FUNCTIONAL GROUP



ACETYL ACETATE



ESTER FUNCTIONAL GROUP

Figure H-4. Examples of Ether and Ester Functional Groups.

### H.3 REFERENCES FOR APPENDIX H

- [1] “Polyurethanes,” in *Fire Retardant Materials*, Edited by A.R. Horrocks and D. Price, Woodhead Publishing Limited, Cambridge England, 2001, pp.243-245.
- [2] *Fire Protection Handbook, Seventeenth Edition*, A.E. Cote, Editor-in-Chief, National Fire Protection Association, Quincy, MA, p. 3-111, 2001.
- [3] Troitzsch, J., “The Burning of Plastics”, Chapter 4 in *International Plastics Flammability Handbook*, Second Edition, Hanser Publishers, New York, NY, 1983, pp 16 – 30.
- [4] “Polyurethanes,” in *Fire Retardant Materials*, Edited by A.R. Horrocks and D. Price, Woodhead Publishing Limited, Cambridge England, 2001, p. 244.
- [5] Frisch, K.C., and Reegen, S.L., “Relationship Between Chemical Structure and Flammability Resistance of Polyurethanes,” in *Flame-Retardant Polymeric materials*, Edited by M. Lewin, S.M. Atlas, and E.M. Pearce, Plenum Press, New York, NY, 1975, pp. 291-336.



# APPENDIX I. PYROLYSIS OF POLYURETHANE FOAM

## I.1 LABORATORY REPORT NUMBER 2004-CC-045

This work was contracted with the US Army Aberdeen Test Center and coordinated by Dr. Steven H. Hoke of the Chromatography Analysis Division.



## *U.S. Army Aberdeen Test Center*

400 Colleran Road  
Aberdeen Proving Ground, MD 21005-5059

### **WARFIGHTER CORE APPLIED SCIENCES TEAM CHEMISTRY UNIT**

Attn: Steven H. Hoke, Ph.D.

USACHPPM  
Chromatography Analysis Division  
400 Colleran Road Bldg AA-363  
APG, MD 21005

Project Number: None

Report Number: 2004-CC-045a (amended 6 December 2004)  
Title: Combustion of Foam Panels

This report shall not be reproduced except in its entirety without the written approval of the Chemistry Unit. The results relate only to the specific samples/test item/test scenario identified within this report.

#### **Authorized for Release:**

Signature

Date: 6 December 2004

Judith D. Galloway  
Chief, Chemistry Unit

MEMORANDUM FOR USACHPPM Chromatography Analysis Division,  
ATTN: Steven H. Hoke, Ph.D

SUBJECT: Combustion of Foam Panels, Laboratory Report Number 2004-CC-045

1. References:

a. Chemistry Team Internal Operating Procedure No. 360, Operation of 760 Fourier Transform Infrared Spectrometer with MCT-A detector.

b. Chemistry Team Internal Operating Procedure No. 361, FTIR Analysis of Solids using the Brill Pyrolysis Cell.

2. Two samples from foam panels were received by the Chemistry Unit. The samples were assigned sample numbers 0310027-01 and 0310027-02. See Tables 1 and 2, section I.3, below for sample descriptions. The combustion products given off when these foam panels burn has become a concern. Identification of combustion products in air (21% oxygen) was requested.

3. Initial work with these samples focused on identification of the foam and adhesive on the foam. Next the foam was pyrolyzed in nitrogen. The final analytical determination was combustion of the foam in air. Most of the identification analysis was performed with the Continuum microscope linked with a Thermo-Nicolet Magnum FTIR optical bench. Pyrolysis and combustion were performed with a CDS pyrolysis (Brill) cell fitted in the sample compartment of the FTIR bench.

4. The samples were received wet with water. They were air dried before analysis was begun. The identification analysis was performed using a FTIR spectrometer and an Attenuated Total Reflectance accessory (ATR) and the infrared microscope accessory (Thermo Continuum). The photographs and infrared spectra are in Figures 1 to 10, section I.4.

5. Identification of the foam type was performed by running the infrared spectrum of the unburned foam sample 0310027-01 (Figures 1 and 2). The spectrum produced (Figure 3.) closely matched polyether urethane foam (Figure 4.). Since foam is a polymer product made with various monomers in various ratios an exact match is not possible. This match shows the basic components that make up the bulk of the material. This foam is therefore a polyether urethane co-polymer product.

CSTE-DTC-AT-WC-C (70-10r)  
MEMORANDUM FOR USACHPPM Chromatography Analysis Division  
SUBJECT: Combustion of Foam Panels, Laboratory Report Number 2004-CC-045

6. The picture of a foam cell in Figure 2. shows that each cell is covered with a thick oily liquid. This liquid is not visible to the naked eye as shown in the picture in Figure 1. Identification of this liquid is essential as it is a significant component of the foam. The spectrum produced by the liquid (Figure 5.) closely matched polypropylene glycol (Figure 6.).

7. Figure 7. is a picture of the burned foam sample 0310027-02 with adhesive on the outer surface. The adhesive side of the foam was positioned against the ATR accessory and the infrared spectrum acquired (Figure 8). The library search produced the match seen in Figure 9. The best match is a latex rubber based mineral filled adhesive. A second library search was performed against a library of minerals and the library match shown in figure 10 was produced. The mineral filling in the adhesive is a silicate class compound similar to the natural mineral Kaolinite (see information with Figure 10).

8. The identification of the combustion products produced by the foam sample 0310027-01 was determined using Pyrolysis/Fourier Transform Infrared (FTIR) spectroscopy (reference 1a and 1b). See section I.2 for an explanation of this technique. This type of analysis involves rapidly heating a small amount of the sample and monitoring the gas phase above the heated sample with FTIR spectroscopy. Gas products were identified using a Nicolet 760 FTIR spectrometer with an MCT-A detector. The sample was pyrolyzed (reference 1b) in a CDS Brill Cell, which fits into the sample compartment of the FTIR spectrometer so the gas products from heating could be identified in near real-time. The Brill Cell was connected to a CDS 2000 Pyrolyzer equipped with a CDS FTIR probe rod. The probe rod contains a small electrically heated ribbon upon which the samples were placed. (The ribbon can be heated up to 1350°C at a variety of heating rates from 1 °C/min to 1,000,000 °C/sec. The samples (~2 mg each) were heated at 20 °C for 2 seconds then heated at a rate of 300 °C/second up to 1000 °C and held at 1000 °C for 30 seconds for this combustion study. Pyrolysis was also performed on these samples. Plots of the evolved gas phase spectra were then made. The gas spectra were searched against a database and identified.

9. Infrared spectra of pyrolysis and combustion of the samples are in Figures 11 through 19, section I.4. Descriptive data on the samples is in Tables 1 and 2, section I.3. Identification of the pyrolysis and combustion products is in Table 3. Since the two foam samples were identical only samples, 0310027-0, was pyrolyzed and combusted.

CSTE-DTC-AT-WC-C (70-10r)

MEMORANDUM FOR CHPPM Chromatography Analysis Division

SUBJECT: Combustion of Foam Panels, Laboratory Report Number 2004-CC-045

10. Pyrolysis occurs when the sample is heated in a 100% nitrogen atmosphere. Initial pyrolysis products are produced about 8 seconds into the 30 second heating time. Initial products frequently contain vaporized parent molecules (the starting compound). Final pyrolysis products are what are present at the end of the run (29 to 31 seconds). The parent molecule is often converted completely into lighter weight molecules by this time.

11. The pyrolysis of foam is shown in Figures 11 to 14. The fully pyrolyzed foam is displayed in figure 11. A large absorption at  $\sim 2270\text{ cm}^{-1}$  is produced in this spectrum. The best library match; methyl isocyanate, is shown in figure 12. Figure 13. is the infrared spectrum of the pyrolyzed foam with all of the major absorption peaks labeled. Note that due to a lack of oxygen the amounts of carbon dioxide and carbon monoxide are low.

12. Figure 14 shows the foam pyrolysis progression. Initially the isocyanate compound (which is thought to be a mixture of C1 to C4 isocyanates) and foam vapor is detected, next carbon monoxide and carbon dioxide are formed from the foam vapor. The final pyrolysis products are an Isocyanate Compound ( $\text{H}_y\text{C}_x\text{NCO}$ ), and much lesser quantities of Carbon Dioxide ( $\text{CO}_2$ ), Carbon Monoxide ( $\text{CO}$ ), Ethylene ( $\text{C}_2\text{H}_4$ ), Acetylene ( $\text{C}_2\text{H}_2$ ), Hydrogen Cyanide ( $\text{HCN}$ ) and Vaporized Foam. The more oxygen starved the combustion of foam the more the gases produced will favor the final pyrolysis products. Not all of the foam is consumed in this pyrolysis. See section I.5. for more information on the reaction mechanism and isocyanate compounds.

13. Combustion occurs when the sample is heated in an oxygen atmosphere. Initial combustion products are produced about 8 seconds into the 30 second heating time. Initial products frequently contain vaporized parent molecules (the starting compound). Final combustion products are what are present at the end of the run (29 to 31 seconds). The parent molecule is often converted completely into carbon dioxide and water vapor by this time.

14. The combustion of the foam is shown in Figures 15 through 18. The fully combusted foam is displayed in figure 15. A large absorption at  $\sim 2270\text{ cm}^{-1}$  is produced in this spectrum. The best library match; an isocyanate compound, is shown in figure 16 along with the major gases that are produced in this combustion. Figure 17 is the infrared spectrum of the combusted foam with all of the major absorption peaks labeled.

CSTE-DTC-AT-WC-C (70-10r)

MEMORANDUM FOR CHPPM Chromatography Analysis Division

SUBJECT: Combustion of Foam Panels, Laboratory Report Number 2004-CC-045

15. Figure 18 shows the foam combustion progression. The initial combustion products are the isocyanate compound (which is thought to be a mixture of C1 to C4 isocyanates) and foam vapor. At this point (about 6 seconds into the combustion) the products are the same as pyrolysis. As the combustion progresses (see middle and lower spectra on Figure 18.) large quantities of carbon dioxide and carbon monoxide are produced. The final products are the Isocyanate Compound ( $H_yC_xNCO$ ), Carbon Dioxide ( $CO_2$ ), Carbon Monoxide (CO), Methane ( $CH_4$ ), Ethylene ( $C_2H_4$ ), Acetylene ( $C_2H_2$ ), Hydrogen Cyanide (HCN), and Vaporized Foam. Combustion is incomplete as evidenced by the presents of carbon monoxide and foam vapor. See section I.5. for more information on the reaction mechanism and isocyanate compounds.

16. Figure 19. is included to show some of the major functional chemical groups in the original foam. The aliphatic hydrocarbons produce Methane ( $CH_4$ ), Ethylene ( $C_2H_4$ ), Acetylene ( $C_2H_2$ ), as they break down into smaller molecules during combustion. As these smaller molecules are oxidized (combusted) they form Carbon Dioxide ( $CO_2$ ) and Carbon Monoxide (CO). The isocyanate compound is released from the polymer backbone by the heat of combustion and forms the mixture of C1 to C4 isocyanates. The nitrile compound is the most likely source of the hydrogen cyanide. The ether and urethane (not labeled) parts of the foam also form isocyanates (see section I.5 explanation of thermal degradation mechanisms). All other parts on the foam contribute to the Carbon Dioxide ( $CO_2$ ) and Carbon Monoxide (CO) seen in the combustion spectra.

17. The POC for this report is Paul Marsh, (410) 278-3024.

## I.2 Analytical Method: Fourier Transform Infrared Spectroscopy With Brill Pyrolysis Cell

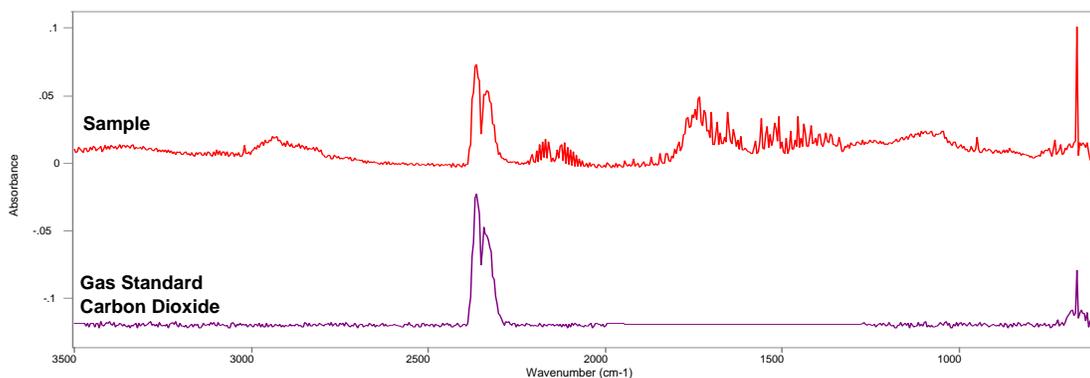
Fourier transform infrared spectroscopy (FTIR) is an analytical technique that exploits the infrared light absorbing characteristics of chemical compounds. Most major chemical functional groups i.e., alcohols, hydrocarbons, ethers etc., have specific absorption bands in the infrared region of the light spectrum. From noting which infrared frequencies a sample absorbs, the chemical structure of a sample can be determined. Quantitative information can be determined from the intensity of the absorption bands.

An FTIR spectrophotometer is the instrument used to scan the infrared light region. The instrument produces a plot of absorption vs. infrared frequency. The major parts of an FTIR spectrophotometer with Brill Pyrolysis Cell are as follows:

1. Source of infrared light (glowbar)
2. Interferometer (frequency modulator)
3. Brill pyrolysis Gas Cell (sample is held in the cell) with heated probe
4. Detector of infrared light (MCT semiconductor)
5. Computer controller with Data Base of infrared spectra

The Brill Pyrolysis Cell is an accessory that fits into the sample compartment of the FTIR spectrometer. The accessory has two parts the gas cell and pyrolysis probe. The pyrolysis probe has a filament (ribbon) that can be rapidly heated to greater than 1000 degrees Celsius. The sample is placed on this ribbon and the probe is placed in the gas cell. The gas cell is a fixed volume container that holds all the gases produced by the pyrolysis of the sample. The atmosphere in the cell can be selected to match the experiment i.e. nitrogen for pyrolysis or nitrogen oxygen mixture for combustion. The cell can be set for static or dynamic flow. The infrared beam passes through the cell and the gases are detected by the FTIR.

To determine the chemical makeup of samples, they must be compared to reference standards. Libraries of gas samples are available to identify the gases detected.



### I.3 Sample Identification and Expected Products

Table 1. Foam Sample Identification

Sample Number	Common Name	Description
0310027-01	Gray polyether urethane foam	New Unburned foam
0310027-02	Gray polyether urethane foam	Piece 1 Foam with adhesive Piece 2 Burned Foam

Table 2. Foam Sample Descriptions

Sample Number	Description
0310027-01	R11 Northwall Unburned 9/5/03
0310027-02	R11Drummer's Box Burnt Foam 9/5/03

Table 3. Foam Pyrolysis and Combustion Products

Sample Number	Test	Expected Combustion Products
0310027-01	<b>Pyrolysis</b>	Isocyanate Compound ( $H_xC_xNCO$ ), Carbon Dioxide ( $CO_2$ ), Carbon Monoxide (CO), Ethylene ( $C_2H_4$ ), Acetylene ( $C_2H_2$ ), Hydrogen Cyanide (HCN), Vaporized Foam
0310027-01	<b>Combustion</b>	Isocyanate Compound ( $H_xC_xNCO$ ), Carbon Dioxide ( $CO_2$ ), Carbon Monoxide (CO), Methane ( $CH_4$ ), Ethylene ( $C_2H_4$ ), Acetylene ( $C_2H_2$ ), Hydrogen Cyanide (HCN), Vaporized Foam

## I.4 Identification



Figure 1. Sample 0310027-01 unburned foam.

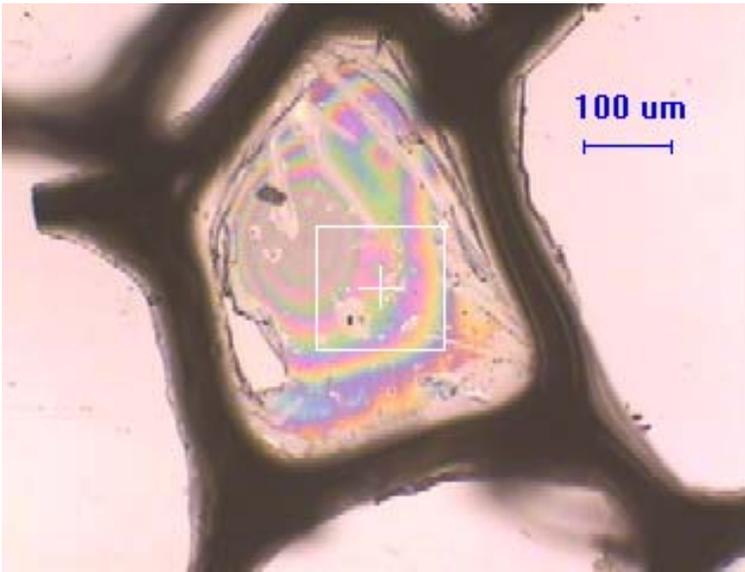


Figure 2. Microscope picture of sample 0310027-01 unburned foam at 100X magnification. This is a picture of one foam cell. All of the foam cells outer edges are covered in a thick clear liquid. This cell has the liquid actually spanning the open area of the cell.

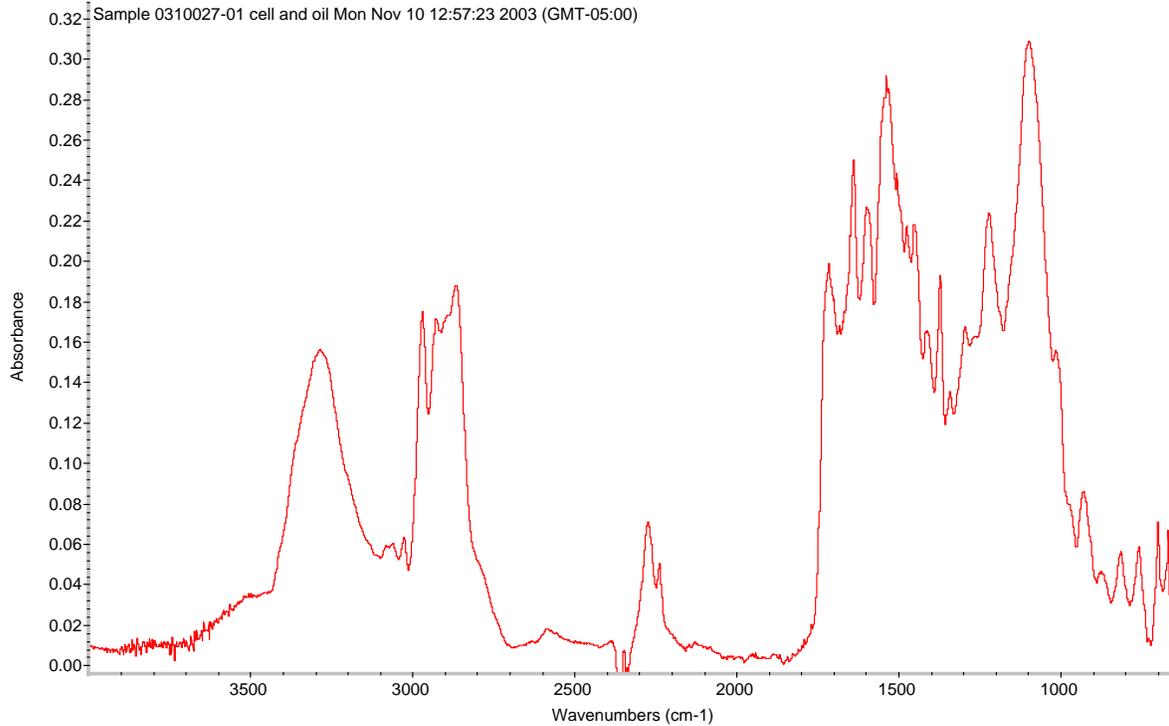


Figure 3. Infrared spectrum of sample unburned gray foam.

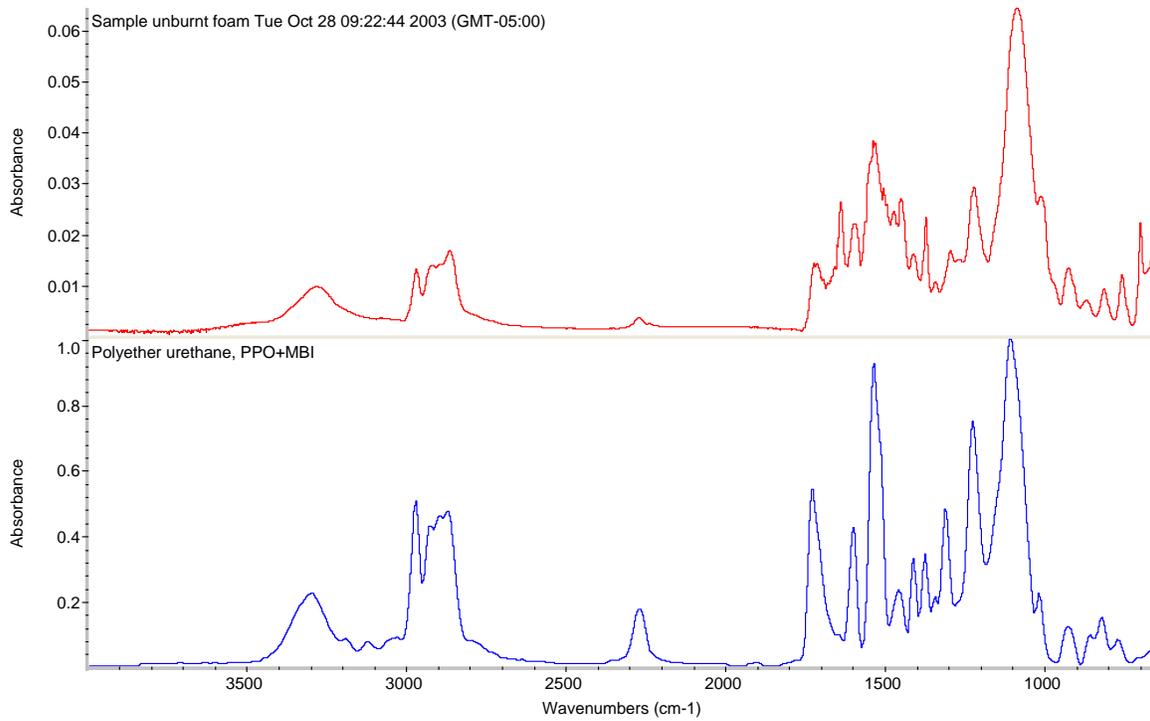


Figure 4. Infrared spectrum of sample unburned gray foam (top), best library match polyether urethane foam (bottom).

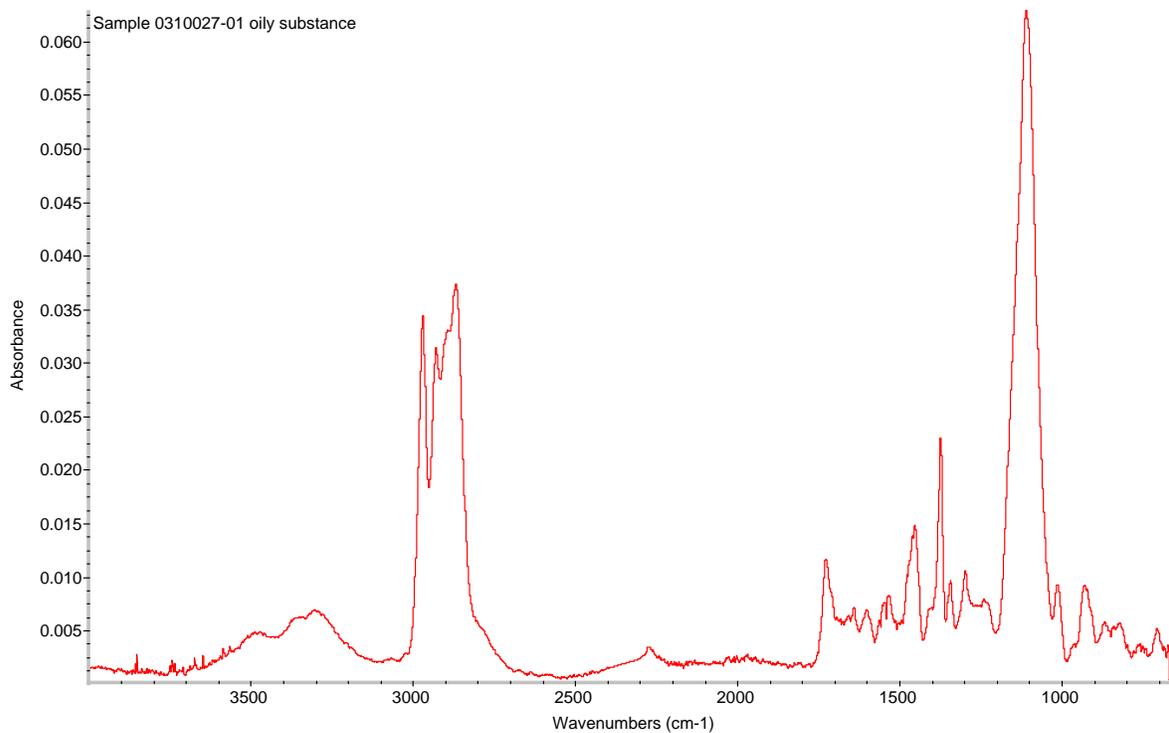


Figure 5. Infrared spectrum of sample oil on unburned gray foam.

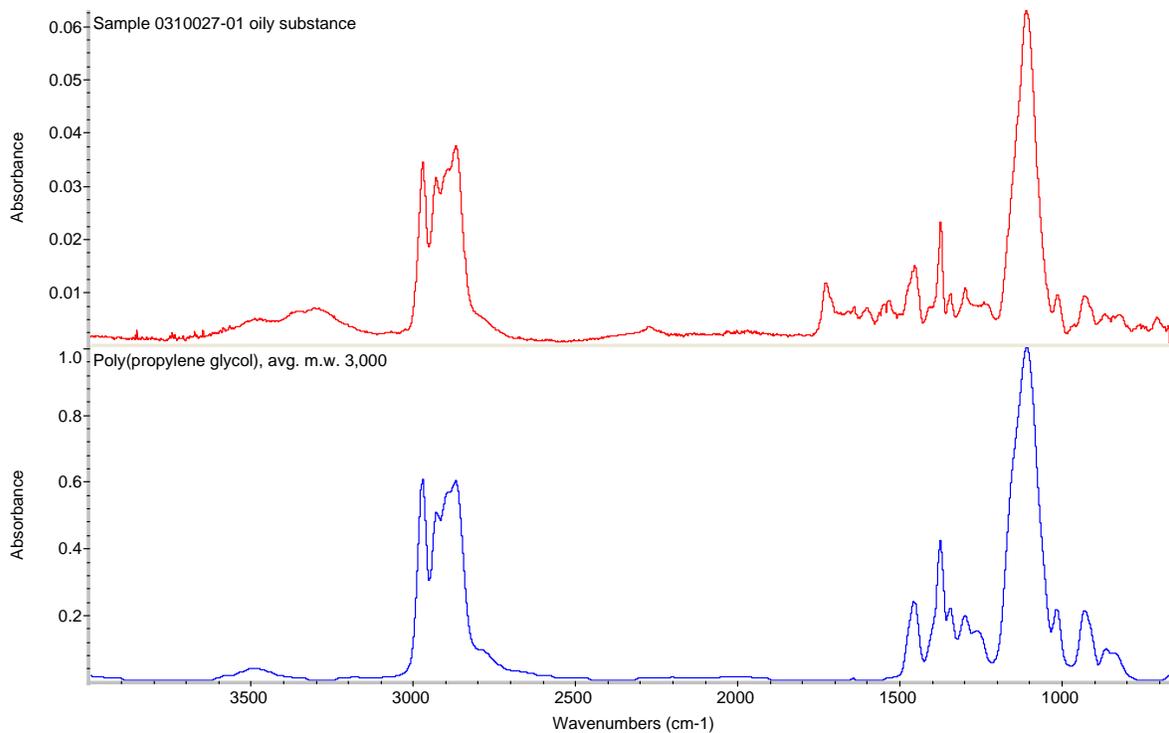


Figure 6. Infrared spectrum of sample oil on unburned gray foam (top), best library match polypropylene glycol (bottom).



Figure 7. Sample 0310027-02 piece1 foam with adhesive.

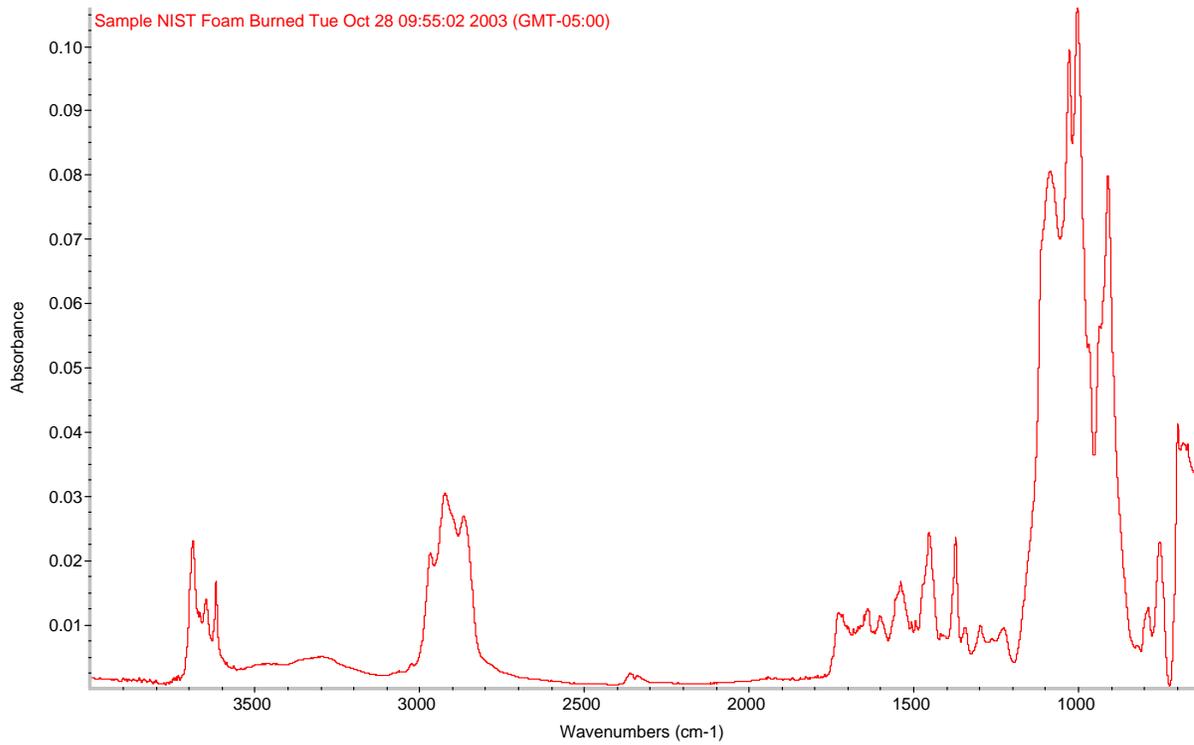


Figure 8. Infrared spectrum of sample foam adhesive.

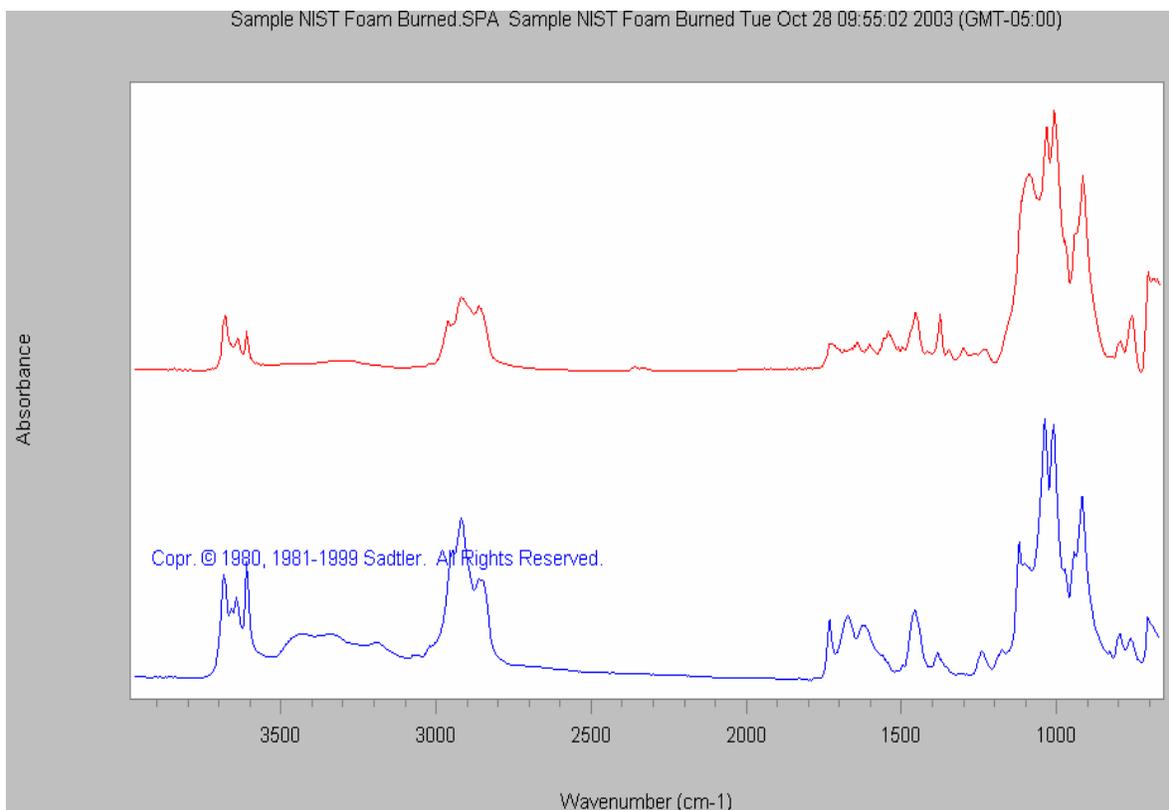


Figure 9. Infrared spectrum of foam adhesive (top), best library match a mineral filled latex based adhesive (bottom).

Database Information:

WELWOOD MULTI-PURPOSE FLOOR ADHESIVE

Chemical Description= LATEX-BASED ADHESIVE

Content= Solids Content= 55%

Density= (Specific Gravity)= 1.17 g/ml

FlashPt= (PMCC) 100 °C Flash and Fire

Weight= 9.5 LBS/GAL

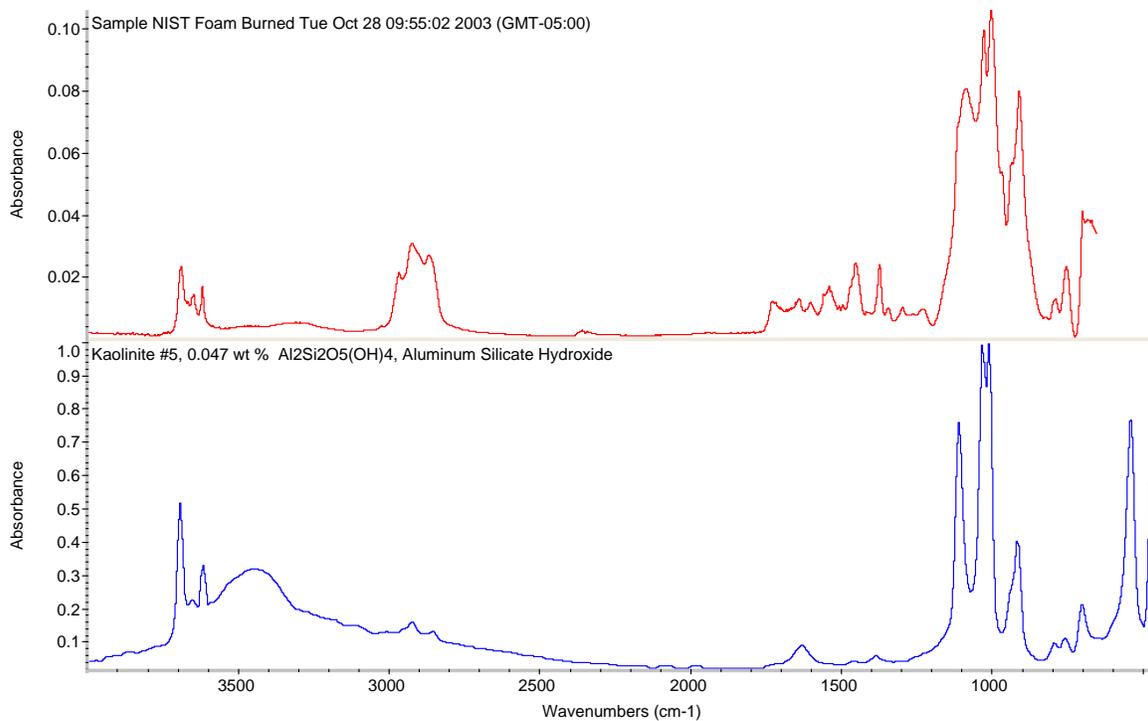


Figure 10. Infrared spectrum of sample foam adhesive (top), Best library match of the mineral filler kaolinite  $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ , (bottom).

#### Database Information on KAOLINITE:

- **Chemistry:**  $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ , Aluminum Silicate Hydroxide
- **Uses:** In the production of ceramics, as a filler for paint, rubber and plastics and the largest use is in the paper industry to produce a glossy paper such as is used in most magazines.

# Pyrolysis

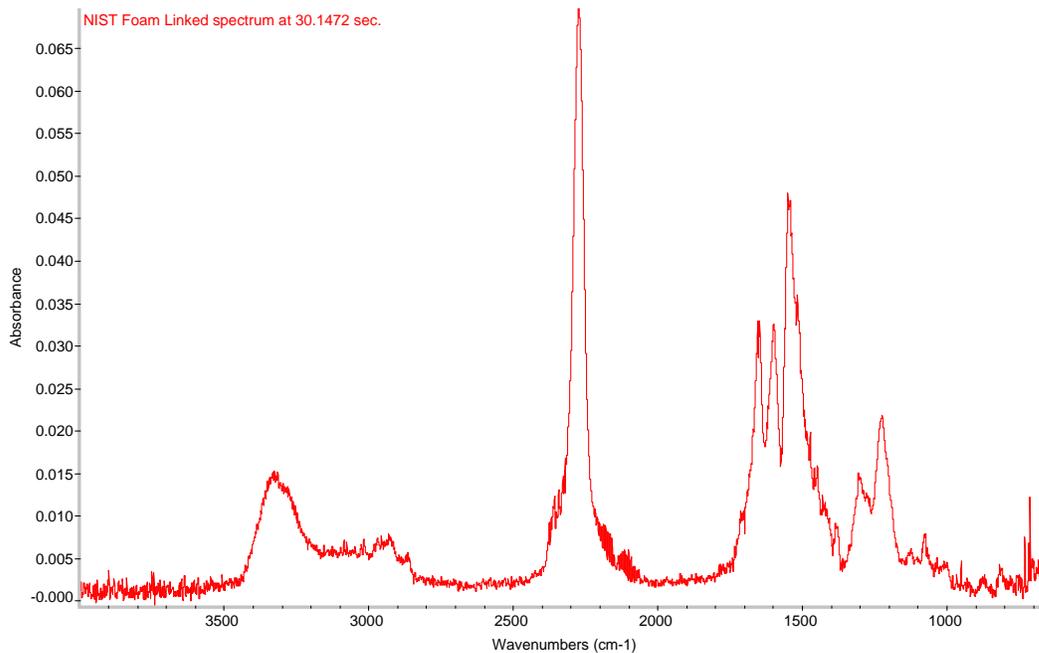


Figure 11. Infrared spectrum of foam pyrolysis. The isocyanate peak 2270 cm<sup>-1</sup> is from a class of compounds with the general formula H<sub>x</sub>C<sub>x</sub>HNO. These compounds are very toxic.

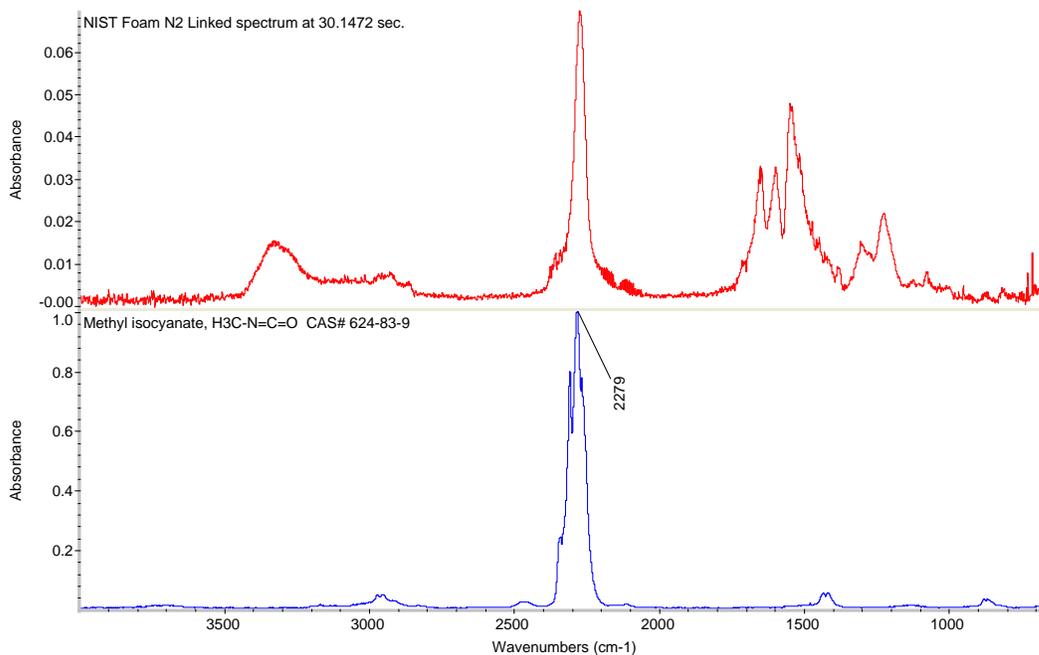


Figure 12. Infrared spectrum of sample pyrolyzed foam (top). Best library match is methyl isocyanate (peak ~2270 cm<sup>-1</sup>). This is a match to a class of isocyanate compounds. Methyl, Propyl, and even Butyl isocyanate have spectra that cannot be distinguished at this resolution.

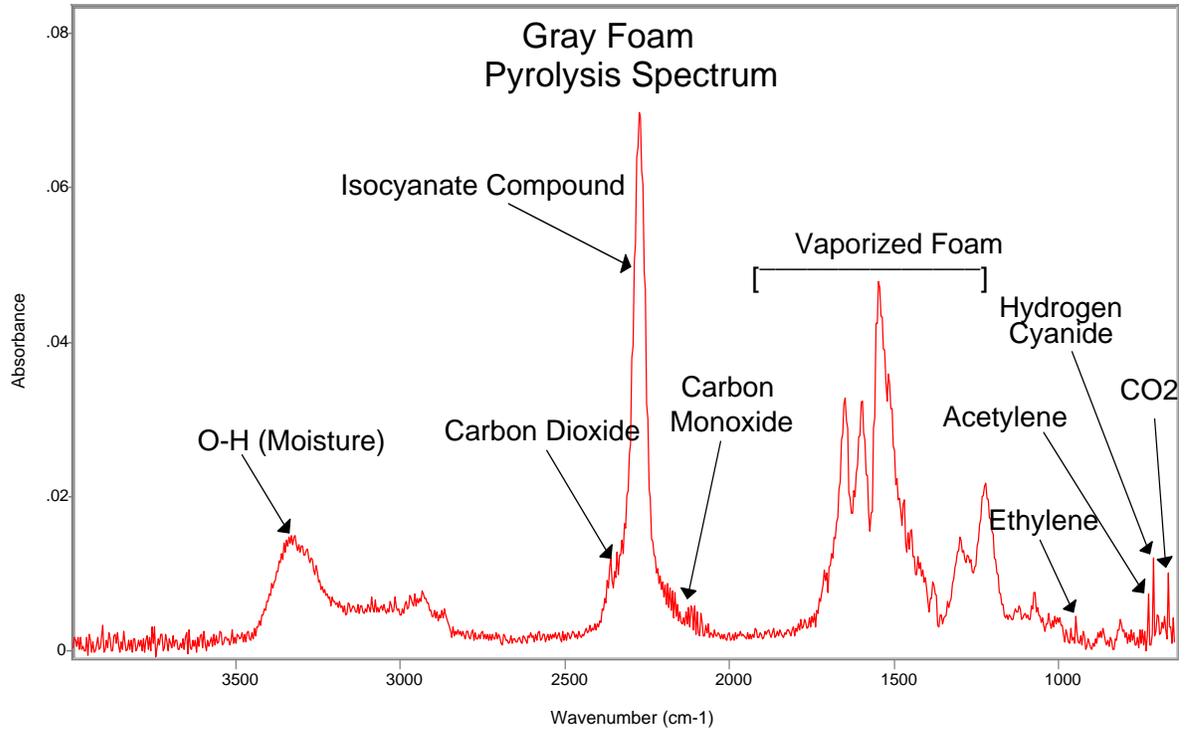


Figure 13. Infrared spectrum of gray foam pyrolysis with gases labeled. The more oxygen starved the combustion the more the final products will be similar to the pyrolysis products.

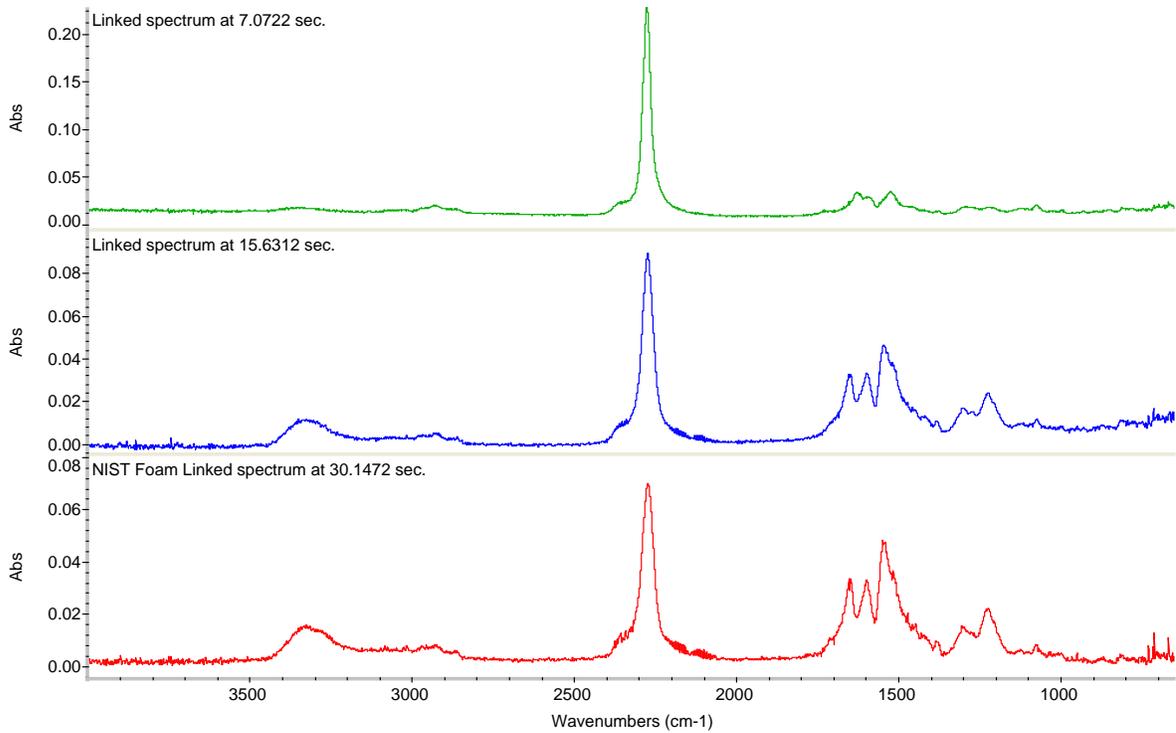


Figure 14. Infrared spectrum of foam pyrolysis progression.

# Combustion

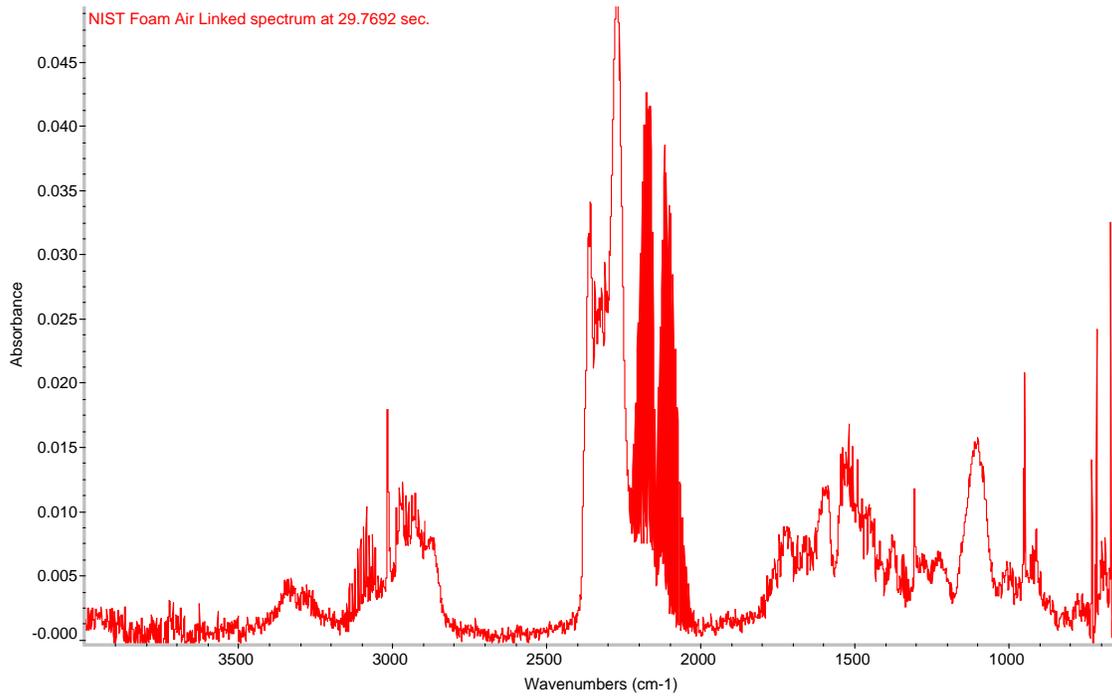


Figure 15. Infrared spectrum of foam combustion in air.

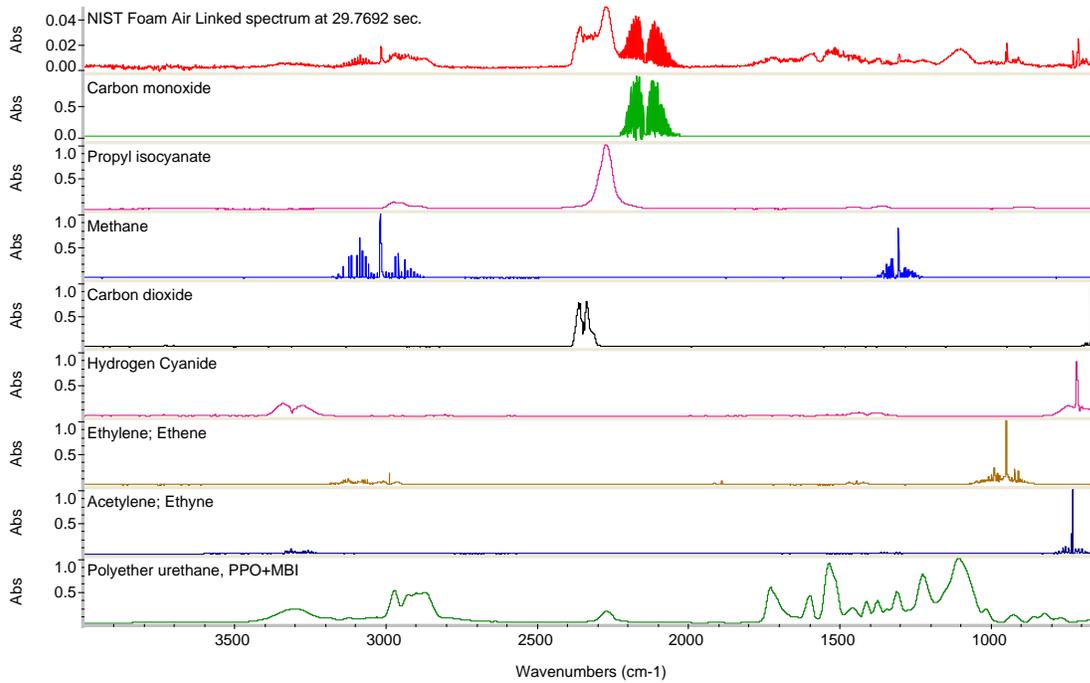


Figure 16. Infrared spectrum of foam combustion (top) and identified gases below.

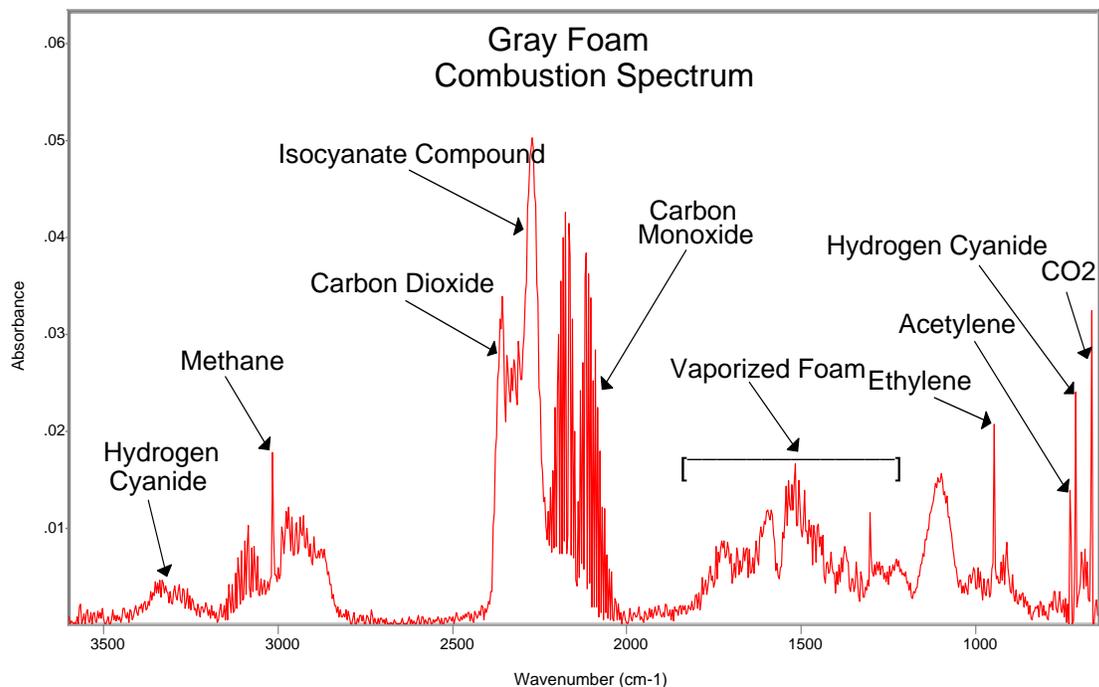


Figure 17. Infrared spectrum of gray foam combustion with combustion gases labeled

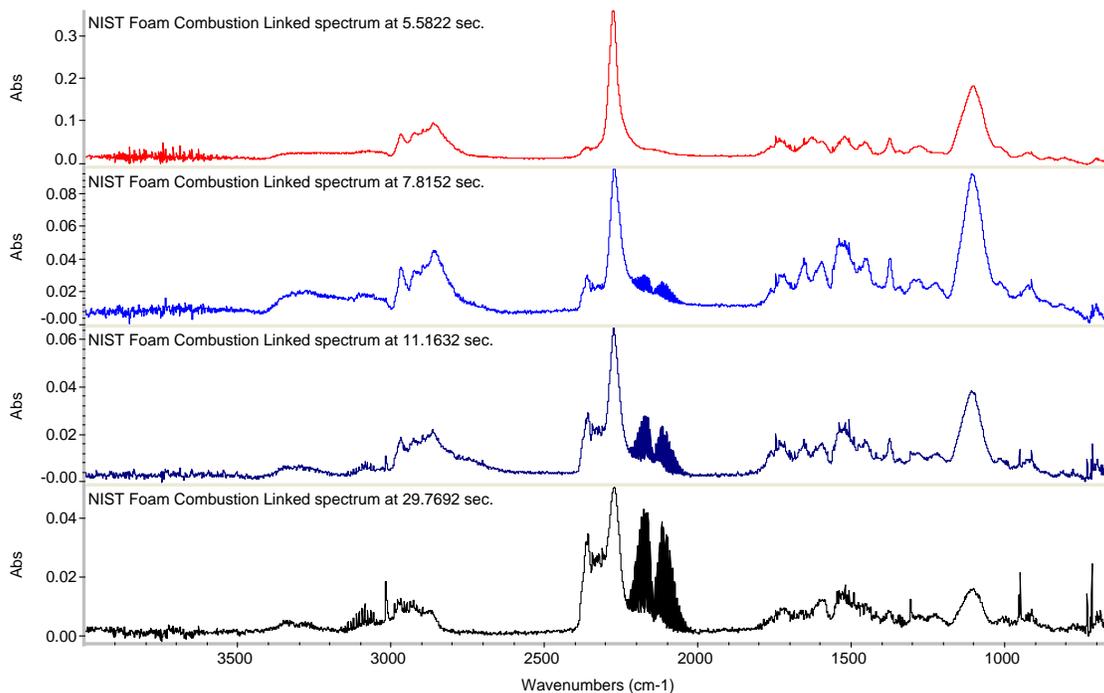


Figure 18. Infrared spectrum of foam combustion progression. Note the growth of the carbon monoxide peak (centered at  $2150\text{ cm}^{-1}$ ) as the combustion progresses from 5 to 30 seconds. The isocyanate compound peak ( $\sim 2270\text{ cm}^{-1}$ ) dominates each spectrum. The polypropylene peak ( $\sim 1100\text{ cm}^{-1}$ ) is decreasing showing that the oily polypropylene glycol compound is being consumed as the combustion progresses.

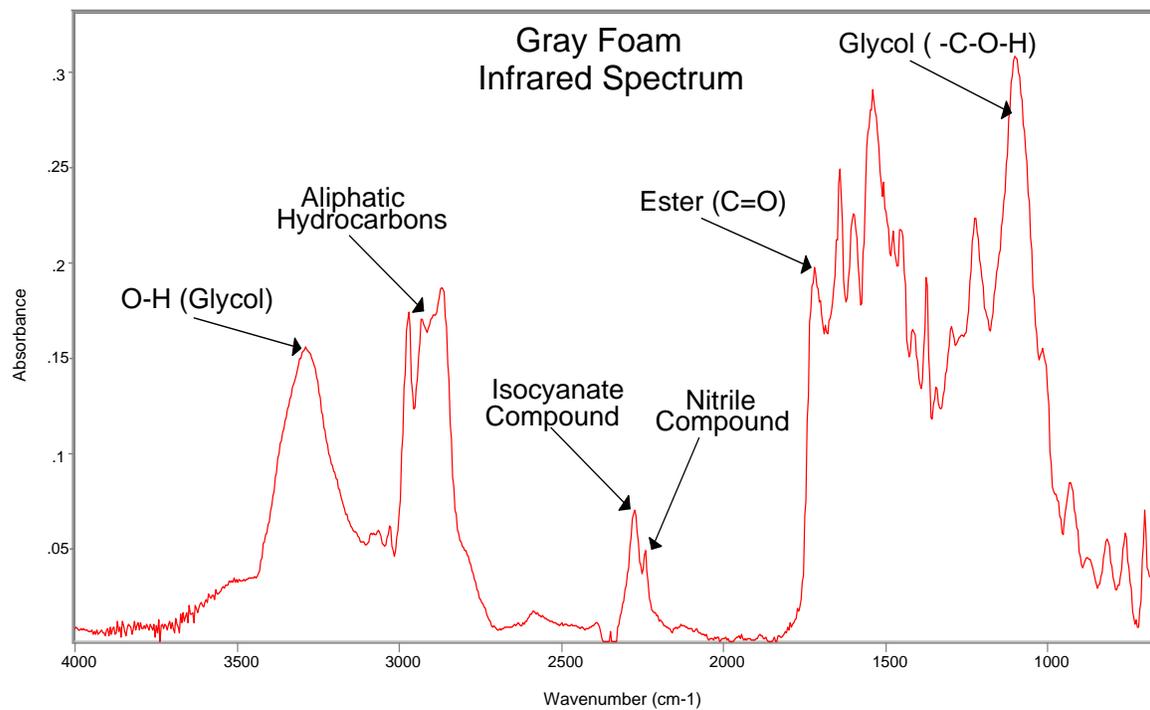


Figure 19. Infrared spectrum of gray polyether urethane foam with major structures labeled.

## I.5 Background Information

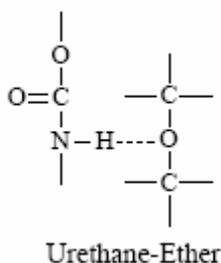
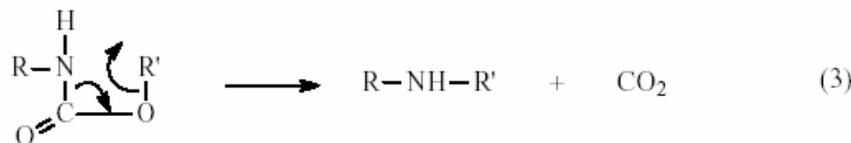
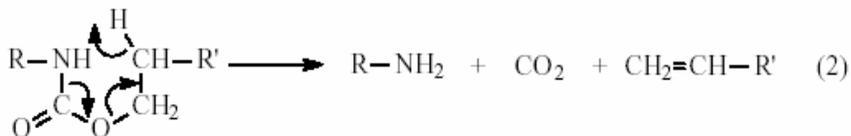
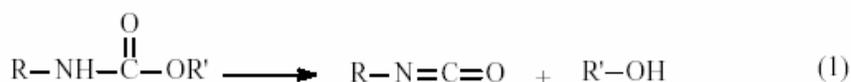


Figure 1. Basic chemical structure of polyether urethane foam.

The chemical structure of the foam as shown in Figure 1. consists of two parts. The left side of the figure shows the urethane (OC=ONH) structure, the right side shows the ether (O—C—O) structure.

The thermal degradation mechanism of polyurethane is very complicated. It has been suggested that polyurethanes break down by a combination of three independent pathways: (1) dissociation to the original polyol and isocyanate; (2) formation of a primary amine, an alkene, and a carbon dioxide in a concerted reaction involving a six-membered cyclic transition state; (3) formation of a secondary amine and carbon dioxide through a four-membered ring transition state, as shown in Scheme 2.2.[143-147]




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Reference: pg 50 of <http://scholar.lib.vt.edu/theses/available/etd-72698-13572/unrestricted/Disswhl2.pdf>

From the referenced combustion mechanism above pathway 1 which produces isocyanates must be the dominant combustion pathway. The large isocyanate peak in both the pyrolysis and combustion spectra of Figure 2. support this.

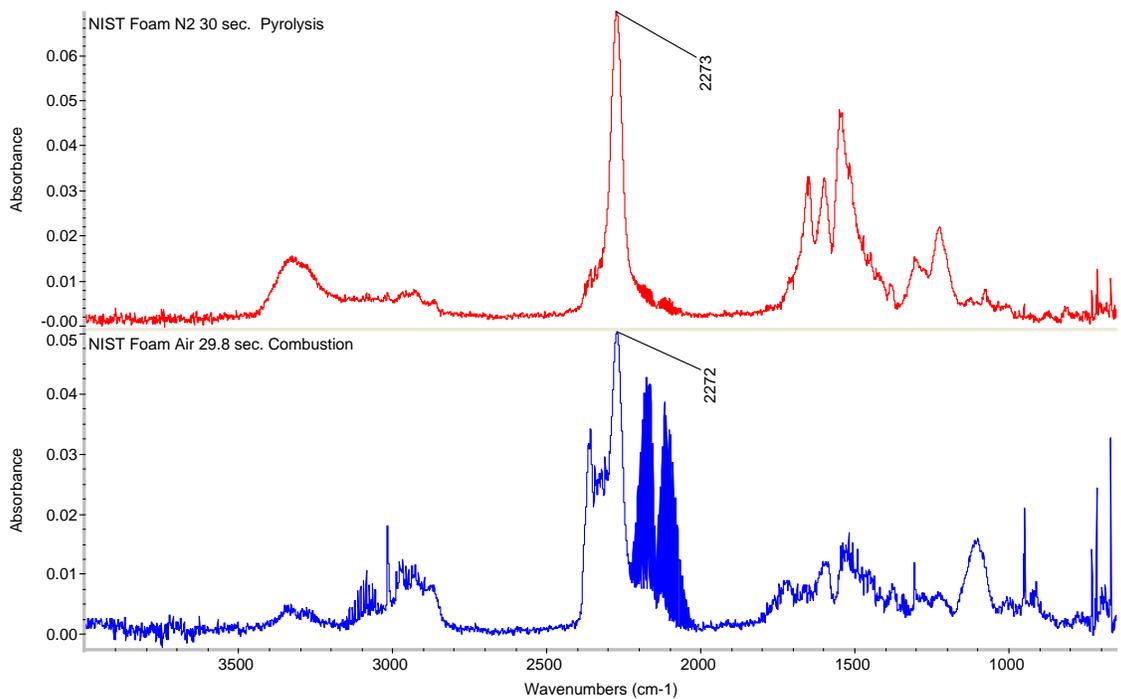


Figure 2. Infrared spectrum of foam pyrolysis gases (top) and combustion gases (bottom). The dominate peak in each spectrum is the peak at  $\sim 2270\text{ cm}^{-1}$ . This peak most closely matches isocyanate compounds (see figure 3). The related isocyanide compounds are not a good match (see figure 4) because their absorbance is too far from  $2270\text{ cm}^{-1}$ .

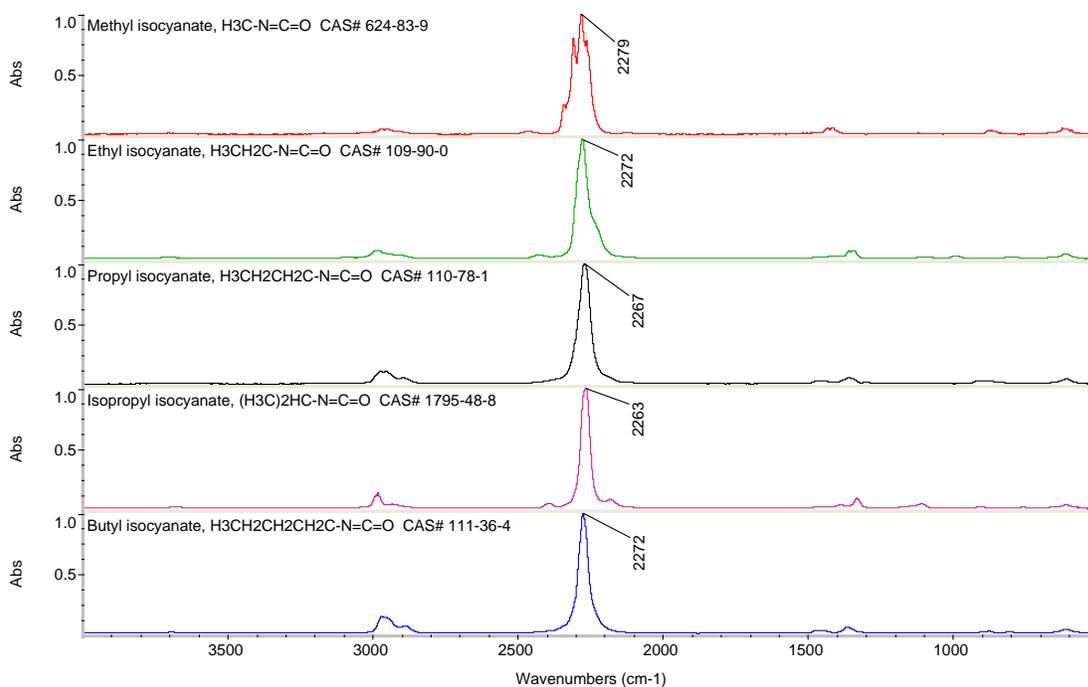


Figure 3. Infrared spectra of selected isocyanate compounds all with absorbances in the  $2270 \pm 9 \text{ cm}^{-1}$  range. These are some of the most likely compounds to match the  $2270 \text{ cm}^{-1}$  peak in the pyrolysis and combustion spectra (Figure 2.).

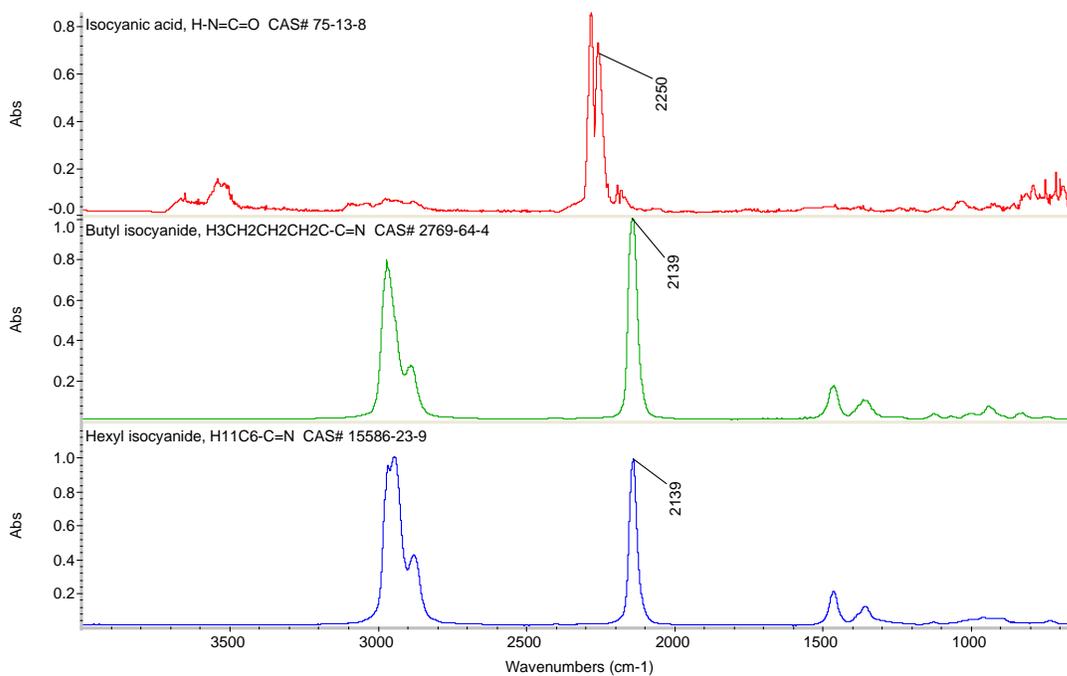


Figure 4. Infrared spectra of selected isocyanide compounds. These have a slightly different structure than the isocyanate compounds in Figure 3. These do not match the  $2270 \text{ cm}^{-1}$  peak in the pyrolysis and combustion spectra (Figure 2.).



## APPENDIX J. HYDROGEN CYANIDE ANALYSIS

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### J.1 HYDROGEN CYANIDE REPORT

This work was contracted with the US Army Aberdeen Test Center and performed by Dr. Steven H. Hoke of the Chromatography Analysis Division.

**TEST #:** 1 Sprinkler September 5, 2003

**TEST #:** 2 No Sprinkler September 10, 2003

**ORGANIZATION:** NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY,  
GAITHERSBURG, MD

**TEST FIXTURE:** Rhode Island Test

**SETUP:** Two sampling positions were used to conduct real-time hydrogen cyanide analysis on two different test days at NIST. The two sampling positions were designated position 1 (West – NIST Location D) and position 2 (East- NIST Location C), and were 3.66 m and 1.83 m west of the stage, respectively. Each sample position was located 1.5 m off the floor and 2.74 m from the south wall of the compartment (Figure J-1).

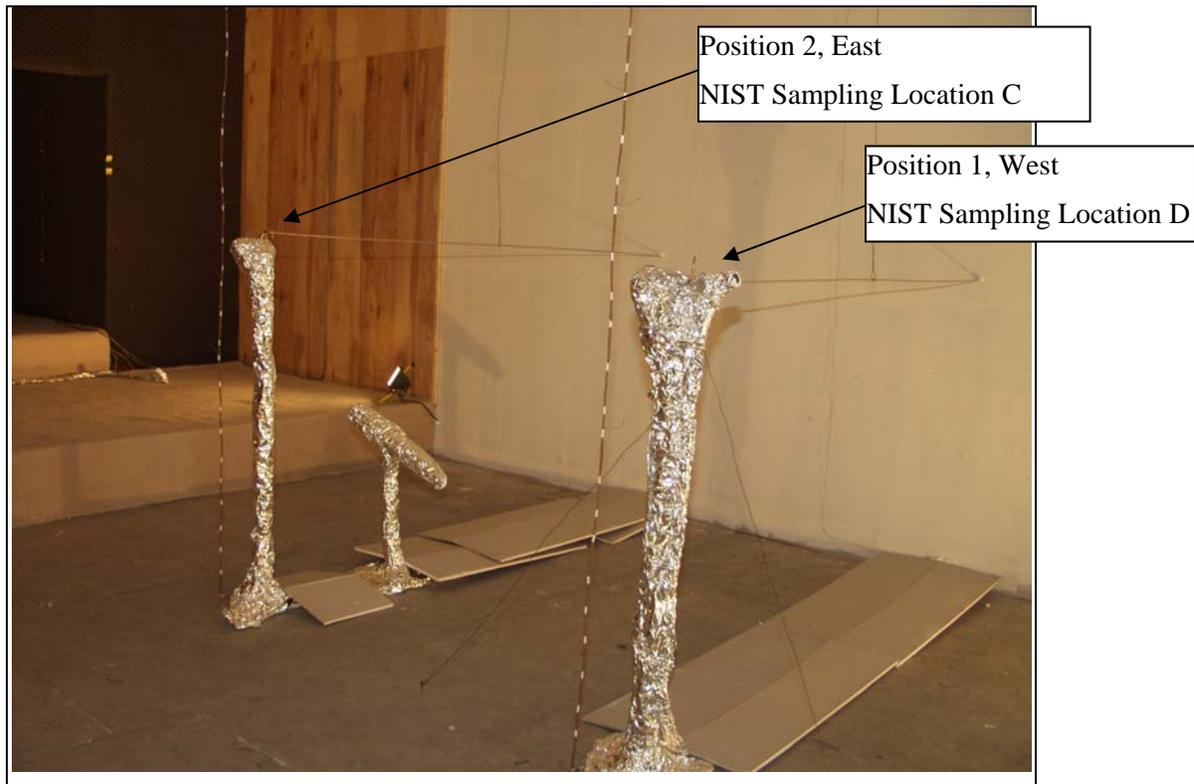


Figure J-1. Sampling positions inside Rhode Island test fixture.

The Sampling equipment was located on a table just outside the south wall of the compartment. Air samples were taken through a ¼-in. o.d. 304 stainless steel tubing. An additional 3 ft. of stainless steel tubing was placed on the outside to provide for cooling of the hot sample gases. A stainless steel 4-port sampling manifold using Swagelok tees was attached to the end of each sample line. Red silicone tubing was used to attach samplers to the manifold (Figure J-2).

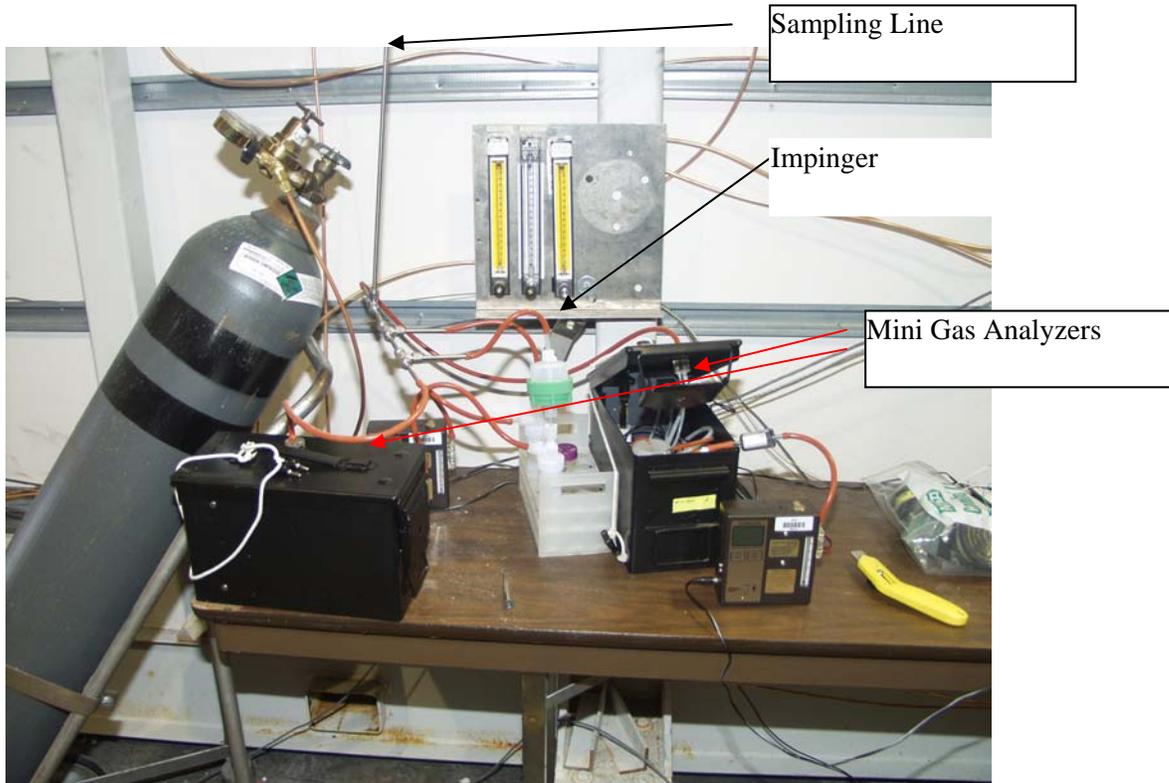


Figure J-2. Sampling set up at Position 1 for test 1.

At each sampling position two impinger samples were taken, one with a filter and one without. Each of these impingers used 0.1 M KOH as trapping solution. For the first test two mini gas real-time cyanide analyzers were used at position 1 and a suitcase-size version of the analyzer was used at position 2. For test 2 a mini gas analyzer was used at each position. Airflow rates were measured and recorded before each test. Voltage signals from the analyzers were recorded on data loggers and also sent to the main control computer.

With the high gas temperatures anticipated a 3-ft. extension of stainless steel tubing was attached between the exterior wall and the sampling manifold. To determine the cooling effect this had on the sample gases, a T type thermocouple was attached to the stainless steel tubing just outside the wall and one just before the sampling manifold. A Fluke model 2635A Hydra Series II Data Bucket collected data from each of the

two thermocouples. This data was only collected for the second test because higher temperatures were anticipated.

After the second test both of the 9-ft. stainless steel lines were removed from the test fixture and rinsed in a vertical position with 10 mL of 0.1 M KOH.

Upon returning to the laboratory the filters were weighed and then placed in a screw cap-polypropylene test tube with 10 mL of 0.1 M KOH.

After each test the contents of the impingers were transferred to a test tube and labeled.

Impinger samples were analyzed according to NIOSH Method 7904.

The real-time mini gas analyzers as described elsewhere (Paper submitted to J. Process Anal. Chem. for publication) were modified to use an off-the-shelf cyanide combination electrode and 0.1 M KOH as the trapping solution. Calibration standards were prepared in 0.1 M KOH using KCN at levels of 2, 5, 10, and 30-ppm cyanide. This corresponds to an upper and lower calibration limit in air of 153 and 10 ppm HCN, respectively. The gas analyzer showed linearity up to 1284 ppm HCN in air, so the high values obtained during the second test can be considered valid.

## RESULTS:

Figures J-3 to J-5 show real-time results from the three HCN gas analyzers used for test 1 conducted on 5 Sept 03. The automatic sprinkler system activated at about 25 sec.; therefore, there was very little HCN produced.

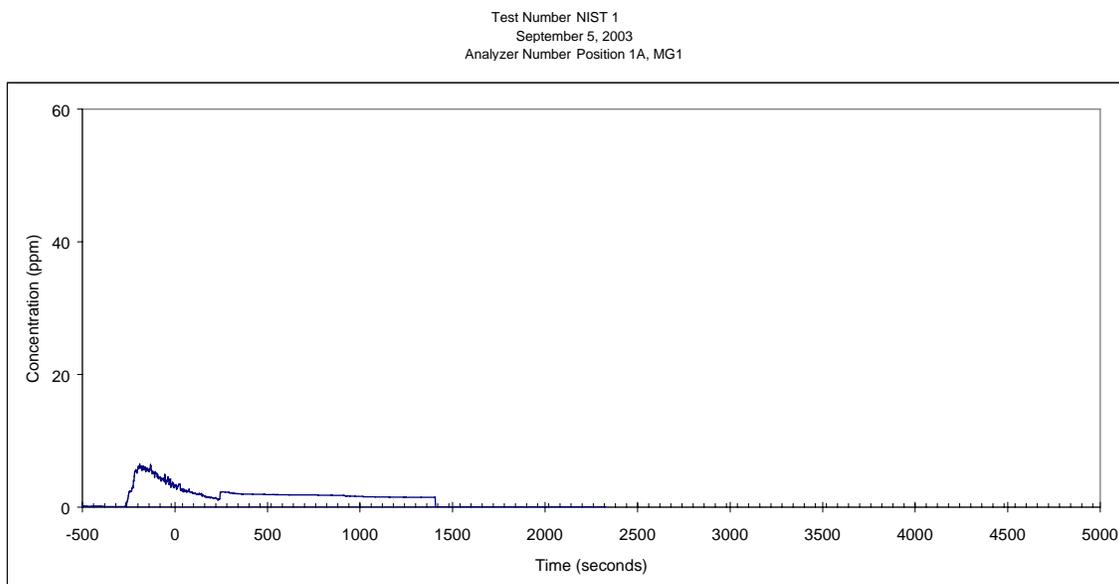


Figure J-3. Hydrogen cyanide response from mini gas analyzer located at position 1.

Test Number NIST 1  
September 5, 2003  
Analyzer Number Position 1B, MG2

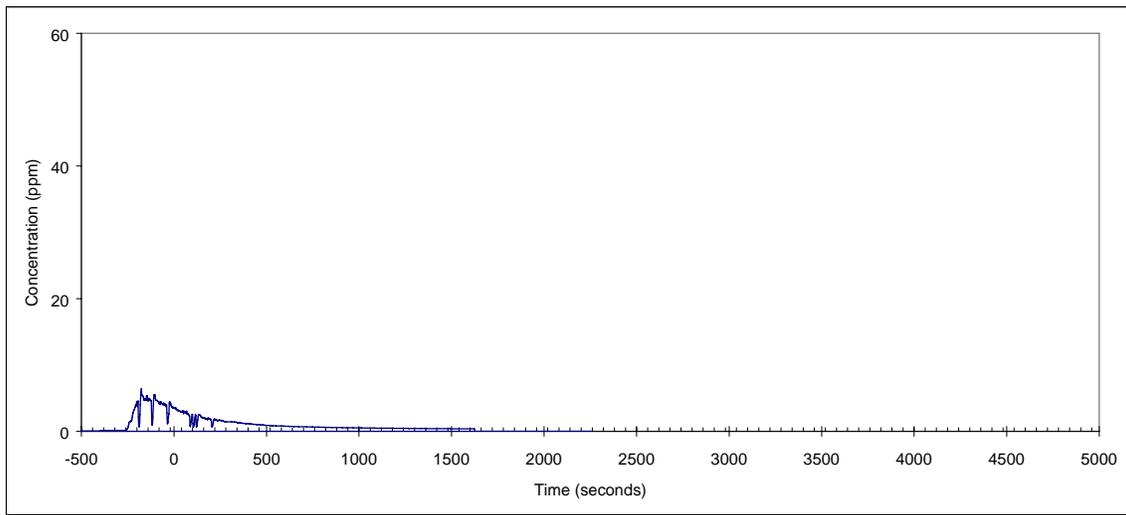


Figure J-4. Hydrogen cyanide response from mini gas analyzer located at position 1.

Test Number NIST 1  
September 5, 2003  
Analyzer Number Position 2B

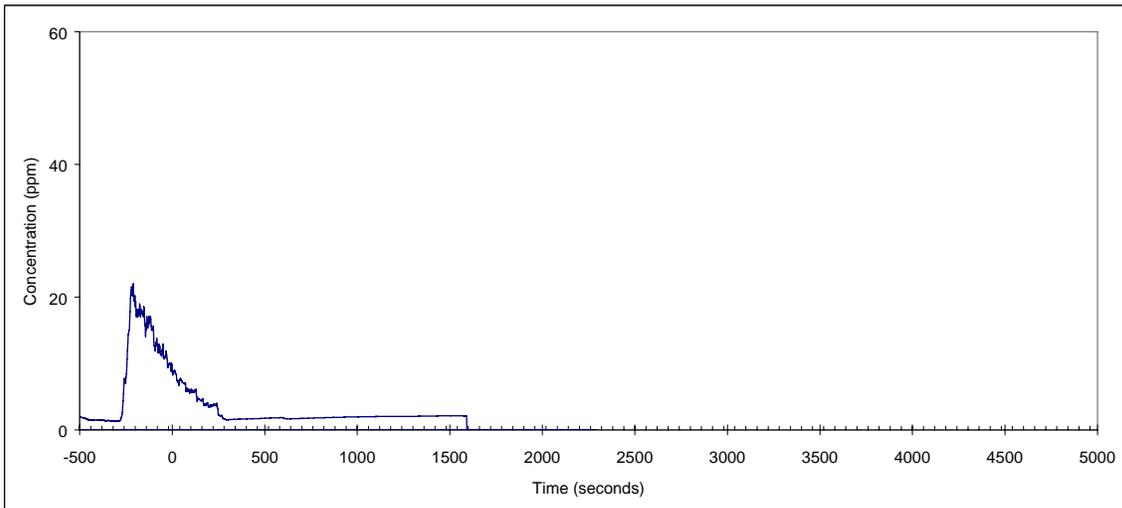


Figure J-5. Hydrogen cyanide response from large gas analyzer located at position 2.

Figures J-6 and J-7 show real-time results from the two mini gas HCN analyzers used for test 2 conducted on 10 Sept 03. This fire burned much longer and as indicated by the response produced much higher values of HCN.

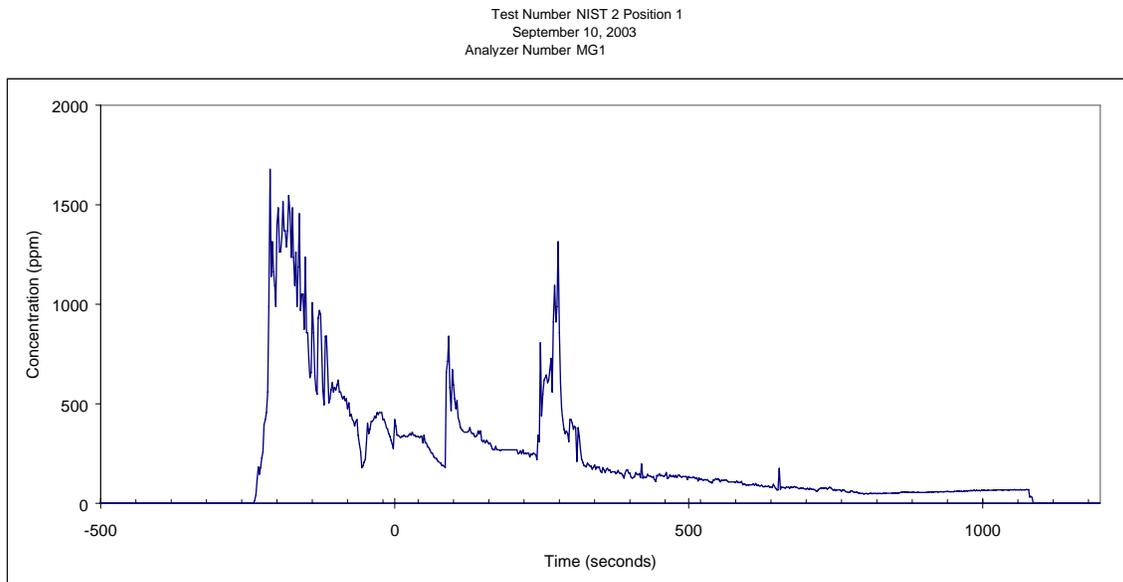


Figure J-6. Hydrogen cyanide response from mini gas 1 located at position 1

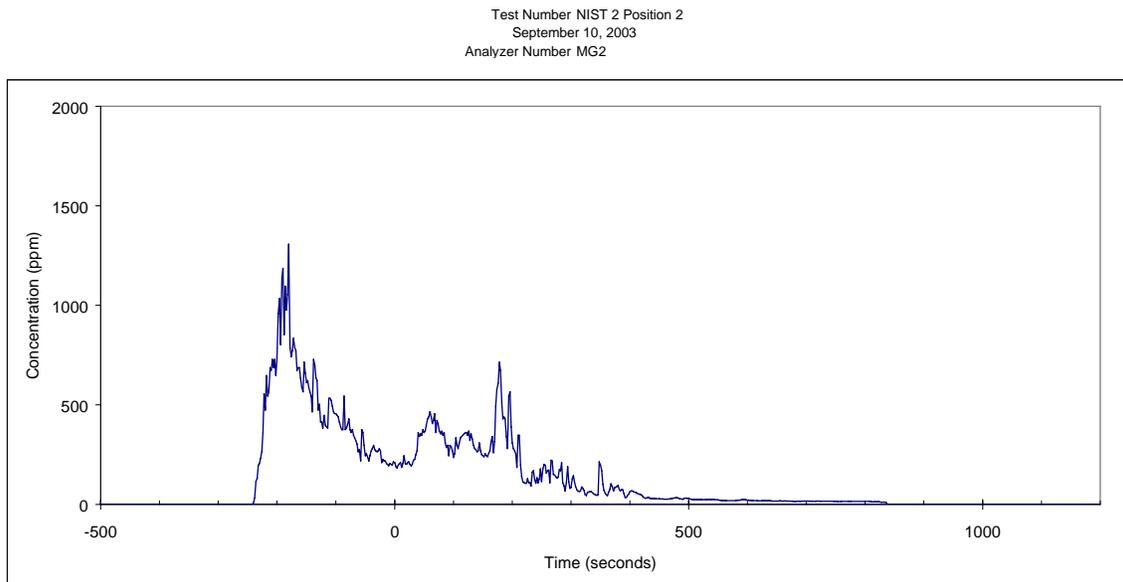


Figure J-7. Hydrogen cyanide response from mini gas 2 located at position 2.

Impinger and filter samples were analyzed according to NIOSH method 7904.

**Table J-1. Impinger data for Rhode Island Tests.**

**(All values reported in ppm HCN for the indicated run time. )**

Position	Test Date	Impinger ppm HCN	Impinger (Filter) ppm HCN	Filter ppm HCN	Run Time
1 (West) (NIST Sample Location D)	5 Sept 03	5.0	4.7	BDL	8 min.
2 (East) (NIST Sample Location D)	5 Sept 03	5.1	5.0	BDL	8 min.
1 (West) (NIST Sample Location D)	10 Sept 03	213	153	BDL	1.67 min.
2 (East) (NIST Sample Location D)	10 Sept 03	248	176	BDL	1.67 min.
BDL= Below Detection Limit of 2.5 ppm.					

For example at Position 1 on 5 Sept 03 the impinger measured an 8-min. TWA of 5 ppm HCN. At Position 1 on 10 Sept 03, a TWA of 213 ppm HCN was measured over a time of 1.67 min.

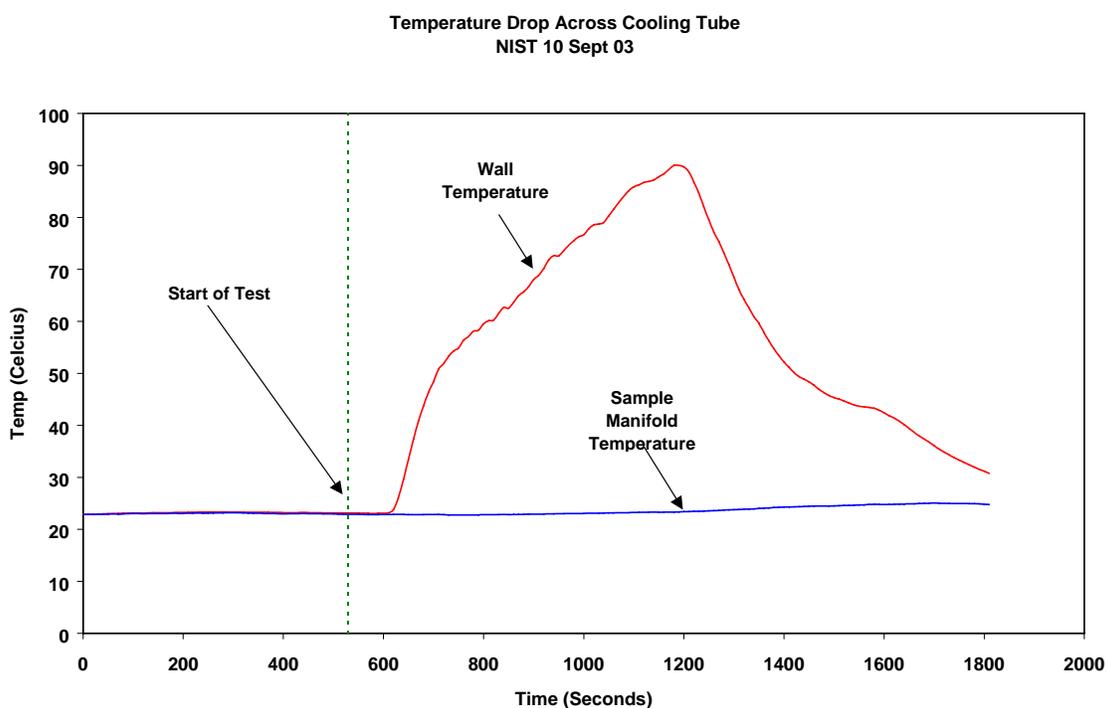
The impinger values may be low compared to the gas analyzer values because the impinger bubbler may not quantitatively collect aerosol forms of HCN.

The impingers behind the filters were expected to be lower than those of the impingers with no filters because any HCN collected on the filters, as aerosols would not be part of the impinger measurement. Because of the large amount of particulate matter on the filter, it was decided to estimate the total weight on the filter prior to cyanide analysis. However, any aerosol forms of HCN on the filters from test 2 were lost because of the time required to obtain filter weights.

The filters were photographed after the second test because they appeared to have a large amount of particulate matter on them (photographs were not available to include in this report). For this reason it was

decided to weigh the filters in an attempt to estimate exposure to total particulate matter. Since the filters were not pre-weighed, six new filters were weighed from the same pack to establish a tare weight. The weight of the filter from position 1 was significantly different from the mean so that <5% of the time we would be wrong in making that assumption. The difference between the mean filter weight and that of position 1 was 24.540 mg. This calculates to an exposure level of 12,649 mg/m<sup>3</sup>. This is considerably higher than the OSHA PEL TWA of 15 mg/m<sup>3</sup> (see attachment J-1). The weight of the filter from position 2 was not significantly different from the mean.

The data from the two thermocouples was recorded at 10-sec. intervals. The figure below shows that the 3-ft. extension successfully cooled the sample gases prior to entering any of the sampling devices.



After the first test one of the 9-ft. lines was rinsed with 10 mL of 0.1 M KOH. After test 2 both of the 9-ft. stainless steel sample lines were rinsed. For the second test both of the rinses has a yellow tinge; however, line 2 rinse was much darker. Analysis of all three samples for anions by ion chromatography showed a small amount of chloride and a very large amount of sulfate ion. The amount of HCN measured in the rinse samples represented only a few percent of the total HCN measured.

Two foam samples, one unburned and one partially burned, from the test on 5 Sept 03, were submitted to the FTIR lab at the Aberdeen Test Center for analysis. The pyrolysis and combustion analysis both showed the presence of hydrogen cyanide and organo isocyanates, which could include methyl isocyanate. According to NIOSH and OSHA methyl isocyanate is much more of an exposure hazard than hydrogen cyanide (Appendix FF-2 and FF-3).

The attached report summarizes the FTIR work. This FTIR technique could be a valuable tool for predicting the types of compounds to sample for prior to conducting the actual test burn. In this way the proper sampling devices could be obtained and the calibration ranges could be adjusted to match anticipated levels of combustion products produced in a fire.

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## J.2 NIOSH POCKET GUIDE TO CHEMICAL HAZARDS

### J.2.1 Particulates not otherwise regulated

#### CAS RTECS

##### Synonyms & Trade Names

"Inert" dusts, Nuisance dusts, PNOR [Note: Includes all inert or nuisance dusts, whether mineral, inorganic, not listed specifically in 1910.1000.] **DOD ID &**

##### Guide Exposure

**Limits** NIOSH REL: [See Appendix D](#)

OSHA PEL: TWA 15 mg/m<sup>3</sup> (total) TWA 5 mg/m<sup>3</sup> (resp)

**IDLH** N.D. See: [IDLH INDEX](#)

##### Conversion

##### Physical Description

Dusts from solid substances without specific occupational exposure standards.

Properties vary depending upon the specific solid.

##### Incompatibilities & Reactivities

Varies

##### Measurement Methods

NIOSH [0500](#), [0600](#)

See: [NMAM](#) or [OSHA Methods](#)

##### Personal Protection & Sanitation

Skin: No recommendation

Eyes: No recommendation

Wash skin: No recommendation

Remove: No recommendation

Change: No recommendation **First Aid** ([See procedures](#))

Eye: Irrigate immediately

Breathing: Fresh air

[Important additional information about respirator selection](#)

**Respirator Recommendations** To be added later

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, skin, throat, upper respiratory system

**Target Organs** Eyes, skin, respiratory system

See also: [INTRODUCTION](#)

## J.2.2 Methyl isocyanate

CAS 624-83-9

CH<sub>3</sub>NCO RTECS [NQ9450000](#)

### Synonyms & Trade Names

Methyl ester of isocyanic acid, MIC DOT ID & Guide 2480 [155](#)

**Exposure Limits** NIOSH REL: TWA 0.02 ppm (0.05 mg/m<sup>3</sup>) [skin]

OSHA PEL: TWA 0.02 ppm (0.05 mg/m<sup>3</sup>) [skin]

**IDLH** 3 ppm See: [624839](#) Conversion 1 ppm = 2.34 mg/m<sup>3</sup>

**Physical Description:** Colorless liquid with a sharp, pungent odor.

MW: 57.1 BP: 102 - 104°F FRZ: -49°F Sol (59°F): 10% VP: 348 mmHg IP: 10.67 eV

Sp.Gr: 0.96 FLP: 19°F UEL: 26% LEL: 5.3%

Class IB Flammable Liquid: FLP. below 73°F and BP at or above 100°F.

### Incompatibilities & Reactivities

Water, oxidizers, acids, alkalis, amines, iron, tin, copper [Note: Usually contains inhibitors to prevent polymerization.]

### Measurement Methods

OSHA [54](#)

See: [NMAM](#) or [OSHA Methods](#)

### Personal Protection & Sanitation

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet (flammable)

Change: No recommendation

Provide: Eyewash, Quick drench **First Aid** ([See procedures](#))

Eye: Irrigate immediately

Skin: Water flush immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

[Important additional information about respirator selection](#)

**Respirator Recommendations** NIOSH/OSHA

**Up to 0.2 ppm:** (APF = 10) Any supplied-air respirator\*

**Up to 0.5 ppm:** (APF = 25) Any supplied-air respirator operated in a continuous-flow mode\*

**Up to 1 ppm:** (APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

**Up to 3 ppm:** (APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

**Emergency or planned entry into unknown concentrations or IDLH conditions:** (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; respiratory sensitization, cough, pulmonary secretions, chest pain, dyspnea (breathing difficulty); asthma; eye, skin damage; in animals: pulmonary edema

**Target Organs** Eyes, skin, respiratory system See also: [INTRODUCTION](#) See ICSC CARD: [0004](#) See MEDICAL TESTS: [0143](#)

## J.2.3 Hydrogen cyanide

### CAS 74-90-8

HCN RTECS [MW6825000](#)

#### Synonyms & Trade Names

Formonitrile, Hydrocyanic acid, Prussic acid

1051 [117](#) (>20% solution)

1051 [117](#) (anhydrous)

1613 [154](#) (</=20% solution)

#### DOT ID & Guide

**Exposure Limits** NIOSH REL: ST 4.7 ppm (5 mg/m<sup>3</sup>) [skin]

OSHA PEL†: TWA 10 ppm (11 mg/m<sup>3</sup>) [skin]

**IDLH** 50 ppm See: [74908](#) **Conversion** 1 ppm = 1.10 mg/m<sup>3</sup> **Physical Description**

Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. [Note: Often used as a 96% solution in water.]

MW: 27.0 BP: 78°F (96%) FRZ: 7°F (96%)

Sol: Miscible VP: 630 mmHg IP: 13.60 eV

Sp.Gr: 0.69 FLP: 0°F (96%) UEL: 40.0%

LEL: 5.6% Class IA Flammable Liquid Flammable Gas

#### Incompatibilities & Reactivities

Amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, caustics, ammonia [Note: Can polymerize at 122-140°F.] **Measurement Methods**

NIOSH [6010](#)

See: [NMAM](#) or [OSHA Methods](#)

#### Personal Protection & Sanitation

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet (flammable)

Change: No recommendation

Provide: Eyewash, Quick drench **First Aid** ([See procedures](#))

Eye: Irrigate immediately

Skin: Water flush immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

#### [Important additional information about respirator selection](#)

**Respirator Recommendations** NIOSH

**Up to 47 ppm:** (APF = 10) Any supplied-air respirator

**Up to 50 ppm:** (APF = 25) Any supplied-air respirator operated in a continuous-flow mode/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:** (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact

**Symptoms** Asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes

**Target Organs** central nervous system, cardiovascular system, thyroid, blood

See also: [INTRODUCTION](#) See ICSC CARD: [0492](#) See MEDICAL TESTS: [0117](#)



## APPENDIX K. CODE COMPARISON TABLES

### K.1 Code Comparison of IBC [1] and NFPA 5000 [2]

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
	Chapter 1	Administration						
General	101.2	Scope.	The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.	Scope	1.3.1	Buildings and Structures.	The provisions of the Code shall apply to the construction, alteration, repair, equipment, use and occupancy, maintenance, relocation, and demolition of every building or structure, or any appurtenances connected or attached to such buildings or structures within the jurisdiction.	Similar
General	101.3	Intent.	The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.	Purpose	1.2	Purpose.	The purpose of the Code is to provide minimum design regulations to safeguard life, health, property, and public welfare and to minimize injuries by regulating and controlling the permitting, design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within the jurisdiction and certain equipment specifically regulated herein.	Similar
General	101.4.6	Fire prevention.	The provisions of the <i>International Fire Code</i> shall apply to matters affecting or relating to structures, processes, and premises from the hazard of fire or explosion arising from the storage, handling, or use of structures, materials, or devices; from conditions hazardous to life, property, or public welfare in the occupancy of structures or premises; and from the construction, extension, repair, alteration, or removal of fire suppression and alarm systems or fire hazards in the structure or on the premises from occupancy or operation.	Referenced publications	2.2	NFPA Publications.	NFPA 1, Fire Prevention Code, 2000 edition. Specific sections only.	Similar-Different standards are cited that cover the same issues.
Applicability	102.6	Existing Structures.	The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the International Property Maintenance Code or the International Fire Code, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.	Compliance of buildings and structures.	1.7.5.2.2	Existing Installations.	Buildings in existence at the time of the adoption of this Code shall be permitted to have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of this Code, provided such continued use is not dangerous to life.	Similar
Duties and Powers of Building Official	104.1	General.	The building official is hereby authorized and directed to enforce the provisions of this code. The building official shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.3.2.1	Examination of plans.	The authority having jurisdiction shall examine all plans and applications for permits and amendments thereto for their compliance with this Code. If the applications or the plans do not conform to the requirements of all pertinent laws, the authority having jurisdiction shall reject such application for a building permit in writing, stating the reasons	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.				therefore. Plans that are rejected shall be returned for corrections. If, upon examination, the application, plans, and specifications are found to comply with the requirements of this Code, the plans shall be signed by the authority having jurisdiction or its deputy and shall be stamped "approved."	
Duties and Powers of Building Official	104.2	Applications and permits.	The building official shall receive applications, review construction documents and issue permits for the erection, and alteration, demolition and moving of buildings and structures, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.1.1.1	Permits required.	No person, firm, or corporation shall erect, construct, enlarge, alter, repair, relocate, improve, convert, or demolish any building, structure, or part thereof in the jurisdiction, or cause the same to be done, without first obtaining from the authority having jurisdiction a separate building permit for the work to be accomplished for each such building, structure, or temporary structure. Permits shall not be required for the following: (List of items)	Similar
Duties and Powers of Building Official	104.3	Notices and orders.	The building official shall issue all necessary notices or orders to ensure compliance with this code	Building Permits, Plans and Specifications, and Inspections.	1.7.6.5.1	Permit Card.	When plans, specifications, and application for permit have been approved and the required fee has been paid, the authority having jurisdiction will issue a permit for the work. With each permit, the authority having jurisdiction shall issue a weather-resistant permit card bearing the legal description of the property, the nature of the work being done, the names of the owner and builder or contractor, and other pertinent information. The permit card shall be posted and maintained in legible condition in a conspicuous place within 200 ft (60 m) of the construction area during the entire time period the work authorized by the permit is in progress.	Similar
Duties and Powers of Building Official	104.4	Inspections.	The building official shall make all of the required inspections, or the building official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.6.1.1	Inspection Requirements.	Before issuing a permit, the authority having jurisdiction shall be permitted to inspect any building or structure for which an application has been received for a permit to enlarge, alter, repair, relocate, demolish, or change the occupancy thereof. The authority having jurisdiction shall inspect all buildings and structures from time to time during the work for which a permit was issued and on completion of the work. The authority having jurisdiction shall cause to be kept a record of every inspection and of all violations of this Code and of the correction and disposition of such violations.	Similar
Duties and Powers of Building Official	104.6	Right of entry.	Where it is necessary to make an inspection to enforce the provisions of this code, or where the building official has reasonable cause to believe that there exists in a structure or upon a premises a condition which is contrary to or in violation of this code which makes the structure or premises unsafe, dangerous or hazardous, the building official is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested. If such structure or premises is unoccupied, the building official shall first make a reasonable effort to locate the owner or other person	Building Permits, Plans and Specifications, and Inspections.	1.7.6.6.1.5	Inspection Requirements.	The authority having jurisdiction shall make or cause to be made the inspections required in 1.7.6.6.1. Written reports of inspectors employed by approved inspection services shall be permitted, provided that, after investigation, the authority having jurisdiction is satisfied as to the qualifications and reliability of the inspection service. No certificate called for by any of these requirements shall be based on such reports, unless the reports are in writing and are certified by the officer of the agency who made the inspection. Reports issued by inspection services engaged by the owner, designer, or contractor of a building shall be promptly forwarded to the authority having jurisdiction for its information and records.	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			having charge or control of the structure or premises and request entry. If entry is refused, the building official shall have recourse to the remedies provided by law to secure entry.					
Duties and Powers of Building Official	104.7	Department records.	The building official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for retention of public records.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.6.4	Inspection Reports.	The authority having jurisdiction shall keep a record of all inspections made, results, plans filed, surveys made, and certificates of occupancy issued.	Similar
Duties and Powers of Building Official	104.9	Approved materials and equipment.	Materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.	Equivalency.	1.5.4	Standards.	Construction systems, materials, or methods of design referred to in this Code shall be considered as standards of quality and strength. New or alternative construction systems, materials, or methods of design shall be at least equal to, and shall meet the intent of, these standards for the corresponding use intended.	Similar
Duties and Powers of Building Official	104.10	Modifications.	Wherever there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative, provided the building official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, accessibility, life and fire safety, or structural requirements. The details of action granting modifications shall be recorded and entered in the files of the department of building safety.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.3.2.2	Examination of Plans.	When practical difficulties are involved in carrying out the requirements of this Code, the authority having jurisdiction shall be permitted to grant modifications for individual cases. Such permission shall require, first, a finding that a special individual reason makes strict compliance impractical and, second, that the modification is in conformance with the intent and purpose of the Code. Fire protection and structural integrity shall not be lessened.	Similar
Duties and Powers of Building Official	104.11	Alternative materials, design & methods of construction & equipment.	The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method on work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.	Equivalency.	1.5.3	Permitted Alternatives.	The provisions of this Code shall not be construed to prevent the use of construction systems, materials, or methods of design, or interpolations, calculations, evaluations, or similar evidence based on test data acceptable to the authority having jurisdiction, as alternatives to the standards and provisions set forth in this Code. Such alternatives shall be permitted to be offered for approval, and their consideration shall be as provided in 1.5.2 through 1.5.8.	Similar
Permits	105.1	Required.	Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first make application to the building official and obtain the required permit	Building Permits, Plans and Specifications, and Inspections.	1.7.6.1.1.1	Permits required.	No person, firm, or corporation shall erect, construct, enlarge, alter, repair, relocate, improve, convert, or demolish any building, structure, or part thereof in the jurisdiction, or cause the same to be done, without first obtaining from the authority having jurisdiction a separate building permit for the work to be accomplished for each such building, structure, or temporary structure. Permits shall not be required for the following: (List of items)	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
Permits	105.2	Work exempt from permit.	<p>Exemptions from permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Permits shall not be required for the following: Building: 1. One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet (11.15 m<sup>2</sup>). 2. Fences not over 6 feet (1829 mm) high. 3. Oil derricks. 4. Retaining walls which are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or III-A liquids. 5. Water tanks supported directly on grade if the capacity does not exceed 5,000 gallons (18 925 L) and the ratio of height to diameter or width does not exceed 2 to 1. 6. Sidewalks and driveways not more than 30 inches (762 mm) above grade and not over any basement or story below and which are not part of an accessible route. 7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work. 8. Temporary motion picture, television and theater stage sets and scenery. 9. Prefabricated swimming pools accessory to a Group R-3 occupancy, as applicable in Section 101.2, which are less than 24 inches (610 mm) deep, do not exceed 5,000 gallons (18 925 L) and are installed entirely above ground. 10. Shade cloth structures constructed for nursery or agricultural purposes and not including service systems. 11. Swings and other playground equipment accessory to detached one- and two-family dwellings. 12. Window awnings supported by an exterior wall which do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support of Group R-3, as applicable in Section 101.2, and Group U occupancies. 13. Movable cases, counters and partitions not over 5 feet 9 inches (1753 mm) in height. Electrical: Repairs and maintenance: Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles. Radio and television transmitting stations: The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for power supply, the installations of towers and antennas. Temporary testing systems: A permit shall not be required for the testing or servicing of electrical equipment or apparatus. Gas: 1. Portable heating appliance. 2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe. Mechanical: 1. Portable heating appliance. 2. Portable ventilation equipment. 3. Portable cooling</p>	Building Permits, Plans and Specifications, and Inspections.	1.7.6.1.1.1	Permits required.	No person, firm, or corporation shall erect, construct, enlarge, alter, repair, relocate, improve, convert, or demolish any building, structure, or part thereof in the jurisdiction, or cause the same to be done, without first obtaining from the authority having jurisdiction a separate building permit for the work to be accomplished for each such building, structure, or temporary structure. Permits shall not be required for the following: (List of items)	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			unit. 4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code. 5. Replacement of any part which does not alter its approval or make it unsafe. 6. Portable evaporative cooler. 7. Self-contained refrigeration system containing 10 pounds (4.54 kg) or less of refrigerant and actuated by motors of 1 horsepower (746 W) or less. Plumbing: 1. The stopping of leaks in drains, water, soil, waste or vent pipe provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a permit shall be obtained and inspection made as provided in this code. 2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.					
Permits	105.2.2	Repairs.	Application or notice to the building official is not required for ordinary repairs to structures, replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles. Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety	Building Permits, Plans and Specifications, and Inspections.	1.7.6.1.1.1	Permits required.	No person, firm, or corporation shall erect, construct, enlarge, alter, repair, relocate, improve, convert, or demolish any building, structure, or part thereof in the jurisdiction, or cause the same to be done, without first obtaining from the authority having jurisdiction a separate building permit for the work to be accomplished for each such building, structure, or temporary structure. Permits shall not be required for the following: (List of items)	Similar
Permits	105.3	Application for permit.	To obtain a permit, the applicant shall first file an application therefore in writing on a form furnished by the department of building safety for that purpose. Such application shall: 1. Identify and describe the work to be covered by the permit for which application is made. 2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work. 3. Indicate the use and occupancy for which the proposed work is intended. 4. Be accompanied by construction documents and other information as required in Section 106.3. 5. State the valuation of the proposed work. 6. Be signed by the applicant, or the applicant's authorized agent. 7. Give such other data and information as required by the building official.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.2.1	Application Requirements.	To obtain a permit, the applicant shall first file an application therefore in writing on a form supplied for that purpose by the department of building and safety. Such application shall include the following: (List of items)	Similar
Permits	105.3.1	Action on application.	The building official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the	Building Permits, Plans and	1.7.6.3.2.1	Examination of plans.	The authority having jurisdiction shall examine all plans and applications for permits and amendments thereto for their compliance with this Code. If the	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing, stating the reasons therefore. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefore as soon as practicable.	Specifications, and Inspections.			applications or the plans do not conform to the requirements of all pertinent laws, the authority having jurisdiction shall reject such application for a building permit in writing, stating the reasons therefore. Plans that are rejected shall be returned for corrections. If, upon examination, the application, plans, and specifications are found to comply with the requirements of this Code, the plans shall be signed by the authority having jurisdiction or its deputy and shall be stamped "approved."	
Permits	105.4	Validity of permit.	The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction of errors in the construction documents and other data. The building official is also authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this jurisdiction.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.5.2.1	Compliance with the Code.	Issuing or granting of a permit or approval of plans and specifications by the authority having jurisdiction shall not be construed to be a permit for, or an approval of, any violations of any of the provisions of this Code. No permit presuming to give authority to violate or cancel any of the provisions of this Code shall be valid, except insofar as the performance of the work that it authorizes is lawful.	Similar
Construction Documents	106.1	Submittal documents.	Construction documents, special inspection and structural observation programs, and other data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional. Exception: The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.3.1.1	Plans and Specifications Requirements.	Each application for a permit shall be accompanied by two sets of plans, specifications, and calculations when required by the authority having jurisdiction.	Similar
Construction Documents	106.1.1	Information on construction documents.	Construction documents shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.3.1.4	Plans and Specifications Requirements.	Plans shall be drawn to scale, shall be identified by name of designer and owner on every sheet, and shall be mechanically reproduced prints on substantial paper or cloth. A plot plan shall show all occupied and unoccupied parts of the lot or lots. The use, name, and occupancy of all parts of the building shall be shown, including all foundations, wall sections, floor plans, elevations, and structural details. Mechanical, plumbing, electrical, fire sprinkler, and alarm details shall be shown on the plans and represent the designs for those disciplines, along with such other information to show clearly the nature, character, and location of the proposed work.	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
Construction Documents	106.1.1.1	Fire protection system shop drawings.	Shop drawings for the fire protection system(s) shall be submitted to indicate conformance with this code and the construction documents and shall be approved prior to the start of system installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.3.1.7	Plans and Specifications Requirements.	The construction documents and shop drawings submitted to the authority having jurisdiction shall contain sufficient detail for evaluation of the protected hazards and the effectiveness of the system. The shop drawings for the installation of fire protection systems shall be submitted for review and approval prior to the installation of a fire protection system.	Similar
Construction Documents	106.1.2	Means of egress.	The construction documents shall show in sufficient detail the location, construction, size and character of all portions of the means of egress in compliance with the provisions of this code. In other than occupancies in Groups R-2, R-3, as applicable in Section 101.2, and I-1, the construction documents shall designate the number of occupants to be accommodated on every floor, and in all rooms and spaces.	Plans and Specifications	1.7.6.3.1.4		Plans shall be drawn to scale, shall be identified by name of designer and owner on every sheet, and shall be mechanically reproduced prints on substantial paper or cloth. A plot plan shall show all occupied and unoccupied parts of the lot or lots. The use, name, and occupancy of all parts of the building shall be shown, including all foundations, wall sections, floor plans, elevations, and structural details. Mechanical, plumbing, electrical, fire sprinkler, and alarm details shall be shown on the plans and represent the designs for those disciplines, along with such other information to show clearly the nature, character, and location of the proposed work.	Similar
Construction Documents	106.1.3	Exterior wall envelope.	Construction documents for all buildings shall describe the exterior wall envelope in sufficient detail to determine compliance with this code. The construction documents shall provide details of the exterior wall envelope as required, including flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive membrane and details around openings. The construction documents shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system, which was tested, where applicable, as well as the test procedure used.	Plans and Specifications	1.7.6.3.1.4		Plans shall be drawn to scale, shall be identified by name of designer and owner on every sheet, and shall be mechanically reproduced prints on substantial paper or cloth. A plot plan shall show all occupied and unoccupied parts of the lot or lots. The use, name, and occupancy of all parts of the building shall be shown, including all foundations, wall sections, floor plans, elevations, and structural details. Mechanical, plumbing, electrical, fire sprinkler, and alarm details shall be shown on the plans and represent the designs for those disciplines, along with such other information to show clearly the nature, character, and location of the proposed work.	Similar
Construction Documents	106.5	Retention of construction documents.	One set of approved construction documents shall be retained by the building official for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws	Building Permits, Plans and Specifications, and Inspections.	1.7.6.3.4.1	Approved Plans.	The authority having jurisdiction shall retain one set of the approved plans, specifications, and computations. The other set shall be kept at the building site, open to inspection at all times when the offices of the jurisdiction are open.	Property corner stakes
Inspections	109.1	General.	Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to	Building Permits, Plans and Specifications, and Inspections.	1.7.6.6.1.1	Inspection Requirements.	Before issuing a permit, the authority having jurisdiction shall be permitted to inspect any building or structure for which an application has been received for a permit to enlarge, alter, repair, relocate, demolish, or change the occupancy thereof. The authority having jurisdiction shall inspect all buildings and structures from time to time during the work for which a permit was issued and on completion of the work. The authority having jurisdiction shall cause to be kept a record of every inspection and of all violations of this Code and of	Property line dimensions

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			remain accessible and exposed for inspection purposes. Neither the building official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.				the correction and disposition of such violations.	
Inspections	109.2	Preliminary inspection.	Before issuing a permit, the building official is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.6.1.3	Inspection Requirements.	All construction or work for which a permit is required shall be subject to mandatory inspections by the authority having jurisdiction as prescribed in 1.7.6.6.3, and certain types of construction shall have special engineering inspections as specified in Chapter 40. Prior to issuance of a certificate of occupancy, a final inspection shall be made by the authority having jurisdiction of all construction or work for which a permit has been issued.	Existing structures and their location
Inspections	109.3	Required inspections.	The building official, upon notification, shall make the inspections set forth in Sections 109.3.1 through 109.3.10.	Building Permits, Plans and Specifications, and Inspections.	1.7.6.6.3.3	Mandatory Inspections.	The permit holder or permit holder's agent shall notify the authority having jurisdiction of the time when a given stage of construction will be ready for inspection. The authority having jurisdiction shall then make such called inspection and other inspection as necessary, and it either shall approve in writing on the permit card that stage of the construction as completed or shall notify the permit holder or permit holder's agent specifically wherein the work fails to comply with the provisions of this Code.	Existing rights-of-way
Certificate of Occupancy	110.1	Use and occupancy.	No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the building official has issued a certificate of occupancy therefore as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction	Certificate of Occupancy.	1.7.6.8.1.1	Certificate Requirements.	No building hereafter erected, altered, enlarged, or relocated or for which a change of occupancy has been made, shall be used in whole or in part until a certificate of occupancy has been issued by the authority having jurisdiction certifying that the building and occupancy are in accordance with the provisions of this Code and all other laws and regulations applying thereto. When the building or part thereof complies with the provisions of all pertinent laws and regulations, the authority having jurisdiction shall issue the certificate of occupancy for the building or part thereof. A certificate of occupancy for places of assembly shall indicate thereon, and make record of, the number of persons for whom such certificate is issued. In all manufacturing, commercial, storage, or warehouse occupancies, the design live loads shall be plainly posted.	Sidewalks
Certificate of Occupancy	110.2	Certificate issued.	After the building official inspects the building or structure and finds no violations of the provisions of this code or other laws that are enforced by the department of building safety, the building official shall issue a certificate of occupancy that contains the following: 1. The building permit number. 2. The address of the structure. 3. The name and address of the owner. 4. A description of that portion of the structure for which the certificate is issued. 5. A statement that the described portion of the structure has been inspected for compliance with the	Certificate of Occupancy.	1.7.6.8.1.2	Certificate Requirements.	When, in the opinion of the authority having jurisdiction, any building altered or enlarged, or both, is in compliance with this Code, the owner shall be issued a letter affirming compliance in lieu of a certificate of occupancy.	Easements

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			requirements of this code for the occupancy and division of occupancy and the use for which the proposed occupancy is classified. 6. The name of the building official. 7. The edition of the code under which the permit was issued. 8. The use and occupancy, in accordance with the provisions of Chapter 3. 9. The type of construction as defined in Chapter 6. 10. The design occupant load. 11. If an automatic sprinkler system is provided, whether the sprinkler system is required. 12. Any special stipulations and conditions of the building permit.					
Unsafe Structures and Equipment	115.1	Conditions.	Structures or existing equipment that are or hereafter become unsafe, insanitary or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or which constitute a fire hazard, or are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe structures shall be taken down and removed or made safe, as the building official deems necessary and as provided for in this section. A vacant structure that is not secured against entry shall be deemed unsafe	Unsafe Buildings and Fire Hazards.	1.7.5.3.1.1	Description of Unsafe Building.	All buildings that are, or that hereafter become, as follows shall be considered unsafe buildings: (1) Unsanitary; (2) Deficient in means of egress; (3) A hazard from fire or natural or man-made threats; (4) Dangerous to human life or public welfare by reason of illegal or improper use, occupancy, or maintenance; (5) Non-compliant with the provisions of applicable codes; (6) Significantly damaged by fire or explosion or other natural or man-made cause; (7) Incomplete buildings for which building permits have expired; (8) The falling away, hanging loose, or loosening of any siding, block, or other building material, structural member, appurtenance, or part thereof of a building, a partially destroyed building, or any part of a building when caused by deterioration or overstressing; (9) The existence of unsanitary conditions by reason of inadequate or malfunctioning sanitary facilities or waste disposal system.	Similar
Unsafe Structures and Equipment	115.2	Record.	The building official shall cause a report to be filed on an unsafe condition. The report shall state the occupancy of the structure and the nature of the unsafe condition.	Unsafe Buildings and Fire Hazards.	1.7.5.3.3	Inspection of Unsafe Buildings.	The authority having jurisdiction, on his/her own initiative, or as a result of reports filed with the department of building and safety, shall examine or cause to be examined every building appearing to be or reported to be unsafe, and, if such is found to be an unsafe building as defined in 1.7.5.3.1.1, the authority having jurisdiction shall post the property on which the building is located and shall furnish the owner of such building with a written notice of violation. The manner of posting and furnishing written notice shall be as provided in 1.7.5.3.4 and 1.7.5.3.5, inclusive.	Similar
Unsafe Structures and Equipment	115.3	Notice.	If an unsafe condition is found, the building official shall serve on the owner, agent or person in control of the structure, a written notice that describes the condition deemed unsafe and specifies the required repairs or improvements to be made to abate the unsafe condition, or that requires the unsafe structure to be demolished within a stipulated time. Such notice shall require the person thus notified to declare immediately to the building official acceptance or rejection of the terms of the order.	Unsafe Buildings and Fire Hazards.	1.7.5.3.4	Notice of Violation.	At least 14 days prior to posting a noncomplying building, the authority having jurisdiction shall give the owner of the premises written notice by certified mail, addressed to the owner's last known address. If proof of service by certified mail is not completed by signed return receipt, a copy of the written notice shall be affixed to the structure concerned, and such procedure shall be considered proper service, and the time for compliance stipulated in the notice shall commence with the date on which such notice is so affixed. This written notice shall state the defects that constitute a violation of this Code and prescribe the action to be taken by the owner of the building to	Similar

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							comply with the Code and the time within which compliance must be accomplished. Such time shall be reasonable under the circumstances of the case, subject to reasonable extension when requested in writing, for reasons that the authority having jurisdiction considers as justifying an extension of time. All extensions of time shall be by written approval of the authority having jurisdiction. In addition, ...	
Unsafe Structures and Equipment	115.4	Method of service.	Such notice shall be deemed properly served if a copy thereof is (a) delivered to the owner personally; (b) sent by certified or registered mail addressed to the owner at the last known address with the return receipt requested; or (c) delivered in any other manner as prescribed by local law. If the certified or registered letter is returned showing that the letter was not delivered, a copy thereof shall be posted in a conspicuous place in or about the structure affected by such notice. Service of such notice in the foregoing manner upon the owner's agent or upon the person responsible for the structure shall constitute service of notice upon the owner.	Unsafe Buildings and Fire Hazards.	1.7.5.3.4	Notice of Violation.	At least 14 days prior to posting a noncomplying building, the authority having jurisdiction shall give the owner of the premises written notice by certified mail, addressed to the owner's last known address. If proof of service by certified mail is not completed by signed return receipt, a copy of the written notice shall be affixed to the structure concerned, and such procedure shall be considered proper service, and the time for compliance stipulated in the notice shall commence with the date on which such notice is so affixed. This written notice shall state the defects that constitute a violation of this Code and prescribe the action to be taken by the owner of the building to comply with the Code and the time within which compliance must be accomplished. Such time shall be reasonable under the circumstances of the case, subject to reasonable extension when requested in writing, for reasons that the authority having jurisdiction considers as justifying an extension of time. All extensions of time shall be by written approval of the authority having jurisdiction. In addition, ...	Similar
Unsafe Structures and Equipment	115.5	Restoration.	The structure or equipment determined to be unsafe by the building official is permitted to be restored to a safe condition. To the extent that repairs, alterations or additions are made or a change of occupancy occurs during the restoration of the structure, such repairs, alterations, additions or change of occupancy shall comply with the requirements of Section 105.2.2 and Chapter 34.	Unsafe Buildings and Fire Hazards.	1.7.5.3.8	Appeal and Review.	The owner of, or anyone having an interest in, a building that has been determined to be unsafe, concerning which a notice of violation has been served by the authority having jurisdiction as stated in the notice of violation, shall be permitted to appeal to the board of appeals, and such appeal shall be filed in accordance with the provisions of 1.7.3.6 and 1.7.3.7 prior to the expiration of the time allowed for compliance specified in such notice. In no case shall the appeal period be less than 15 days.	Similar
	Chapter 3	Use and Occupancy Classification						
Assembly Group A	303.1	Assembly Group A.	Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering together of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption or awaiting transportation. A room or space used for assembly purposes by less than 50 persons and accessory to another occupancy shall be included as a part of that occupancy. Assembly areas with less than 750 square feet (69.7 m <sup>2</sup> ) and which are accessory to another occupancy according to Section 302.2.1 are not assembly occupancies. .... Assembly occupancies shall include	General Definitions.	3.3.371.1	Assembly Occupancy.	An occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load.	Similar-NFPA does not have sub-classifications.

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			the following: ... A-2 Assembly uses intended for food and/or drink consumption, including, but not limited to: Banquet halls, Nightclubs, Restaurants, Taverns and bars. ....					
	Chapter 4	Special Detailed Requirements Based on Use and Occupancy						
Stages and Platforms	410.1	Applicability.	The provisions of this section shall apply to all parts of buildings and structures that contain stages or platforms and similar appurtenances as herein defined.	Special Provisions.	16.4.5	Stages and Platforms.	Stages and Platforms.	Similar
Stages and Platforms	410.2	Definitions.	The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein. FLY GALLERY. A raised floor area above a stage from which the movement of scenery and operation of other stage effects are controlled. GRIDIRON. The structural framing over a stage supporting equipment for hanging or flying scenery and other stage effects. PINRAIL. A rail on or above a stage through which belaying pins are inserted and to which lines are fastened. PLATFORM. A raised area within a building used for..., the presentation of music, ...wherein there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days. PROSCENIUM WALL. The wall that separates the stage from the auditorium or assembly seating area. STAGE. A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound...	Special Provisions.	3.3.516	Stage.	A space within a building used for entertainment and utilizing drops or scenery or other stage effects.	Similar
Stages and Platforms	410.3	Stages.	Stage construction shall comply with Sections 410.3.1 through 410.3.7.	Stages and Platforms.	16.4.5.2	Stage Construction.	Stage Construction.	Similar
Stages and Platforms	410.3.1	Stage construction.	Stages shall be constructed of materials as required for floors for the type of construction of the building in which such stages are located. Exceptions: 1. Stages of Type IIB or IV construction with a nominal 2-inch (51 mm) wood deck, provided that the stage is separated from other areas in accordance with Section 410.3.5. 2. In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided the space below the stage is equipped with an automatic fire-extinguishing system in accordance with Section 903 or 904. 3. In all types of construction, the finished floor shall be constructed of wood or approved noncombustible materials. Openings through stage floors shall be equipped with tight-fitting, solid wood trap doors with approved safety locks.	Stages and Platforms.	16.4.5.2.1	Stage Construction.	Regular stages shall be constructed of materials as required for the type of construction of the building in which they are located. In all cases, the finished floor shall be permitted to be of wood.	Similar
Stages and Platforms	410.3.1.1	Stage height and area.	Stage areas shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height shall be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the	Stages and Platforms.	16.4.5.2.2	Stage Construction.	Legitimate stages shall be constructed of materials required for Type I buildings, except that the area extending from the proscenium opening to the back wall of the stage, and for a distance of 6 ft (183 cm) beyond the proscenium opening on each side, shall be permitted to be constructed of steel or heavy	Different-NFPA only for stages. The structure in the Station was not a stage but a platform.

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			stage.				timber covered with a wood floor not less than 1½ in. (3.8 cm) in actual thickness.	
Stages and Platforms	410.3.3	Exterior stage doors.	Where protection of openings is required, exterior exit doors shall be protected with fire doors that comply with Section 715. Exterior openings that are located on the stage for means of egress or loading and unloading purposes, and that are likely to be open during occupancy of the theater, shall be constructed with vestibules to prevent air drafts into the auditorium.	Stages and Platforms			See section 16.4.5.2	Different-NFPA does not have a separate section directly addressing egress from stages.
Stages and Platforms	410.3.4	Proscenium wall.	Where the stage height is greater than 50 feet (15 240 mm), all portions of the stage shall be completely separated from the seating area by a proscenium wall with not less than a 2-hour fire-resistance rating extending continuously from the foundation to the roof.	Stages and Platforms.	16.4.5.5	Proscenium Walls.	Legitimate stages shall be completely separated from the seating area by a proscenium wall of not less than 2-hour fire-resistive noncombustible or limited-combustible construction. The proscenium wall shall extend at least 4 ft (122 cm) above the roof of the auditorium in combustible construction. All openings in the proscenium wall of a legitimate stage shall be protected by a fire assembly having a 1½-hour fire protection rating. Exception No. 1: The main proscenium opening used for viewing performances shall be provided with an automatic-closing fire-resistive curtain as described in 16.4.5.6. Exception No. 2: Proscenium walls shall not be required in smoke-protected assembly seating facilities constructed and operated in accordance with 16.4.2.	Similar
Stages and Platforms	410.3.5	Proscenium curtain.	The proscenium opening of every stage with a height greater than 50 feet (15 240 mm) shall be provided with a curtain of approved material or an approved water curtain complying with Section 903.3.1.1. The curtain shall be designed and installed to intercept hot gases, flames and smoke, and to prevent a glow from a severe fire on the stage from showing on the auditorium side for a period of 20 minutes. The closing of the curtain from the full open position shall be affected in less than 30 seconds, but the last 8 feet (2438 mm) of travel shall require not less than 5 seconds.	Stages and Platforms.	16.4.5.5	Proscenium Walls.	Legitimate stages shall be completely separated from the seating area by a proscenium wall of not less than 2-hour fire-resistive noncombustible or limited-combustible construction. The proscenium wall shall extend at least 4 ft (122 cm) above the roof of the auditorium in combustible construction. All openings in the proscenium wall of a legitimate stage shall be protected by a fire assembly having a 1½-hour fire protection rating. Exception No. 1: The main proscenium opening used for viewing performances shall be provided with an automatic-closing fire-resistive curtain as described in 16.4.5.6. Exception No. 2: Proscenium walls shall not be required in smoke-protected assembly seating facilities constructed and operated in accordance with 16.4.2.	Similar
Stages and Platforms	410.3.6	Scenery.	Combustible materials used in sets and scenery shall be rendered flame resistant in accordance with Section 805 and the International Fire Code. Foam plastics and materials containing foam plastics shall comply with Section 2603 and the International Fire Code.	Not addressed	Not addressed	Not addressed		Similar. NFPA addresses in NFPA 1 as it is considered an operational matter.
Stages and Platforms	410.3.7	Stage ventilation.	Emergency ventilation shall be provided for stages larger than 1,000 square feet (93 m <sup>2</sup> ) in floor area, or with a stage height greater than 50 feet (15 240 mm). Such ventilation shall comply with Section 410.3.7.1 or 410.3.7.2	Stages and Platforms.	16.4.5.4.2	Roof Vents.	(A) Two or more vents shall be located near the center of, and above the highest part of, the stage area. (B) The vents shall be raised above the roof and shall provide a net-free vent area equal to 5 percent of the stage area. (C) Vents shall be constructed to open automatically	Similar

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							by approved heat-activated devices. (D) Supplemental means shall be provided for manual operation and periodic testing of the ventilator from the stage floor. (E) Vents shall be labeled.	
Stages and Platforms	410.4	Platform construction.	Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located. Permanent platforms are permitted to be constructed of fire-retardant-treated wood for Type I, II, and IV construction where the platforms are not more than 30 inches (762mm) above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet (279 m2) in area. Where the space beneath the permanent platform is used for storage or any other purpose other than equipment, wiring or plumbing, the floor construction shall not be less than 1-hour fire-resistant construction. Where the space beneath the permanent platform is used only for equipment, wiring or plumbing, the underside of the permanent platform need not be protected.	Stages and Platforms.	16.4.5.1	Platform Construction.	Temporary platforms shall be permitted to be constructed of any materials. The space between the floor and the platform above shall not be used for any purpose other than electrical wiring to platform equipment.(A) Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located, except that the finished floor shall be permitted to be of wood in all types of construction.(B) Where the space beneath the platform is used for storage or any purpose other than equipment wiring or plumbing, the floor shall not be of less than 1-hour fire-resistive construction.	Similar
Stages and Platforms	410.5	Dressing and appurtenant rooms.	Dressing and appurtenant rooms shall comply with Sections 410.5.1 through 410.5.4.	Not addressed	Not addressed	Not addressed	See section 16.4.5.3	Different
Stages and Platforms	410.5.2	Separation from each other.	Dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage shall be separated from each other by fire barrier wall and horizontal assemblies, or both, with not less than a 1-hour fire-resistance rating with approved opening protectives.	Accessory Rooms.	16.4.5.3		Workshops, storerooms, permanent dressing rooms, and other accessory spaces contiguous to stages shall be separated from each other and other building areas by 1-hour fire resistance-rated construction and protected openings. Exception: A separation shall not be required for stages having a floor area not exceeding 1000 ft2 (93 m2).	Similar
Stages and Platforms	410.5.3	Opening protectives.	Openings other than to trunk rooms and the necessary doorways at stage level shall not connect such rooms with the stage, and such openings shall be protected with fire door assemblies that comply with Section 715	Not addressed	Not addressed	Not addressed		Different-NFPA does not address.
Stages and Platforms	410.5.4	Stage exits.	At least one approved means of egress shall be provided from each side of the stage; and from each side of the space under the stage. At least one means of escape shall be provided from each fly gallery and from the gridiron. A steel ladder, alternating tread stairway or spiral stairway is permitted to be provided from the gridiron to a scuttle in the stage roof.	Number of Exits	16.2.4.6		A second means of egress shall not be required from lighting and access catwalks, galleries, and gridirons where a means of escape to a floor or a roof is provided. Ladders, alternating tread devices, or spiral stairs shall be permitted in such means of escape.	Similar
Stages and Platforms	410.6	Automatic sprinkler system.	Stages shall be equipped with an automatic fire-extinguishing system in accordance with Chapter 9. The system shall be installed under the roof and gridiron, in the tie and fly galleries and in places behind the proscenium wall of the stage and in dressing rooms, lounges, workshops and storerooms accessory to such stages. Exceptions: 1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height utilized exclusively for storage of tables and chairs, provided the concealed space is separated from the adjacent spaces by not	Stages and Platforms.	16.4.5.9	Fire Protection.	Every stage shall be protected by an approved, supervised automatic sprinkler system installed in compliance with Section 55.3. The protection shall be provided throughout the stage and in storerooms, workshops, permanent dressing rooms, and other accessory spaces contiguous to such stages. Exception No. 1: Sprinklers shall not be required for stages of 1000 ft2 (93 m2) or less and of 50 ft (15 m) or less in height where curtains, scenery, or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single	Similar

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			less than 5/8-inch (15.9 mm) Type X gypsum board. 2. Sprinklers are not required for stages 1,000 square feet (93m <sup>2</sup> ) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.				main curtain, borders, legs, and a single backdrop. Exception No. 2: Sprinklers shall not be required under stage areas less than 4 ft (1.2 m) in clear height used exclusively for chair or table storage and lined on the inside with -in. (1.6-cm) Type X gypsum wallboard or an approved equivalent.	
Stages and Platforms	410.7	Standpipes.	Standpipe systems shall be provided in accordance with Section 905.	Stages and Platforms.	16.4.5.10	Standpipes or Hose Connections.	Regular stages over 1000 ft <sup>2</sup> (93 m <sup>2</sup> ) in area and all legitimate stages shall be equipped with 1½-in. (38-mm) hose lines for first aid fire fighting at each side of the stage. Hose connections shall be in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, unless Class II or Class III standpipes in accordance with NFPA 14, Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems, are used.	Similar
	Chapter 5	General Building Heights and Areas						
General Height and Area Limitations	503.1	General.	The height and area for buildings of different construction types shall be governed by the intended use of the building and shall not exceed the limits in Table 503 except as modified hereafter. Each part of a building included within the exterior walls or the exterior walls and fire walls where provided shall be permitted to be a separate building.	Height and Area Limitations.	7.4.1	General.	Except as modified in Section 7.4 through Section 7.6, the heights and areas of buildings, based on their intended occupancy and type of construction classification, shall not exceed the limits set forth in Table 7.4.1 where the values in Table 7.4.1 for sprinklered buildings apply to buildings protected throughout with an approved, electrically supervised automatic sprinkler system in accordance with 55.3.1.1(1).	Similar, but slightly different values or approaches used. .
General Height and Area Limitations	503	Table 0503.	See Table.	Height and Area Limitations.	7.4.1	General.	Table 7.4.1	Similar, but slightly different values or approaches used.
Area Modifications	506.1	General.	The areas limited by Table 503 shall be permitted to be increased due to frontage (lf) and automatic sprinkler system protection (ls) in accordance with the following: (Equation 5-1)	Area Increases Permitted.	7.6.2	Area Increase.	The floor areas specified in Table 7.4.1 shall be permitted to be increased to account for frontage (lf) and automatic sprinkler protection (ls) in accordance with the following equation: (7.1)	Similar
Area Modifications	506.2	Frontage increase.	Every building shall adjoin or have access to a public way to receive an area increase for frontage. Where a building has more than 25 percent of its perimeter on a public way or open space having a minimum width of 20 feet (6096 mm), the frontage increase shall be determined in accordance with the following: (Equation 5-2)	Area Increases Permitted.	7.6.2.1	Frontage Increase.	When a building has more than 25 percent of its perimeter fronting or facing on a public way or open space having a minimum width of 20 ft (6 m), the frontage increase shall be determined in accordance with the following equations: (7.2) (7.3)	Similar
Area Modifications	506.3	Automatic sprinkler system increase.	Where a building is protected throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the area limitation in Table 503 is permitted to be increased by an additional 200 percent (ls = 200 percent) for multistory buildings and an additional 300 percent (ls = 300 percent) for single-story buildings. These increases are permitted in addition to the height and story increases in accordance with Section 504.2. Exceptions: 1. Buildings with an occupancy in Group H-1, H-2 or H-3.	Area Increases Permitted.	7.6.2.2	Automatic Sprinkler Increase	Buildings protected with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13 shall be permitted to have the following sprinkler (ls) area increases: (1) 200 percent (ls = 200) for buildings of two stories or more (2) 300 percent (ls = 300) for single-story buildings	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			2. Fire-resistance rating substitution in accordance with Table 601, Note d.					
Area Modifications	506.4	Area determination.	The maximum area of a building with more than one story shall be determined by multiplying the allowable area of the first floor (Aa), as determined in Section 506.1, by the number of stories as listed below. 1. For two-story buildings, multiply by 2; 2. For three-story or higher buildings, multiply by 3; and, 3. No story shall exceed the allowable area per floor (Aa), as determined in Section 506.1 for the occupancies on that floor. Exceptions: 1. Unlimited area buildings in accordance with Section 507. 2. The maximum area of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.2 shall be determined by multiplying the allowable area per floor (Aa), as determined in Section 506.1 by the number of stories.	Area Increases Permitted.	7.6.2	Area Increase.	The floor areas specified in Table 7.4.1 shall be permitted to be increased to account for frontage (lf) and automatic sprinkler protection (ls) in accordance with the following equation: (7.1)	Similar
	Chapter 6	Types of Construction						
Construction Classification	602.1	General.	Building and structures erected or to be erected, altered, or extended in height or area shall be classified in one of the construction types defined in Sections 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602.	Construction Types.	7.2.1.1	General.	All buildings and parts of buildings hereafter constructed shall conform to the requirements for the specific types of construction as provided in this chapter and shall comply with the applicable requirements of other chapters and sections of this Code.	Similar
Construction Classification	602.5	Type V.	Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by this code	Construction Types.	7.2.6	Type V (111 or 000) Construction.	Type V (111 or 000) construction shall be that type in which exterior walls, bearing walls, columns, beams, girders, trusses, arches, floors, and roofs are entirely or partially of wood or other approved material.	Similar
	Chapter 7	Fire-Resistance-Rated Construction						
Concealed Spaces	717.1	General.	Fireblocking and draftstopping shall be installed in combustible concealed locations in accordance with this section. Fireblocking shall comply with Section 717.2. Draftstopping in floor/ceiling spaces and attic spaces shall comply with Sections 717.3 and 717.4, respectively. The permitted use of combustible materials in concealed spaces of noncombustible buildings shall be limited to the applications indicated in Section 717.5.	Concealed Spaces.	8.14.1.1	Draft Stops.	Any concealed combustible space in which building materials having a flame spread index greater than Class A are exposed shall be draftstopped as follows: (1) Every unoccupied attic space shall be subdivided by draftstops into areas not to exceed 3000 ft <sup>2</sup> (280 m <sup>2</sup> ). (2) Any concealed space between the ceiling and the floor or roof above shall be draftstopped for the full depth of the space along the line of support for the floor or roof structural members and, if necessary, at other locations to form areas not to exceed 1000 ft <sup>2</sup> (93 m <sup>2</sup> ) for any space between the ceiling and floor and 3000 ft <sup>2</sup> (280 m <sup>2</sup> ) for any space between the ceiling and roof.	Similar
Concealed Spaces	717.2	Fireblocking.	In combustible construction, fireblocking shall be installed to cut off concealed draft openings (both vertical and horizontal) and shall form an effective barrier between floors, between a top story and a roof or attic space. Fireblocking shall be installed in the locations specified in Sections 717.2.2 through 717.2.7.	Concealed Spaces.	8.14.2.1	Fireblocks.	Concealed spaces constructed of combustible materials shall be fireblocked as follows: (1) In exterior and interior stud walls, at ceilings and floor levels (2) In combustible stud walls and partitions including furred spaces, placed so that the maximum dimension of a concealed space is 8 ft (2440 mm)	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
							(3) At all interconnections between concealed vertical and horizontal spaces such as those that occur at soffits, drop ceilings, and cove ceiling (4) In concealed spaces between stair stringers at the top and bottom of the run (5) At openings around vents, pipes, and ducts at ceiling and floor levels (6) In the spaces between chimneys and wood framing, which are to be solidly filled with approved materials	
Concealed Spaces	717.2.1	Fireblocking materials.	Fireblocking shall consist of 2-inch nominal lumber or two thicknesses of 1-inch nominal lumber with broken lap joints or one thickness of 0.719-inch wood structural panel with joints backed by 0.719-inch wood structural panel or one thickness of 0.75-inch particleboard with joints backed by 0.75-inch particleboard. Gypsum board, cement fiber board, batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place shall be permitted as an acceptable fireblock. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases. The integrity of fireblocks shall be maintained.	Concealed Spaces.	8.14.2.3	Fireblocks.	Fireblocks shall consist of one of the following: (1) Nominal 2-in. (51-mm) lumber of two thicknesses of nominal 1-in. (25-mm) lumber with broken lap joints; one thickness of -in. (18-mm) wood structural panel with joints backed by -in. (18-mm) wood structural panel; or one thickness of ¾-in. (19-mm) particleboard with joints backed by ¾-in. (19-mm) particleboard(2) Gypsum board, cement fiber board, batts or blankets of mineral wool or glass fiber, or other approved materials that are capable of resisting the free passage of fire and smoke within the concealed space installed in such a manner as to be securely retained in place	Similar
Concealed Spaces	717.2.2	Concealed wall spaces.	Fireblocking shall be provided in concealed spaces of stud walls and partitions, including furred spaces, and parallel rows of studs or staggered studs, as follows: a. Vertically at the ceiling and floor levels. b. Horizontally at intervals not exceeding 10 feet (3048 mm).	Concealed Spaces.	8.14.2.1	Fireblocks.	Concealed spaces constructed of combustible materials shall be fireblocked as follows: (1) In exterior and interior stud walls, at ceilings and floor levels (2) In combustible stud walls and partitions including furred spaces, placed so that the maximum dimension of a concealed space is 8 ft (2440 mm) (3) At all interconnections between concealed vertical and horizontal spaces such as those that occur at soffits, drop ceilings, and cove ceiling (4) In concealed spaces between stair stringers at the top and bottom of the run (5) At openings around vents, pipes, and ducts at ceiling and floor levels (6) In the spaces between chimneys and wood framing, which are to be solidly filled with approved materials	Similar
Concealed Spaces	717.2.3	Connections between horizontal and vertical spaces.	Fireblocking shall be provided at Interconnections between concealed vertical stud wall or partition spaces and concealed horizontal spaces created by an assembly of floor joists or trusses, and between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.	Concealed Spaces.	8.14.2.1	Fireblocks.	Concealed spaces constructed of combustible materials shall be fireblocked as follows: (1) In exterior and interior stud walls, at ceilings and floor levels (2) In combustible stud walls and partitions including furred spaces, placed so that the maximum dimension of a concealed space is 8 ft (2440 mm)	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
							(3) At all interconnections between concealed vertical and horizontal spaces such as those that occur at soffits, drop ceilings, and cove ceiling (4) In concealed spaces between stair stringers at the top and bottom of the run (5) At openings around vents, pipes, and ducts at ceiling and floor levels (6) In the spaces between chimneys and wood framing, which are to be solidly filled with approved materials	
Concealed Spaces	717.3	Draftstopping in floors.	In combustible construction, draftstopping shall be installed to subdivide floor/ceiling assemblies in the locations prescribed in Sections 717.3.2 through 717.3.3.	Concealed Spaces.	8.14.1.1	Draft Stops.	Any concealed combustible space in which building materials having a flame spread index greater than Class A are exposed shall be draftstopped as follows: (1) Every unoccupied attic space shall be subdivided by draftstops into areas not to exceed 3000 ft <sup>2</sup> (280 m <sup>2</sup> ). (2) Any concealed space between the ceiling and the floor or roof above shall be draftstopped for the full depth of the space along the line of support for the floor or roof structural members and, if necessary, at other locations to form areas not to exceed 1000 ft <sup>2</sup> (93 m <sup>2</sup> ) for any space between the ceiling and floor and 3000 ft <sup>2</sup> (280 m <sup>2</sup> ) for any space between the ceiling and roof.	Similar
Concealed Spaces	717.3.1	Draftstopping materials.	Draftstopping materials shall not be less than 0.5-inch (12.7 mm) gypsum board, 0.375-inch (9.5 mm) wood structural panel, 0.375-inch (9.5 mm) particleboard or other approved materials adequately supported. The integrity of draftstops shall be maintained.	Concealed Spaces.	8.14.1.3	Draft Stops.	Draftstopping materials shall be not less than ½-in. (13-mm) gypsum board, -in. (12-mm) wood structural panel, or other approved materials adequately supported.	Similar
Thermal- and Sound-Insulating Materials	719.1	General.	Insulating materials, including facings such as vapor retarders and vapor-permeable membranes, similar coverings, and all layers of single and multilayer reflective foil insulations, shall comply with the requirements of this section. Where a flame spread index or a smoke-developed index is specified in this section, such index shall be determined in accordance with ASTM E 84. Any material that is subject to an increase in flame spread index or smoke-developed index beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions shall not be permitted. Exceptions: 1. Fiberboard insulation shall comply with Chapter 23. 2. Foam plastic insulation shall comply with Chapter 26. 3. Duct and pipe insulation and duct and pipe coverings and linings in plenums shall comply with the International Mechanical Code.	Insulating Materials.	8.16.1.1	Flame Spread.	Where a flame spread index or a smoke developed index is specified in Section 8.16, such index shall be determined in accordance with the requirements of NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials, or ASTM E 84, Standard Test Method of Surface Burning Characteristics of Building Materials.	Similar
Thermal- and Sound-Insulating Materials	719.2	Concealed installation.	Insulating materials, where concealed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450. Exception: Cellulose loose-fill insulation that is not spray applied, complying with the requirements of Section 719.6, shall only be required to meet the smoke-developed index of not more than 450.	Insulating Materials.	8.16.2.1	Concealed Insulation.	Insulating materials shall meet the following criteria: (1) When concealed as installed in buildings of any type construction, insulating materials shall have a flame spread index of not more than 75 and a smoke developed index of not more than 450. (2) Cellulose loose-fill insulation that is not spray applied and that complies with the requirements of 8.16.6 shall be required to meet only a smoke developed index of not more than 450.	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
Thermal- and Sound- Insulating Materials	719.3	Exposed installation.	Insulating materials, where exposed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450. Exception: Cellulose loose-fill insulation that is not spray applied complying with the requirements of Section 719.6 shall only be required to meet the smoke-developed index of not more than 450.	Exposed Insulation.	8.16.3.1	General.	Insulating materials shall meet the following criteria: (1) When exposed as installed in buildings of any type construction, insulating materials shall have a flame spread index of not more than 25 and a smoke developed index of not more than 450. (2) Cellulose loose-fill insulation that is not spray applied and that complies with the requirements of 8.16.6 shall be required to meet only a smoke developed index of not more than 450.	Similar
	Chapter 8	Interior Finishes						
General	801.1.1	Interior finishes.	These provisions shall limit the allowable flame spread and smoke development based on location and occupancy classification. Exceptions: 1. Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls or ceilings. 2. Exposed portions of structural members complying with the requirements for buildings of Type IV construction in Section 602.4 shall not be subject to interior finish requirements.	Interior Finish	10.1.2	General.	Materials applied, in total thickness of less than in. (0.90 mm), directly to the surface of walls and ceilings shall be exempt from tests simulating actual installation if they meet the requirements of Class A interior wall or ceiling finish when tested in accordance with 10.3.1 using inorganic reinforced cement board as the substrate material.	Similar
General	801.2.2	Foam plastics.	Foam plastics shall not be used as interior finish or trim except as provided in Section 2603.7 or 2604.	Specific Materials.	10.4.3	Cellular or Foamed Plastic.	Cellular or foamed plastic materials shall not be used as interior wall and ceiling finish, unless specifically permitted by 10.4.3.1 or 10.4.3.2.	Similar
Wall and Ceiling Finishes	803.1	General.	Interior wall and ceiling finishes shall be classified in accordance with ASTM E 84. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indexes. Class A: Flame spread 0-25; smoke-developed 0-450. Class B: Flame spread 26-75; smoke-developed 0-450. Class C: Flame spread 76-200; smoke-developed 0-450. Exception: Materials, other than textiles, tested in accordance with Section 803.2	Interior Finish	10.3.2	Interior Wall or Ceiling Finish Testing and Classification.	Products required to be tested in accordance with NFPA 255 or ASTM E 84 shall be grouped in the classes described in 10.3.2(A) through 10.3.2(C) in accordance with their flame spread and smoke development, except as indicated in 10.3.3.	Similar
Wall and Ceiling Finishes	803.2	Interior wall or ceiling finishes other than textiles.	Interior wall or ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Finishes tested in accordance with NFPA 286 shall comply with Section 803.2.1.	Interior Finish	10.3.6	Interior Wall or Ceiling Finish Testing and Classification.	Products tested in accordance with NFPA 265, Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings in Full Height Panels and Walls, shall comply with the criteria of 10.3.6.1 or 10.3.6.2. Products tested in accordance with NFPA 286 shall comply with the criteria of 10.3.6.3.	Similar
Wall and Ceiling Finishes	803.2.1	Acceptance criteria.	During the 40 kW exposure, the interior finish shall comply with Item 1. During the 160 kW exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Item 3. 1. During the 40kW exposure, flames shall not spread to the ceiling. 2. During the 160 kW exposure, the interior finish shall comply with the following: 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling. 2.2. Flashover, as defined in NFPA 286, shall not occur. 3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m2.	Interior Finish	10.3.6.3	Interior Wall or Ceiling Finish Testing and Classification.	The following conditions shall be met when using the test protocol of NFPA 286: (1) Flame shall not spread to the ceiling during the 40-kW exposure. (2) During the 160-kW exposure, the following criteria shall be met: (a) Flame shall not spread to the outer extremities of the sample on the 8-ft x 12-ft (2.4-m x 3.7-m) wall. (b) Flashover shall not occur. (3) For new installations, the total smoke released throughout the test shall not exceed 1000 m2.	Similar
Wall and Ceiling	803.3	Stability.	Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner	Not addressed	Not addressed	Not addressed		Different-NFPA does not

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Finishes			that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.					address.
Wall and Ceiling Finishes	803.4.1	Direct attachment and furred construction.	Where walls and ceilings are required by any provision in this code to be of fire-resistance-rated or noncombustible construction, the interior finish material shall be applied directly against such construction or to furring strips not exceeding 1.75 inches (44 mm) applied directly against such surfaces. The intervening spaces between such furring strips shall be filled with inorganic or Class A material or shall be fireblocked at a maximum of 8 feet (2438 mm) in any direction in accordance with Section 717.	Not addressed	Not addressed	Not addressed		Different-NFPA does not address.
Wall and Ceiling Finishes	803.4.2	Set-out construction.	Where walls and ceilings are required to be of fire-resistance-rated or noncombustible construction and walls are set out or ceilings are dropped distances greater than specified in Section 803.4.1, Class A finish materials shall be used except where interior finish materials are protected on both sides by an automatic sprinkler system or attached to noncombustible backing or furring strips installed as specified in Section 803.4.1. The hangers and assembly members of such dropped ceilings that are below the main ceiling line shall be of noncombustible materials, except that in Type III and V construction, fire-retardant-treated wood shall be permitted. The construction of each set-out wall shall be of fire-resistance-rated construction as required elsewhere in this code.	Not addressed	Not addressed	Not addressed		Different-NFPA does not address.
Wall and Ceiling Finishes	803.5	Interior finish requirements based on group.	Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.5 for the group and location designated. Interior wall and ceiling finish materials, other than textiles, tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.2.1, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 is required.	Interior Finish	10.3.1.2	Interior Wall or Ceiling Finish Testing and Classification.	Interior wall and ceiling finish tested in accordance with NFPA 286, Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth, and meeting the conditions of 10.3.6.3 shall be permitted to be used where a Class A classification in accordance with NFPA 255 or ASTM E 84 is required.	Similar
Wall and Ceiling Finishes	Table 803.5	Interior Wall and Ceiling Finish Requirements by Occupancy (Table)	Use-Group A-2 (Non-Sprinklered): Vertical exits and exit passageways, Class A; Exit access corridors and other exitways, Class A (Lobby areas may be Class B); Rooms and enclosed spaces, Class B (Occupant Load ≤ 300, Class C permitted).	Protection.	16.3.3	Interior Finish.	Interior finish shall be in accordance with Chapter 10. 16.3.3.2 Interior wall and ceiling finish materials complying with Chapter 10 shall be Class A or Class B in all corridors and lobbies and shall be Class A in enclosed stairways. 16.3.3.3 Interior wall and ceiling finish materials complying with Chapter 10 shall be Class A or Class B in general assembly areas having occupant loads of more than 300 and shall be Class A, Class B, or Class C in assembly areas having occupant loads of 300 or fewer.	Similar
Wall and Ceiling Finishes	803.8	Insulation.	Thermal and acoustical insulation shall comply with Section 719	Insulating Materials.	8.16	Flame Spread.	Insulating materials, including vapor barriers, breather papers, facings, and similar coverings, and every layer of multilayer reflective foil insulations, shall comply with the requirements of Section 8.16.	Similar
Wall and	803.9	Acoustical	The quality, design, fabrication and erection of metal	NFPA 5000	No specific			Similar. While h

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
Ceiling Finishes		ceiling systems.	suspension systems for acoustical tile and lay-in panel ceilings in buildings or structures shall conform with generally accepted engineering practice, the provisions of this chapter and other applicable requirements of this code				section on acoustical ceiling systems	not specifically addressed by NFPA 5000, general provisions within the code impose similar requirements.
Wall and Ceiling Finishes	803.9.1	Materials and installation.	Acoustical materials complying with the interior finish requirements of Section 803 shall be installed in accordance with the manufacturer's recommendations and applicable provisions for applying interior finish.	Not addressed	10.3.1	Interior Wall; Ceiling	Interior wall or ceiling finish that is required elsewhere in this Code to be Class A, Class B, or Class C shall be classified based on test results from NFP 255, <i>Standard Method of Test of Surface Burning Characteristics of Building Materials</i> , or ASTM E 84, <i>Standard Test Method of Surface Burning Characteristics of Building Materials</i> , except as indicated in 10.3.1.1 or 10.3.1.2	Similar
Decorations and Trim	805.1	General.	In occupancies of Groups A, E, I, R-1 and dormitories in Group R-2, curtains, draperies, hangings and other decorative materials suspended from walls or ceilings shall be flame resistant in accordance with Section 805.2 and NFPA 701 or noncombustible. In Groups I-1 and I-2, combustible decorations shall be flame retardant unless the decorations, such as photographs and paintings, are of such limited quantities that a hazard of fire development or spread is not present. In Group I-3, combustible decorations are prohibited.	Not addressed	Not addressed	Not addressed	See chapter 10.5	Similar. NFPA addresses in NFPA 1 as it is considered an operational matter.
Decorations and Trim	805.1.1	Non-combustible materials.	The permissible amount of noncombustible decorative material shall not be limited.	Not addressed	Not addressed	Not addressed		Similar. NFPA addresses in NFPA 1 as it is considered an operational matter.
Decorations and Trim	805.1.2	Flame-resistant materials.	The permissible amount of flame-resistant decorative materials shall not exceed 10 percent of the aggregate area of walls and ceilings. Exception: In auditoriums of Group A, the permissible amount of flame-resistant decorative material shall not exceed 50 percent of the aggregate area of walls and ceilings where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and the material is installed in accordance with Section 803.3.	Not addressed	Not addressed	Not addressed		Similar. NFPA addresses in NFPA 1 as it is considered an operational matter.
Decorations and Trim	805.2	Acceptance criteria and reports.	Where required to be flame resistant, decorative materials shall be tested by an approved agency and pass Test 1 or 2, as appropriate, described in NFPA 701 or such materials shall be noncombustible. Reports of test results shall be prepared in accordance with NFPA 701 and furnished to the building official upon request.	Refer to NFPA 1				Similar. NFPA addresses in NFPA 1 as it is considered an operational matter.
Decorations and Trim	805.3	Foam plastic.	Plastic used as trim in any occupancy shall comply with Section 2604.2.	Plastics.	48.5.1	Specific Requirements — Interior Finish and	All plastic materials installed as interior finish or trim shall comply with requirements of Chapter 10.	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
						Trim.		
	Chapter 9	Fire Protection Systems						
General	901.6	Supervisory service.	Where required, fire protection systems shall be monitored by an approved supervising station in accordance with NFPA 72.	Detection, Alarm, and Communications Systems.	55.3.2.1	Supervisory Signals	Where electrically supervised automatic sprinkler systems are required by another section of this Code, supervisory attachments shall be installed and monitored for integrity in accordance with NFPA 72, and a distinctive supervisory signal shall be provided to indicate a condition that would impair the satisfactory operation of the sprinkler system.	Similar
General	901.6.1	Automatic sprinkler systems.	Automatic sprinkler systems shall be monitored by an approved supervising station. A supervising station is not required for automatic sprinkler systems protecting one- and two- family dwellings or limited area systems serving fewer than 20 sprinklers.	Detection, Alarm, and Communications Systems.	55.3.2.1	Supervisory Signals	Where electrically supervised automatic sprinkler systems are required by another section of this Code, supervisory attachments shall be installed and monitored for integrity in accordance with NFPA 72, and a distinctive supervisory signal shall be provided to indicate a condition that would impair the satisfactory operation of the sprinkler system.	Similar
Automatic Sprinkler Systems	903.2.1	Group A.	An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section. For Group A-1, A-2, A-3 and A-4 occupancies, the automatic sprinkler system shall be provided throughout the floor area where the Group A-1, A-2, A-3 or A-4 occupancy is located, and in all floors between the Group A occupancy and the level of exit discharge. For Group A-5 occupancies, the automatic sprinkler system shall be provided in the spaces indicated in Section 903.2.1.5.	Extinguishment Requirements.	16.3.5.1.1	Sprinkler Systems.	Buildings containing assembly occupancies with occupant loads greater than 300 shall be protected by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3 as follows: (1) Throughout the story containing the assembly occupancy (2) Throughout all stories below the story containing the assembly occupancy (3) In the case of an assembly occupancy located below the level of exit discharge, throughout all stories intervening between that story and the level of exit discharge, including the level of exit discharge	Different-NFPA requirements based on occupancy load only.
Automatic Sprinkler Systems	903.2.1.2	Group A-2.	An automatic sprinkler system shall be provided for Group A-2 occupancies where one of the following conditions exists: 1. The fire area exceeds 5,000 square feet. 2. The fire area has an occupant load of 300 or more. 3. The fire area is located on a floor other than the level of exit discharge. 3. The fire area is located on a floor other than the level of exit discharge. Exception: Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.	Extinguishment Requirements.	16.3.5.1.1	Sprinkler Systems.	Buildings containing assembly occupancies with occupant loads greater than 300 shall be protected by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3 as follows: (1) Throughout the story containing the assembly occupancy (2) Throughout all stories below the story containing the assembly occupancy (3) In the case of an assembly occupancy located below the level of exit discharge, throughout all stories intervening between that story and the level of exit discharge, including the level of exit discharge	Different-NFPA requirements based on occupancy load only.
Automatic Sprinkler Systems	903.2.1.2	Group A-2.	An automatic sprinkler system shall be provided for Group A-2 occupancies where one of the following conditions exists: 1. The fire area exceeds 5,000 square feet. 2. The fire area has an occupant load of 300 or more. 3. The fire area is located on a floor other than the level of exit discharge. 3. The fire area is located on a floor other than the level of exit discharge. Exception: Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.	Extinguishment Requirements.	16.1.6	Occupant Load	The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space or shall be determined as the maximum probable population of the space under consideration, whichever is greater. In areas not in excess of 10,000 ft <sup>2</sup> (930 m <sup>2</sup> ), the occupant load shall not exceed one person in 5 ft <sup>2</sup> (0.46 m <sup>2</sup> ); in areas in excess of 10,000 ft <sup>2</sup> (930 m <sup>2</sup> ), the occupant load shall not exceed one person in 7 ft <sup>2</sup> (0.65 m <sup>2</sup> ).	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
Automatic Sprinkler Systems	903.3.1	Standards.	Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.	Automatic Sprinklers.	55.3.1.1	General.	Each automatic sprinkler system required by another section of this Code shall be in accordance with one of the following: (1) NFPA 13, Standard for the Installation of Sprinkler Systems(2) NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height(3) NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	Similar
Automatic Sprinkler Systems	903.3.1.1	NFPA 13 sprinkler systems.	Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Section 903.3.1.1.1.	Automatic Sprinklers.	55.3.1.1	General.	Each automatic sprinkler system required by another section of this Code shall be in accordance with one of the following: (1) NFPA 13, Standard for the Installation of Sprinkler Systems (2) NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height (3) NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	Similar
Automatic Sprinkler Systems	903.3.4	Actuation.	Automatic sprinkler systems shall be automatically actuated unless specifically provided for in this code.	Automatic Sprinklers.	55.3.1.1	General.	Each automatic sprinkler system required by another section of this Code shall be in accordance with one of the following: (1) NFPA 13, Standard for the Installation of Sprinkler Systems (2) NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height (3) NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	Similar-Automatic response required by NFPA 13.
Automatic Sprinkler Systems	903.3.5	Water supplies.	Water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with the requirements of this section and the International Plumbing Code.	Automatic Sprinklers.	55.3.1.1	General.	Each automatic sprinkler system required by another section of this Code shall be in accordance with one of the following: (1) NFPA 13, Standard for the Installation of Sprinkler Systems (2) NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height (3) NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	Similar
Automatic Sprinkler Systems	903.3.7	Fire department connections.	The location of fire department connections shall be approved by the building official.	Automatic Sprinklers.	55.3.1.1	General.	Each automatic sprinkler system required by another section of this Code shall be in accordance with one of the following: (1) NFPA 13, Standard for the Installation of Sprinkler Systems(2) NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height(3) NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	Similar-FD connection placement specified by NFPA 13.
Automatic Sprinkler Systems	903.4	Sprinkler system monitoring and	All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures and water-flow	Electrical Supervision.	55.3.2.1.1	Supervisory Signals.	Monitoring shall include, but shall not be limited to, monitoring of control valves, fire pump power supplies and running conditions, water tank levels	Similar

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		alarms.	switches on all sprinkler systems shall be electrically supervised. Exceptions: 1. Automatic sprinkler systems protecting one- and two-family dwellings. 2. Limited area systems serving fewer than 20 sprinklers. 3. Automatic sprinkler systems installed in accordance with NFPA13R where a common supply main is used to supply both domestic water and the automatic sprinkler systems and a separate shutoff valve for the automatic sprinkler system is not provided. 4. Jockey pump control valves that are sealed or locked in the open position. 5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position. 6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position. 7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.				and temperatures, tank pressure, and air pressure on dry-pipe valves.	
Alternative Automatic Fire-Extinguishing Systems	904.1	General.	Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of this section and the applicable referenced standards.	Other Automatic Extinguishing Equipment.	55.5.1	Alternative Systems.	In any occupancy where the character of the fuel for fire is such that extinguishment or control of the fire is accomplished by a type of automatic extinguishing system in lieu of an automatic sprinkler system, such extinguishing system shall be installed in accordance with the applicable standard referenced in Table 55.5.1.	Similar
Alternative Automatic Fire-Extinguishing Systems	904.2	Where required.	Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the building official. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions permitted by other requirements of this code. 3. Size, placement and position of nozzles or discharge orifices. 4. Location and identification of audible and visible alarm devices. 5. Identification of devices with proper designations. 6. Operating instructions.	Other Automatic Extinguishing Equipment.	55.5.1	Alternative Systems.	In any occupancy where the character of the fuel for fire is such that extinguishment or control of the fire is accomplished by a type of automatic extinguishing system in lieu of an automatic sprinkler system, such extinguishing system shall be installed in accordance with the applicable standard referenced in Table 55.5.1.	Similar
Portable Fire Extinguishers	906.1	General.	Portable fire extinguishers shall be provided in occupancies and locations as required by the International Fire Code.	Extinguishment Requirements.	16.3.5.3	Portable Fire Extinguishers.	Portable fire extinguishers shall be installed in assembly occupancies in accordance with Section 55.6.	Similar
Fire Alarm and Detection Systems	907.1	General.	This section covers the application, installation, performance and maintenance of fire alarm systems and their components.	Fire Detection, Alarm, and Communication Systems.	55.2.1.2	General.	A fire alarm system shall be installed in accordance with the applicable requirements of Chapter 52 and NFPA 72®, National Fire Alarm Code®.	Similar
Fire Alarm and Detection Systems	907.2	Where required.	An approved manual, automatic or manual and automatic fire alarm system shall be provided in accordance with Sections 907.2.1 through 907.2.23. Where automatic sprinkler protection, installed in accordance with Section 903.3.1.1 or 903.3.1.2, is provided and connected to the building fire alarm system, automatic heat detection required by this section shall not be required. An approved automatic fire detection system shall be installed in accordance with the provisions of this code and NFPA72. Devices, combinations of devices, appliances and equipment shall comply with Section 907.1.2. The automatic fire	Detection, Alarm Systems	16.3.4.1	General.	Assembly occupancies with occupant loads greater than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with Section 55.2 and 16.3.4.2 through 16.3.4.3.4.	Similar

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			detectors shall be smoke detectors, except that an approved alternative type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.					
Fire Alarm and Detection Systems	907.2.1	Group A.	A manual fire alarm system shall be installed in accordance with NFPA 72 in Group A occupancies having an occupant load of 300 or more. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy. Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system and the notification appliances will activate upon sprinkler water flow.	Detection, Alarm, and Communications Systems.	16.3.4.1	General.	Assembly occupancies with occupant loads greater than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with Section 55.2 and 16.3.4.2 through 16.3.4.3.4. Exception No. 1: Assembly occupancies that are a part of a mixed occupancy shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met. Exception No. 2: Voice communication or public address systems complying with 16.3.4.3.3 shall not be required to comply with Section 55.2.	Similar
	Chapter 10	Means of Egress						
Administration	1001.1	General.	Buildings or portions thereof shall be provided with a means of egress system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof.	Means of Egress Requirements.	16.2.1	General.	All means of egress shall be in accordance with Chapter 11 and this chapter.	Similar, but slightly different values or approaches used..
Administration	1001.2	Minimum requirements.	It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the capacity of the means of egress to less than required by this code. a means of escape and access for rescue in the event of an emergency. EXIT. That portion of a means of egress system which is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives as required to provide a protected path of egress travel between the exit access and the exit discharge. Exits include exterior exit doors at ground level, exit enclosures, exit passageways, exterior exit stairs, exterior exit ramps and horizontal exits.	Means of Egress.	15.6.2.1.2	Number of Means of Egress.	Every story utilized for human occupancy on which there is a rehabilitation work area shall be provided with the minimum number of means of egress required by NFPA 101, Life Safety Code, for existing occupancies.	Similar
Administration	1001.3	Maintenance.	Means of egress shall be maintained in accordance with the <i>International Fire Code</i> .	Means of Egress.	11.1.10.1	Means of Egress Reliability	Maintenance. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.	Different-NFPA contains all means of egress references.
General Means of Egress	1003.2	Ceiling height.	The means of egress shall have a ceiling height of not less than 7 feet (2134 mm). Exceptions: 1. Sloped ceilings in accordance with Section 1208.2. 2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with Section 1208.2. 3. Allowable projections in accordance with Section 1003.3. 4. Stair headroom in accordance with Section 1009.2. 5. Door height in accordance with Section 1008.1.1.	General.	11.1.5	Headroom.	Means of egress shall be designed and maintained to provide headroom as provided in other sections of this Code and shall be not less than 7 ft 6 in. (2.3 m) with projections from the ceiling not less than 6 ft 8 in. (2 m) nominal height above the finished floor. The minimum ceiling height shall be maintained for not less than two-thirds of the ceiling area of any room or space, provided the ceiling height of the remaining ceiling area is not less than 6 ft 8 in. (2 m). Headroom on stairs shall be not less than 6 ft 8 in. (2	Different-NFPA uses 7'-6"

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
							m) and shall be measured vertically above a plane parallel to and tangent with the most forward projection of the stair tread.	
General Means of Egress	1003.3	Protruding objects.	Protruding objects shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.	Width.	11.2.1.2.2	Clear Width.	Clear width shall be measured as follows: (1) Clear width shall be measured at the narrowest point in the door opening. (2) For swinging doors, clear width shall be measured between the face of the door and the stop. (3) Clear width shall be measured without subtracting for the obstructions permitted by 11.2.1.2.3.2 and 11.2.1.2.3.3.	Different-NFPA simply uses clear width.
General Means of Egress	1003.3.1	Headroom.	Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 provided a minimum headroom of 80 inches (2032 mm) shall be provided for any walking surface, including walks, corridors, aisles and passageways. Not more than 50 percent of the ceiling area of a means of egress shall be reduced in height by protruding objects. Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm). A barrier shall be provided where the vertical clearance is less than 80 inches (2032 mm) high. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the floor.	General.	11.1.5	Headroom.	Means of egress shall be designed and maintained to provide headroom as provided in other sections of this Code and shall be not less than 7 ft 6 in. (2.3 m) with projections from the ceiling not less than 6 ft 8 in. (2 m) nominal height above the finished floor. The minimum ceiling height shall be maintained for not less than two-thirds of the ceiling area of any room or space, provided the ceiling height of the remaining ceiling area is not less than 6 ft 8 in. (2 m). Headroom on stairs shall be not less than 6 ft 8 in. (2 m) and shall be measured vertically above a plane parallel to and tangent with the most forward projection of the stair tread.	Different-NFPA uses 7'- 6"
General Means of Egress	1003.3.2	Freestanding objects.	A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 12 inches (305 mm) where the lowest point of the leading edge is more than 27 inches (686mm) and less than 80 inches (2032 mm) above the walking surface. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (685 mm) maximum or 80 inches (2030 mm) minimum above the finish floor or ground. Exception: This requirement shall not apply to sloping portions of handrails serving stairs and ramps.	Means of Egress Reliability.	11.1.10.2.1	Furnishings and Decorations in Means of Egress.	No furnishings, decorations, or other objects shall obstruct the access to, egress from, or visibility of exits.	Similar
General Means of Egress	1003.3.3	Horizontal projections.	Structural elements, fixtures or furnishings shall not project horizontally from either side more than 4 inches (102 mm) over any walking surface between the heights of 27 inches (686 mm) and 80 inches (2032 mm) above the walking surface. Exception: Handrails serving stairs and ramps are permitted to protrude 4.5 inches (114 mm) from the wall.	Protruding Objects.	12.5		Protruding objects on circulation paths shall comply with ICC/ANSI A117.1, Section 307.	Similar
General Means of Egress	1003.4	Floor surface.	Walking surfaces of the means of egress shall have a slip-resistant surface and be securely attached.	Walking Surfaces in the Means of Egress.	11.1.6.4	Slip Resistance.	Walking surfaces shall be slip resistant under foreseeable conditions. The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.	Similar
General Means of Egress	1003.5	Elevation change.	Where changes in elevation of less than 12 inches (305 mm) exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal (5-percent slope), ramps complying with Section 1010 shall be	General.	11.1.7	Changes in Level in Means of Egress.	Changes in level in means of egress shall be achieved by an approved means of egress where the elevation difference exceeds 21 in. (53.3 cm). 11.1.7.2* Changes in level in means of egress not in excess of 21 in. (53.3 cm) shall be achieved either by	Similar

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			used. Where the difference in elevation is 6 inches (152 mm) or less, the ramp shall be equipped with either handrails or floor finish materials that contrast with adjacent floor finish materials. Exceptions: 1. A single step with a maximum riser height of 7 inches (178 mm) is permitted for buildings with occupancies in Groups F, H, R-2 and R-3 as applicable in Section 101.2, and Groups S and U at exterior doors not required to be accessible by Chapter 11. 2. A stair with a single riser or with two risers and a tread is permitted at locations not required to be accessible by Chapter 11, provided that the risers and treads comply with Section 1009.3, the minimum depth of the tread is 13 inches (330 mm) and at least one handrail complying with Section 1009.11 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the stair. 3. An aisle serving seating that has a difference in elevation less than 12 inches (305 mm) is permitted at locations not required to be accessible by Chapter 11, provided that the risers and treads comply with Section 1024.11 and the aisle is provided with a handrail complying with Section 1024.13. Any change in elevation in a corridor serving nonambulatory persons in a Group I-2 occupancy shall be by means of a ramp or sloped walkway.				a ramp complying with the requirements of 11.2.5 or by a stair complying with the requirements of 11.2.2. 11.1.7.2.1 Where a ramp is used to meet the requirement of 11.1.7.2, the presence and location of ramped portions of walkways shall be readily apparent. 11.1.7.2.2 Where a stair is used to meet the requirement of 11.1.7.2, the tread depth of such stair shall be not less than 13 in. (33 cm). 11.1.7.2.3 Tread depth in industrial equipment access areas as provided in 29.2.5.3 shall be permitted. 11.1.7.2.4. The presence and location of each step shall be readily apparent.	
General Means of Egress	1003.6	Means of egress continuity.	The path of egress travel along a means of egress shall not be interrupted by any building element other than a means of egress component as specified in this chapter. Obstructions shall not be placed in the required width of a means of egress except projections permitted by this chapter. The required capacity of a means of egress system shall not be diminished along the path of egress travel.	Arrangement of Means of Egress.	11.5.4.3	Accessible Means of Egress.	Each required accessible means of egress shall be continuous from each accessible occupied area to a public way or area of refuge in accordance with 11.2.12.2.2.	Similar
Occupant Load	1004.1	Design occupant load.	In determining means of egress requirements, the number of occupants for whom means of egress facilities shall be provided shall be established by the largest number computed in accordance with Sections 1004.1.1 through 1004.1.3.	Occupant Load.	11.3.1.1	Sufficient Capacity for Occupant Load.	The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.	Similar
Occupant Load	1004.1.1	Actual number.	The actual number of occupants for whom each occupied space, floor or building is designed.	Occupant Load.	11.3.1.2	Occupant Load Factor.	The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use, as specified in Table 11.3.1.2 and Figure 11.3.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified, and by applying the net area figure to the net area of the use for which the net area figure is specified.	Similar
Occupant Load	1004.1.2	Number by Table 1004.1.2.	The number of occupants computed at the rate of one occupant per unit of area as prescribed in Table 1004.1.2.	Occupant Load.	11.3.1.2	Occupant Load Factor.	The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use, as	Similar

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							specified in Table 11.3.1.2 and Figure 11.3.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified, and by applying the net area figure to the net area of the use for which the net area figure is specified.	
Occupant Load	1004.3	Posting of occupant load.	Every room or space that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.	Not addressed	Not addressed	Not addressed	Posting of occupant load required on certificate of occupancy.	Similar. NFPA addresses in NFPA 1 as it is considered an operational matter.
Occupant Load	1004.7	Fixed seating.	For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein. For areas having fixed seating without dividing arms, the occupant load shall not be less than the number of seats based on one person for each 18 inches (457 mm) of seating length. The occupant load of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.	Occupant Load.	11.3.1.2	Occupant Load Factor.	The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use, as specified in Table 11.3.1.2 and Figure 11.3.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified, and by applying the net area figure to the net area of the use for which the net area figure is specified.	Similar
Egress Width	1005.1	Minimum required egress width.	The means of egress width shall not be less than required by this section. The total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by the factors in Table 1005.1 and not less than specified elsewhere in this code. Multiple means of egress shall be sized such that the loss of any one means of egress shall not reduce the available capacity to less than 50 percent of the required capacity. The maximum capacity required from any story of a building shall be maintained to the termination of the means of egress. Exception: Means of egress complying with Section 1024.	Arrangement of Means of Egress.	11.5.1.3	General.	Where more than one exit is required from a building or portion thereof, such exits shall be remotely located from each other and shall be arranged and constructed to minimize the possibility that more than one has the potential to be blocked by any one fire or other emergency condition. See section 11.3.4.2	Different-NFPA does not state 50% rule.
Egress Width	1005.2	Door encroachment.	Doors opening into the path of egress travel shall not reduce the required width to less than one-half during the course of the swing. When fully open, the door shall not project more than 7 inches (178 mm) into the required width. Exception: The restrictions on a door swing shall not apply to doors within individual dwelling units and sleeping units of Group R-2 and dwelling units of Group R-3.	Doors.	11.2.1.4.3	Swing and Force to Open.	During its swing, any door in a means of egress shall leave not less than one-half of the required width of an aisle, corridor, passageway, or landing unobstructed and shall not project more than 7 in. (17.8 cm) into the required width of an aisle, corridor, passageway, or landing when fully open. Doors shall not open directly onto a stair without a landing. The landing shall have a width not less than the width of the door. (See 11.2.1.3.)	Similar
Means of Egress Illumination	1006.1	Illumination required.	The means of egress, including the exit discharge, shall be illuminated at all times the building space served by the means of egress is occupied. Exceptions: 1. Occupancies in Group U. 2. Aisle access ways in Group A. 3. Dwelling units and	Illumination of Means of Egress.	11.8.1.1	General.	Illumination of means of egress shall be provided in accordance with Section 11.8 for every building and structure where required in Chapter 16 through Chapter 30. For the purposes of this requirement, exit access shall include only designated stairs,	Similar

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			sleeping units in Groups R-1, R-2 and R-3. 4. Sleeping units of Group I occupancies.				aisles, corridors, ramps, escalators, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, corridors, ramps, escalators, walkways, and exit passageways leading to a public way.	
Means of Egress Illumination	1006.2	Illumination level.	The means of egress illumination level shall not be less than 1 foot-candle (11 lux) at the floor level. Exception: For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the floor level is permitted to be reduced during performances to not less than 0.2 foot-candle (2.15 lux) provided that the required illumination is automatically restored upon activation of a premise's fire alarm system where such system is provided.	Illumination of Means of Egress.	11.8.1.3	General.	The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 11.8.1.1 shall be illuminated to values of at least 1 ft-candle (10 lux) measured at the floor. Exception No. 1: In assembly occupancies, the illumination of the floors of exit access shall be at least 0.2 ft-candle (2 lux) during performances or projections involving directed light. Exception No. 2: The requirement of 11.8.1.3 shall not apply where operations or processes require low lighting levels.	Similar
Means of Egress Illumination	1006.3	Illumination emergency power.	The power supply for means of egress illumination shall normally be provided by the premise's electrical supply. In the event of power supply failure, an emergency electrical system shall automatically illuminate the following areas: 1. Exit access corridors, passageways and aisles in rooms and spaces, which require two or more means of egress. 2. Exit access corridors and exit stairways located in buildings required to have two or more exits. 3. Exterior egress components at other than the level of exit discharge until exit discharge is accomplished for buildings required to have two or more exits. 4. Interior exit discharge elements, as permitted in Section 1023.1, in buildings required to have two or more exits. 5. The portion of the exterior exit discharge immediately adjacent to exit discharge doorways in buildings required to have two or more exits. The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702.	Illumination of Means of Egress.	11.8.2.1	Sources of Illumination.	Illumination of means of egress shall be from a source considered reliable by the authority having jurisdiction. See section 11.9.	Similar
Means of Egress Illumination	1006.4	Performance of system.	Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 1 foot-candle (11 lux) and a minimum at any point of 0.1 foot-candle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 foot-candle (6 lux) average and a minimum at any point of 0.06 foot-candle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.	Emergency Lighting.	11.9.2.1	Performance of System.	Emergency illumination shall be provided for not less than 1½ hours in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 ft-candle (10 lux) and, at any point, not less than 0.1 ft-candle (1 lux), measured along the path of egress at floor level. Illumination levels shall be permitted to decline to not less than an average of 0.6 ft-candle (6 lux) and, at any point, not less than 0.06 ft-candle (0.6 lux) at the end of the required 1½ hours. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.	Similar

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Doors, Gates and Turnstiles	1008.1	Doors.	Means of egress doors shall meet the requirements of this section. Doors serving a means of egress system shall meet the requirements of this section and Section 1017.2. Doors provided for egress purposes in numbers greater than required by this code shall meet the requirements of this section. Means of egress doors shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.	Means of Egress Components.	11.2.1.1.2	Doors.	Every door and every principal entrance that is required to serve as an exit shall be designed and constructed so that the way of egress travel is obvious and direct. Windows that, because of their physical configuration or design and the materials used in their construction, have the potential to be mistaken for doors shall be made inaccessible to the occupants by barriers or railings.	Similar
Doors, Gates and Turnstiles	1008.1.1	Size of doors.	The minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of not less than 32 inches. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Where this section requires a minimum clear width of 32 inches and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches. The maximum width of a swinging door leaf shall be 48 inches nominal... The height of doors shall not be less than 80 inches. Exceptions: ... 3. Door openings to storage closets less than 10 square feet in area shall not be limited by the minimum width ...	Means of Egress Components.	11.2.1.2.4	Minimum Door Width.	Door openings in means of egress shall be not less than 32 in. (81 cm) in clear width unless one of the following conditions exists: (1) Where a pair of doors is provided, not less than one of the doors shall provide not less than a 32-in. (81-cm) clear width opening. (2) Exit access doors serving a room not exceeding 70 ft <sup>2</sup> (6.5 m <sup>2</sup> ) and not required to be accessible to persons with severe mobility impairments shall be not less than 24 in. (61 cm) in door leaf width. (3) Doors serving a building or portion thereof not required to be accessible to persons with severe mobility impairments shall be permitted to be 28 in. (71 cm) in door leaf width.	Similar
Doors, Gates and Turnstiles	1008.1.1.1	Projections into clear width.	There shall not be projections into the required clear width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).	Width.	11.2.1.2.3.3	Measurement.	Projections exceeding 80 in. (2030 mm) above the floor shall not be considered reductions in width.	Similar
Doors, Gates and Turnstiles	1008.1.2	Door swing.	Egress doors shall be side-hinged swinging. Exceptions: 1. Private garages, office areas, factory and storage areas with an occupant load of 10 or less... 4. In other than Group H occupancies, revolving doors complying with Section 1008.1.3.1. 5. In other than Group H occupancies, horizontal sliding doors complying with Section 1008.1.3.3 are permitted in a means of egress. 6. Power-operated doors in accordance with Section 1008.1.3.1... The opening force for interior side-swinging doors without closers shall not exceed a 5-pound force. For other side swinging, sliding and folding doors, the door latch shall release when subjected to a 15-pound force. The door shall be set in motion when subjected to a 30-pound force. The door shall swing to a full-open position when subjected to a 15-pound force. Forces shall be applied to the latch side.	Doors.	11.2.1.4.1	Swing and Force to Open.	Any door in a means of egress shall be of the side-hinged or pivoted-swinging type. The door shall be designed and installed so that it is capable of swinging from any position to the full required width of the opening in which it is installed.	Similar
Doors, Gates and Turnstiles	1008.1.4	Floor elevation.	There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted	Floor Level	11.2.1.3	Landings.	The elevation of the floor surfaces on both sides of a door shall not vary by more than ½ in. (1.3 cm). The elevation shall be maintained on both sides of the doorway for a distance not less than the width of the	Similar

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			to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope). Exceptions: ... 2. Exterior doors as provided for in Section 1003.5, Exception 1, and Section 1017.2, which are not on an accessible route... 4. Variations in elevation due to differences in finish materials, but not more than 0.5 inch (12.7 mm)...				widest leaf. Thresholds at doorways shall not exceed ½ in. (1.3 cm) in height. Raised thresholds and floor level changes in excess of ¼ in. (0.64 cm) at doorways shall be beveled with a slope not steeper than 1 in 2.	
Doors, Gates and Turnstiles	1008.1.5	Landings at doors.	Landings shall have a width not less than the width of the stairway or the door, whichever is the greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). When a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than one-half its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm). Exception: Landing length in the direction of travel in Group R-3 as applicable in Section 101.2 and Group U and within individual units of Group R-2 as applicable in Section 101.2, need not exceed 36 inches (914 mm).	Doors.	11.2.1.4.3	Swing and Force to Open.	During its swing, any door in a means of egress shall leave not less than one-half of the required width of an aisle, corridor, passageway, or landing unobstructed and shall not project more than 7 in. (17.8 cm) into the required width of an aisle, corridor, passageway, or landing when fully open. Doors shall not open directly onto a stair without a landing. The landing shall have a width not less than the width of the door. (See 11.2.1.3.)	Similar
Doors, Gates and Turnstiles	1008.1.6	Thresholds.	Thresholds at doorways shall not exceed 0.75 inch (19.1 mm) in height for sliding doors serving dwelling units or 0.5 inch (12.7 mm) for other doors. Raised thresholds and floor level changes greater than 0.25 inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-percent slope). Exception: The threshold height shall be limited to 7 3/4 inches (197 mm) where the occupancy is Group R-2 or R-3 as applicable in Section 101.2, the door is an exterior door that is not a component of the required means of egress and the doorway is not on an accessible route.	Doors.	11.2.1.3	Floor Level.	The elevation of the floor surfaces on both sides of a door shall not vary by more than ½ in. (1.3 cm). The elevation shall be maintained on both sides of the doorway for a distance not less than the width of the widest leaf. Thresholds at doorways shall not exceed ½ in. (1.3 cm) in height. Raised thresholds and floor level changes in excess of ¼ in. (0.64 cm) at doorways shall be beveled with a slope not steeper than 1 in 2.	Similar
Doors, Gates and Turnstiles	1008.1.7	Door arrangement.	Space between two doors in series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in series shall swing either in the same direction or away from the space between doors.	Doors.	11.2.1.4.1	Swing and Force to Open.	Any door in a means of egress shall be of the side-hinged or pivoted-swinging type. The door shall be designed and installed so that it is capable of swinging from any position to the full required width of the opening in which it is installed.	Different-NFPA: 48" not cited.
Doors, Gates and Turnstiles	1008.1.8	Door operations.	Except as specifically permitted by this section egress doors shall be readily operable from the egress side without the use of a key or special knowledge or effort.	Doors.	11.2.1.5.1	Locks, Latches, and Alarm Devices.	Doors shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the inside of the building. Exception No. 1: The requirement of 11.2.1.5.1 shall not apply where otherwise provided in Chapter 19, Chapter 20, and Chapter 21. Exception No. 2: Exterior doors shall be permitted to have key-operated locks from the egress side, provided that the following criteria are met: (1) Use of this exception shall be permitted in Chapter 16 through Chapter 31 for the specific occupancy. (2) On or adjacent to the door, a readily visible, durable sign with letters not less than 1 in. (2.5 cm) high on a contrasting background shall be provided and shall read as follows: THIS DOOR TO	Similar

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							REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED. (3) The locking device shall be a type that is readily distinguishable as locked.(4) A key shall be immediately available to any occupant inside the building when it is locked.	
Doors, Gates and Turnstiles	1008.1.8.3	Locks and latches.	Locks and latches shall be permitted to prevent operation of doors where any of the following exists: 1. Places of detention or restraint. 2. In buildings in occupancy Group A having an occupant load of 300 or less, Groups B, F, M and S, and in churches, the main exterior door or doors are permitted to be equipped with key-operated locking devices from the egress side provided: 2.1 The locking device is readily distinguishable as locked, 2.2 A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED...2.3 The use of the key-operated locking device is revocable by the building official for due cause...	Doors.	11.2.1.5.1	Locks, Latches, and Alarm Devices.	Doors shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the inside of the building. Exception No. 1: The requirement of 11.2.1.5.1 shall not apply where otherwise provided in Chapter 19, Chapter 20, and Chapter 21. Exception No. 2: Exterior doors shall be permitted to have key-operated locks from the egress side, provided that the following criteria are met: (1) Use of this exception shall be permitted in Chapter 16 through Chapter 31 for the specific occupancy. (2) On or adjacent to the door, a readily visible, durable sign with letters not less than 1 in. (2.5 cm) high on a contrasting background shall be provided and shall read as follows: THIS DOOR TO REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED. (3) The locking device shall be a type that is readily distinguishable as locked. (4) A key shall be immediately available to any occupant inside the building when it is locked.	Similar
Doors, Gates and Turnstiles	1008.1.9	Panic and fire exit hardware.	Where panic and fire exit hardware is installed, it shall comply with the following: 1. The actuating portion of the releasing device shall extend at least one-half of the door leaf width. 2. A maximum unlatching force of 15 pounds (67 N). Each door in a means of egress from an occupancy of Group A or E having an occupant load of 100 or more and any occupancy of Group H-1, H-2, H-3 or H-5 shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware. If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend more than one-half the width of the door measured from the latch side.	Doors.	11.2.1.7.1	Panic Hardware and Fire Exit Hardware.	Where a door is required to be equipped with panic hardware or fire exit hardware, such hardware shall meet the following criteria: (1) It shall consist of a cross bar or push pad, the actuating portion of which extends across not less than one-half of the width of the door leaf and not less than 34 in. (86 cm), but not more than 48 in. (122 cm), above the floor.(2) It shall be constructed so that a horizontal force not to exceed 15 lbs (66 N) actuates the cross bar or push pad and latches.	Similar
Stairways and Handrails	1009.1	Stairway width.	The width of stairways shall be determined as specified in Section 1005.1, but such width shall not be less than 44 inches (1118 mm). See Section 1007.3 for accessible means of egress stairways. Exceptions: 1. Stairways serving an occupant load of 50 or less shall have a width of not less than 36 inches (914 mm). 2. Spiral stairways as provided for in Section 1009.9. 3. Aisle stairs complying with Section 1024. 4. Where a stairway lift is installed on stairways serving occupancies in Group R-3, or within dwelling units in occupancies in Group R-2, both as applicable in Section 101.2, a clear passage width not less than 20	Stairs.	11.2.2.2.1	General.	Stairs used as a component in the means of egress shall conform to the general requirements of Section 11.1 and to the special requirements of 11.2.2. Exception: The requirement of 11.2.2.1 shall not apply to aisle stairs as provided in Chapter 16.	Similar

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			inches (508 mm) shall be provided. If the seat and platform can be folded when not in use, the distance shall be measured from the folded position.					
Stairways and Handrails	1009.3.2	Profile.	The radius of curvature at the leading edge of the tread shall be not greater than 0.5 inch (12.7 mm). Beveling of nosings shall not exceed 0.5 inch (12.7 mm). Risers shall be solid and vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 degrees (0.52 rad) from the vertical. The leading edge (nosings) of treads shall project not more than 1.25 inches (32 mm) beyond the tread below and all projections of the leading edges shall be of uniform size, including the leading edge of the floor at the top of a flight. Exceptions: 1. Solid risers are not required for stairways that are not required to comply with Section 1007.3, provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm). 2. Solid risers are not required for occupancies in Group I-3.	Stair Details.	11.2.2.3.3	Tread and Landing Surfaces.	Stair treads and landings shall be solid, without perforations, and free of projections or lips that could trip stair users. If not vertical, risers shall be permitted to slope under the tread at an angle not to exceed 30 degrees from vertical, but the permitted projection of the nosing shall not exceed 1½ in. (3.8 cm).	Similar
Stairways and Handrails	1009.4	Stairway landings.	There shall be a floor or landing at the top and bottom of each stairway. The width of landings shall not be less than the width of stairways they serve. Every landing shall have a minimum dimension measured in the direction of travel equal to the width of the stairway. Such dimension need not exceed 48 inches (1219 mm) where the stairway has a straight run. Exceptions: 1. Aisle stairs complying with Section 1024. 2. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than 7 inches (178 mm) into a landing.	Stair Details.	11.2.2.3.2	Landings.	Stairs shall have landings at door openings. Stairs and intermediate landings shall continue with no decrease in width along the direction of egress travel. In new buildings, every landing shall have a dimension measured in the direction of travel that is not less than the width of the stair.	Similar
Stairways and Handrails	1009.5	Stairway construction.	All stairways shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.	Stair Details.	11.2.2.3.1.2	Construction.	All components of a stairway, including platforms and landings, shall be constructed of materials consistent with the types permitted for floor construction, based on the type of construction of the building, except that wood handrails shall be permitted for all types of construction. All walking surfaces of a stairway shall be capable of supporting the loads specified in Chapter 35.	Similar
Stairways and Handrails	1009.5.1	Stairway walking surface.	The walking surface of treads and landings of a stairway shall not be sloped steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Stairway treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached. Exception: In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided a sphere with a diameter of 1 1/8 inches (29 mm) cannot pass through the opening.	Stair Details.	11.2.2.3.4	Tread Slope.	Tread slope shall not exceed ¼ in./ft (2 cm/m) (a slope of 1 in 48).	Similar
Stairways and Handrails	1009.11	Handrails.	Stairways shall have handrails on each side. Handrails shall be adequate in strength and attachment in accordance with Section 1607.7. Handrails for ramps,	Guards and Handrails.	11.2.2.4.1.1	Handrails.	Stairs and ramps shall have handrails on both sides unless otherwise permitted in 11.2.2.4.1.6.	Similar

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			where required by Section 1010.8, shall comply with this section. Exceptions: 1. Aisle stairs complying with Section 1024 provided with a center handrail need not have additional handrails. 2. Stairways within dwelling units, spiral stairways and aisle stairs serving seating only on one side are permitted to have a handrail on one side only. 3. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails. 4. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require handrails. 5. Changes in room elevations of only one riser within dwelling units and sleeping units in Group R-2 and R-3 occupancies do not require handrails.					
Stairways and Handrails	1009.11.1	Height.	Handrail height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm).	Guards and Handrails.	11.2.2.4.4	Handrail Details.	Handrails on stairs and ramps shall have a consistent height of not less than 34 in. (86 cm) and not more than 38 in. (96 cm) above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the stair tread or the ramp walking surface.	Similar
Stairways and Handrails	1009.11.2	Intermediate handrails.	Intermediate handrails are required so that all portions of the stairway width required for egress capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.	Guards and Handrails.	11.2.2.4.1.2	Handrails.	In addition, handrails shall be provided within 30 in. (76 cm) of all portions of the required egress width of new stairs.	Similar
Stairways and Handrails	1009.11.3	Handrail graspability.	Handrails with a circular cross section shall have an outside diameter of at least 1.25 inches (32 mm) and not greater than 2 inches (51 mm) or shall provide equivalent graspability. If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6.25 inches (160 mm) with a maximum cross-section dimension of 2.25 inches (57 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).	Guards and Handrails.	11.2.2.4.4	Handrail Details.	Handrails on stairs and ramps shall have a consistent height of not less than 34 in. (86 cm) and not more than 38 in. (96 cm) above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the stair tread or the ramp walking surface.	Similar
Stairways and Handrails	1009.11.4	Continuity.	Handrail-gripping surfaces shall be continuous, without interruption by newel posts or other obstructions. Exceptions: 1. Handrails within dwelling units are permitted to be interrupted by a newel post at a stair landing. 2. Within a dwelling unit, the use of a volute, turnout or starting easing is allowed on the lowest tread. 3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within 1.5 inches (38 mm) of the bottom of the handrail shall not be considered to be obstructions and provided further that for each 0.5 inch (13 mm) of additional handrail perimeter dimension above 4 inches (102 mm), the vertical clearance dimension of 1.5 inches (38 mm) shall be permitted to be reduced by 0.125 inch (3 mm).	Guards and Handrails.	11.2.2.4.4	Handrail Details.	Handrails on stairs and ramps shall have a consistent height of not less than 34 in. (86 cm) and not more than 38 in. (96 cm) above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the stair tread or the ramp walking surface.	Similar
Stairways and Handrails	1009.11.5	Handrail extensions.	Handrails shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent stair flight. Where handrails are not	Guards and Handrails.	11.2.2.4.4	Handrail Details.	Handrails on stairs and ramps shall have a consistent height of not less than 34 in. (86 cm) and not more than 38 in. (96 cm) above the surface of the	Similar

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			continuous between flights, the handrails shall extend horizontally at least 12 inches (305mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. Exceptions: 1. Handrails within a dwelling unit that is not required to be accessible need extend only from the top riser to the bottom riser. 2. Aisle handrails in Group A occupancies in accordance with Section 1024.13.				stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the stair tread or the ramp walking surface.	
Stairways and Handrails	1009.11.6	Clearance.	Clear space between a handrail and a wall or other surface shall be a minimum of 1.5 inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.		11.2.2.4.4	Handrail Details.	Handrails on stairs and ramps shall have a consistent height of not less than 34 in. (86 cm) and not more than 38 in. (96 cm) above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the stair tread or the ramp walking surface.	Similar- NFPA requires 2-1/4 inches and IBC requires 1-1/2 inches"
Ramps	1010.1	Scope.	The provisions of this section shall apply to ramps used as a component of a means of egress. Exceptions: 1. Other than ramps that are part of the accessible routes providing access in accordance with Sections 1108.2.2 through 1108.2.4.1, ramped aisles within assembly rooms or spaces shall conform with the provisions in Section 1024.11. 2. Curb ramps shall comply with ICC A117.1. 3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with Sections 1010.3 through 1010.9 when they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.	Ramps.	11.2.5.1	General.	Every ramp used as a component in a means of egress shall conform to the general requirements of Section 11.1 and to the requirements of 11.2.5.	Similar
Ramps	1010.2	Slope.	Ramps used as part of a means of egress shall have a running slope not steeper than one unit vertical in 12 units horizontal (8-percent slope). The slope of other ramps shall not be steeper than one unit vertical in eight units horizontal (12.5-percent slope). Exception: Aisle ramp slope in occupancies of Group A shall comply with Section 1024.11.	Ramps.	11.2.5.2	Dimensional Criteria.	Dimensional criteria for ramps shall be in accordance with Table 11.2.5.2.	Similar
Ramps	1010.3	Cross slope.	The slope measured perpendicular to the direction of travel of a ramp shall not be steeper than one unit vertical in 48 units horizontal (2-percent slope).	Ramps.	11.2.5.2	Dimensional Criteria.	Dimensional criteria for ramps shall be in accordance with Table 11.2.5.2.	Similar
Ramps	1010.4	Vertical rise.	The rise for any ramp run shall be 30 inches (762 mm) maximum.	Ramps.	11.2.5.2	Dimensional Criteria.	Dimensional criteria for ramps shall be in accordance with Table 11.2.5.2.	Similar
Ramps	1010.5	Minimum dimensions.	The minimum dimensions of means of egress ramps shall comply with Sections 1010.5.1 through 1010.5.3.	Ramps.	11.2.5.2	Dimensional Criteria.	Dimensional criteria for ramps shall be in accordance with Table 11.2.5.2.	Similar
Ramps	1010.5.1	Width.	The minimum width of a means of egress ramp shall not be less than that required for corridors by Section 1016.2. The clear width of a ramp and the clear width between handrails, if provided, shall be 36 inches (914 mm) minimum.	Ramps.	11.2.5.2	Dimensional Criteria.	Dimensional criteria for ramps shall be in accordance with Table 11.2.5.2.	Similar
Ramps	1010.5.3	Restrictions.	Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).	Arrangement of Means of Egress.	1.2.5.3.2	Landings.	Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B): (A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in	Similar

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							the direction of travel. (B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.	
Ramps	1010.6	Landings.	Ramps shall have landings at the bottom and top of each ramp, points of turning, entrance, exits and at doors. Landings shall comply with Sections 1010.6.1 through 1010.6.5.	Ramp Details.	11.2.5.3.2	Landings.	Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B): (A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in the direction of travel. (B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.	Similar
Ramps	1010.6.1	Slope.	Landings shall have a slope not steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Changes in level are not permitted.	Ramp Details.	11.2.5.3.2	Landings.	Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B): (A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in the direction of travel. (B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.	Similar
Ramps	1010.6.2	Width.	The landing shall be at least as wide as the widest ramp run adjoining the landing.	Ramp Details.	11.2.5.3.2	Landings.	Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B): (A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in the direction of travel. (B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.	Similar
Ramps	1010.6.3	Length.	The landing length shall be 60 inches (1525 mm) minimum. Exception: Landings in nonaccessible Group R-2 and R-3 individual dwelling units, as applicable in Section 101.2, are permitted to be 36 inches (914mm) minimum.	Ramp Details.	11.2.5.3.2	Landings.	Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B): (A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in the direction of travel. (B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.	Similar

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Ramps	1010.6.4	Change in direction.	Where changes in direction of travel occur at landings provided between ramp runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.	Ramp Details.	11.2.5.3.2	Landings.	Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B): (A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in the direction of travel. (B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.	Similar
Ramps	1010.7	Ramp construction.	All ramps shall be built of materials consistent with the types permitted for the type of construction of the building; except that wood handrails shall be permitted for all types of construction. Ramps used as an exit shall conform to the applicable requirements of Sections 1019.1 and 1019.1.1 through 1019.1.3 for vertical exit enclosures.	Ramp Details.	11.2.5.3.1	Construction.	Ramp construction shall be as follows: (1) All ramps serving as required means of egress shall be of permanent fixed construction.(2) Each ramp in buildings required by this Code to be of Type I or Type II construction shall be noncombustible or limited-combustible throughout. The ramp floor and landings shall be solid and without perforations.	Similar
Ramps	1010.7.1	Ramp surface.	The surface of ramps shall be of slip-resistant materials that are securely attached.	Walking Surfaces in the Means of Egress.	11.1.6.4	Slip Resistance.	Walking surfaces shall be slip resistant under foreseeable conditions. The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.	Similar
Ramps	1010.8	Handrails.	Ramps with a rise greater than 6 inches (152 mm) shall have handrails on both sides complying with Section 1009.11.	Ramps.	11.2.5.4	Guards and Handrails.	Guards complying with 11.2.2.4 shall be provided for ramps. Handrails complying with 11.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 6 in. (15.2 cm). The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.	Similar
Ramps	1010.9	Edge protection.	Edge protection complying with Section 1010.9.1 or 1010.9.2 shall be provided on each side of ramp runs and at each side of ramp landings. Exceptions: 1. Edge protection is not required on ramps not required to have handrails, provided they have flared sides that comply with the ICC A117.1 curb ramp provisions. 2. Edge protection is not required on the sides of ramp landings serving an adjoining ramp run or stairway. 3. Edge protection is not required on the sides of ramp landings having a vertical drop-off of not more than 0.5 inch (13 mm) within 10 inches (254 mm) horizontally of the required landing area.	Ramp Details.	11.2.5.3.3	Drop-offs.	Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from traveling off the edge of the ramp. Curbs or barriers shall be not less than 2 in. (5.1 cm) in height.	Similar
Ramps	1010.9.1	Railings.	A rail shall be mounted below the handrail 17 inches to 19 inches (432 mm to 483 mm) above the ramp or landing surface.	Ramps.	11.2.5.4	Guards and Handrails.	Guards complying with 11.2.2.4 shall be provided for ramps. Handrails complying with 11.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 6 in. (15.2 cm). The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.	Similar
Ramps	1010.9.2	Curb or barrier.	A curb or barrier shall be provided that prevents the passage of a 4-inch-diameter (102 mm) sphere, where any portion of the sphere is within 4 inches (102 mm) of the floor or ground surface.	Ramps.	11.2.5.4	Guards and Handrails.	Guards complying with 11.2.2.4 shall be provided for ramps. Handrails complying with 11.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 6 in. (15.2 cm). The height of handrails	Similar

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							and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.	
Ramps	1010.1	Guards.	Guards shall be provided where required by Section 1012 and shall be constructed in accordance with Section 1012.	Ramps.	11.2.5.4	Guards and Handrails.	Guards complying with 11.2.2.4 shall be provided for ramps. Handrails complying with 11.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 6 in. (15.2 cm). The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.	Similar
Exit Signs	1011.1	Where required.	Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. Access to exits shall be marked by readily visible exit signs in cases where the exit or the path of egress travel is not immediately visible to the occupants. Exit sign placement shall be such that no point in an exit access corridor is more than 100 feet (30 480 mm) or the listed viewing distance for the sign, whichever is less, from the nearest visible exit sign. Exceptions: 1. Exit signs are not required in rooms or areas, which require only one exit or exit access. 2. Main exterior exit doors or gates which obviously and clearly are identifiable as exits need not have exit signs where approved by the building official...	Marking of Means of Egress.	11.10.1.1	Where Required.	Means of egress shall be marked in accordance with Section 11.10 where required in Chapter 16 through Chapter 30.	Similar
Exit Signs	1011.2	Illumination.	Exit signs shall be internally or externally illuminated. Exception: Tactile signs required by Section 1011.3 need not be provided with illumination.	Marking of Means of Egress.	11.10.1.3	Exit Door Tactile Signage	Tactile signage shall be located at each exit door requiring an exit sign, shall comply with ICC/ANSI A117.1 and shall read as follows: EXIT	Similar
Exit Signs	1011.3	Tactile exit signs.	A tactile sign stating EXIT and complying with ICC A117.1 shall be provided adjacent to each door to an egress stairway, an exit passageway and the exit discharge.	Signs.	12.16.4	Exit Doors.	Exit doors shall be identified by tactile signs in accordance with 11.10.1.3.	Similar
Exit Signs	1011.4	Internally illuminated exit signs.	Internally illuminated exit signs shall be listed and labeled and shall be installed in accordance with the manufacturer's instructions and Section 2702. Exit signs shall be illuminated at all times.	Internally Illuminated Signs.	11.10.7.1	Listing.	Internally illuminated signs shall be listed in accordance with UL 924, Standard for Emergency Lighting and Power Equipment.	Similar
Exit Signs	1011.5	Externally illuminated exit signs.	Externally illuminated exit signs shall comply with Sections 1011.5.1 through 1011.5.3.	Externally Illuminated Signs.	11.10.6.1	Size of Signs.	Externally illuminated signs required by 11.10.1 and 11.10.2 shall have the word "exit" or other appropriate wording in plainly legible letters not less than 6 in. (15.2 cm) high, with the principal strokes of letters not less than 3/4 in. (1.9 cm) wide. The word "exit" shall have letters of a width not less than 2 in. (5 cm), except the letter "l", and the minimum spacing between letters shall be not less than in. (1 cm). Signs larger than the minimum established in this requirement shall have letter widths, strokes, and spacing in proportion to their height. Exception No. 1: The requirement of 11.10.6.1 shall not apply to marking required by 11.10.1.3 and 11.10.1.5. Exception No. 2: Where approved by the authority having jurisdiction, pictograms shall be permitted.	Similar
Exit Signs	1011.5.2	Exit sign illumination.	The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 foot-	Illumination of Signs.	11.10.5.2	Continuous Illumination.	Every sign required to be illuminated by 11.10.6.3 and 11.10.7 shall be continuously illuminated as	Similar

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			candles (54 lux).				required under the provisions of Section 11.8. Exception: Illumination for signs shall be permitted to flash on and off upon activation of the fire alarm system.	
Exit Signs	1011.5.3	Power source.	Exit signs shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702. Exception: Approved exit sign illumination means that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.	Illumination of Signs.	11.10.5.2	Continuous Illumination.	Every sign required to be illuminated by 11.10.6.3 and 11.10.7 shall be continuously illuminated as required under the provisions of Section 11.8. Exception: Illumination for signs shall be permitted to flash on and off upon activation of the fire alarm system.	Similar
Exit Access	1013.1	General.	The exit access arrangement shall comply with Sections 1013 through 1016 and the applicable provisions of Sections 1003 through 1012.	Arrangement of Means of Egress.	11.5.1.1	General.	Exits shall be located and exit access shall be arranged so that exits are readily accessible at all times.	Similar
Exit Access	1013.2	Egress through intervening spaces.	Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas are accessory to the area served; are not a high-hazard occupancy and provide a discernible path of egress travel to an exit. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes. An exit access shall not pass through a room that can be locked to prevent egress. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms. Exceptions: 1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit...	Arrangement of Means of Egress.	11.5.1.8	General.	Exit access from rooms or spaces shall be permitted to be through adjoining or intervening rooms or areas, provided that such adjoining rooms are accessory to the area served. Foyers, lobbies, and reception rooms constructed as required for corridors shall not be construed as intervening rooms. Exit access shall be arranged so that it is not necessary to pass through any area identified under hazardous area protection in Chapter 16 through Chapter 30.	Similar
Exit Access	1013.3	Common path of egress travel.	In occupancies other than Groups H-1, H-2 and H-3, the common path of egress travel shall not exceed 75 feet (22 860 mm). In occupancies in Groups H-1, H-2, and H-3, the common path of egress travel shall not exceed 25 feet (7620 mm). Exceptions: 1. The length of a common path of egress travel in an occupancy in Groups B, F and S shall not be more than 100 feet (30 480 mm), provided that the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1. 2. Where a tenant space in an occupancy in Groups B, S and U has an occupant load of not more than 30, the length of a common path of egress travel shall not be more than 100 feet (30 480 mm). 3. The length of a common path of egress travel in occupancies in Group I-3 shall not be more than 100 feet (30 480 mm).	Arrangement of Means of Egress.	16.2.5.1.2	General.	Common paths of travel shall be permitted for the first 20 ft (6.1 m) from any point where serving any number of occupants and for the first 75 ft (23 m) from any point where serving not more than 50 occupants.	Similar
Exit and Exit Access Doorways	1014.1	Exit or exit access doorways	Two exits or exit access doorways from any space shall be provided where one of the following conditions exists: 1. The occupant load of the space exceeds the	Number of Means of Egress.	11.4.1.1	General.	The number of means of egress from any balcony, mezzanine, story, or portion thereof shall be not less than two.	Similar

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		required.	values in Table 1014.1. 2. The common path of egress travel exceeds the limitations of Section 1013.3. 3. Where required by Sections 1014.3, 1014.4 and 1014.5. Exception: Group I-2 occupancies shall comply with Section 1013.2.2.					
Exit and Exit Access Doorways	1014.2	Exit or exit access doorway arrangement.	Required exits shall be located in a manner that makes their availability obvious. Exits shall be unobstructed at all times. Exit and exit access doorways shall be arranged in accordance with Sections 1014.2.1 and 1014.2.2.	Arrangement of Means of Egress.	11.5.1.1	General.	Exits shall be located and exit access shall be arranged so that exits are readily accessible at all times.	Similar
Exit and Exit Access Doorways	1014.2.1	Two exits or exit access doorways.	Where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access doorways shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways. Interlocking or scissor stairs shall be counted as one exit stairway. Exceptions: 1. Where exit enclosures are provided as a portion of the required exit and are interconnected by a 1-hour fire-resistance-rated corridor conforming to the requirements of Section 1016, the required exit separation shall be measured along the shortest direct line of travel within the corridor. 2. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served.	Arrangement of Means of Egress.	11.5.1.4	General.	Where two exits or exit access doors are required, they shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits and are interconnected by not less than a 1-hour fire resistance-rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor. Exception: In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, the minimum separation distance between two exits or exit access doors measured in accordance with 11.5.1.4 shall be not less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.	Similar
Exit and Exit Access Doorways	1014.2.2	Three or more exits or exit access doorways.	Where access to three or more exits is required, at least two exit doors or exit access doorways shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the area served measured in a straight line between such exit doors or exit access doorways. Additional exits or exit access doorways shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available. Exception: Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance of at least two of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served.	Arrangement of Means of Egress.	11.5.1.5	General.	Where more than two exits or exit access doors are required, at least two of the required exits or exit access doors shall be arranged to comply with the minimum separation distance requirement. The other exits or exit access doors shall be located so that, if one becomes blocked, the others are available.	Similar
Exit and Exit Access Doorways	1014.6	Stage means of egress.	Where two means of egress are required, based on the stage size or occupant load, one means of egress shall be provided on each side of the stage.	Arrangement of Means of Egress.	11.5.1.4	General.	Where two exits or exit access doors are required, they shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits and are interconnected by not less than a 1-	Similar

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							hour fire resistance-rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor. Exception: In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, the minimum separation distance between two exits or exit access doors measured in accordance with 11.5.1.4 shall be not less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.	
Exit and Exit Access Doorways	1015.1	Travel distance limitations.	Exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story to the entrance to an exit along the natural and unobstructed path of egress travel, shall not exceed the distances given in Table 1015.1. Where the path of exit access includes unenclosed stairways or ramps within the exit access or includes unenclosed exit ramps or stairways as permitted in Section 1019.1, the distance of travel on such means of egress components shall also be included in the travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stairway. Exceptions: ... 3. Where an exit stair is permitted to be unenclosed in accordance with Exception 8 or 9 of Section 1019.1, the travel distance shall be measured from the most remote point within a building to an exit discharge.	Means of Egress Requirements.	16.2.6	Travel Distance to Exits.	Exits shall be arranged so that the total length of travel from any point to reach an exit does not exceed 200 ft (60 m) in any assembly occupancy. Exception No. 1: The travel distance shall not exceed 250 ft (75 m) in assembly occupancies protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3. Exception No. 2: The requirement of 16.2.6 shall not apply to smoke-protected assembly seating as permitted by 16.4.2.8 and its exception.	Similar
Exit and Exit Access Doorways	Table 1015.1	Exit access travel distance.	Occupancy A (without sprinkler system): 200 ft	Means of Egress Requirements.	16.2.6	Travel Distance to Exits.	Exits shall be arranged so that the total length of travel from any point to reach an exit does not exceed 200 ft (60 m) in any assembly occupancy. Exception No. 1: The travel distance shall not exceed 250 ft (75 m) in assembly occupancies protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3. Exception No. 2: The requirement of 16.2.6 shall not apply to smoke-protected assembly seating as permitted by 16.4.2.8 and its exception.	Similar
Exits	1017.1	General.	Exits shall comply with Sections 1017 through 1022 and the applicable requirements of Sections 1003 through 1012. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge.	Separation of Means of Egress.	11.1.3.2.2	Exits.	An exit enclosure shall provide a continuous protected path of travel to an exit discharge.	Similar
Exits	1017.2	Exterior exit doors.	Buildings or structures used for human occupancy shall have at least one exterior door that meets the requirements of Section 1008.1.1.	Means of Egress.	11.7.2	Discharge from Exits.	Not more than 50 percent of the required number of exits, and not more than 50 percent of the required egress capacity, shall be permitted to discharge through areas on the level of exit discharge, provided that the criteria of 11.7.2(A) through 11.7.2(C) are met. (A) Discharge shall lead to a free and unobstructed	Similar

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							<p>way to the exterior of the building, and such way is readily visible and identifiable from the point of discharge from the exit.</p> <p>(B) The level of discharge shall be protected throughout by an approved, automatic sprinkler system in accordance with Section 55.3, or the portion of the level of discharge used for discharge shall be protected by an approved, automatic sprinkler system in accordance with Section 55.3 and shall be separated from the nonsprinklered portion of the floor by a fire resistance rating meeting the requirements for the enclosure of exits. (See 11.1.3.2.1.)</p> <p>Exception: The requirement of 11.7.2(B) shall not apply where the discharge area is a vestibule or foyer meeting all of the following:</p> <p>(1) The depth from the exterior of the building shall be not more than 10 ft (3 m), and the length shall be not more than 30 ft (9.1 m).</p> <p>(2) The foyer shall be separated from the remainder of the level of discharge by construction providing protection not less than the equivalent of wired glass in steel frames.</p> <p>(3) The foyer shall serve only as means of egress and shall include an exit directly to the outside.</p>	
Exits	1017.2.1	Detailed requirements.	Exterior exit doors shall comply with the applicable requirements of Section 1008.1.	Means of Egress Components.	11.2.1.1.1	Doors.	A door assembly in a means of egress shall conform to the general requirements of Section 11.1 and to the special requirements of 11.2.1. Such an assembly shall be designated as a door.	Similar
Exits	1017.2.2	Arrangement.	Exterior exit doors shall lead directly to the exit discharge or the public way.	Means of Egress.	11.7.1	Discharge from Exits.	<p>Exits shall terminate directly at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with a safe access to a public way.</p> <p>Exception No. 1: The requirement of 11.7.1 shall not apply to interior exit discharge as otherwise provided in 11.7.2.</p> <p>Exception No. 2: The requirement of 11.7.1 shall not apply to rooftop exit discharge as otherwise provided in 11.7.6.</p> <p>Exception No. 3: Means of egress shall be permitted to terminate in an exterior area of refuge as provided in 21.2.7.1.</p>	Similar
Number of Exits and Continuity	1018.1	Minimum number of exits.	All rooms and spaces within each story shall be provided with and have access to the minimum number of approved independent exits as required by Table 1018.1 based on the occupant load, except as modified in Section 1014.1 or 1018.2. For the purposes of this chapter, occupied roofs shall be provided with exits as required for stories. The required number of exits from any story, basement or individual space shall be maintained until arrival at grade or the public way.	Means of Egress.	11.4.1.4	Number of Means of Egress.	The occupant load of each story considered individually shall be required to be used in computing the number of means of egress at each story, provided that the required number of means of egress is not decreased in the direction of egress travel.	Similar

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Exit Discharge	1023.1	General.	Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter a building. Exceptions: 1. A maximum of 50 percent of the number and capacity of the exit enclosures is permitted to egress through areas on the level of discharge provided all of the following are met... 2. A maximum of 50 percent of the number and capacity of the exit enclosures is permitted to egress through a vestibule provided all of the following are met: 2.1. The entire area of the vestibule is separated from areas below by construction conforming to the fire-resistance rating for the exit enclosure. 2.2. The depth from the exterior of the building is not greater than 10 feet and the length is not greater than 30 feet. 2.3. The area is separated from the remainder of the level of exit discharge by construction providing protection at least the equivalent of approved wired glass in steel frames. 2.4. The area is used only for means of egress and exits directly to the outside....	Means of Egress.	11.7.1	Discharge from Exits.	Exits shall terminate directly at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with a safe access to a public way. Exception No. 1: The requirement of 11.7.1 shall not apply to interior exit discharge as otherwise provided in 11.7.2. Exception No. 2: The requirement of 11.7.1 shall not apply to rooftop exit discharge as otherwise provided in 11.7.6. Exception No. 3: Means of egress shall be permitted to terminate in an exterior area of refuge as provided in 21.2.7.1.	Similar
Exit Discharge	1023.2	Exit discharge capacity.	The capacity of the exit discharge shall be not less than the required discharge capacity of the exits being served.	Capacity of Means of Egress.	11.3.1.1	Sufficient Capacity for Occupant Load.	The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.	Similar
Exit Discharge	1023.3	Exit discharge location.	Exterior balconies, stairways and ramps shall be located at least 10 feet (3048 mm) from adjacent lot lines and from other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 704 based on fire separation distance.	Capacity of Means of Egress.	11.3.1.1	Sufficient Capacity for Occupant Load.	The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.	Similar
Exit Discharge	1023.4	Exit discharge components.	Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.	Enclosure and Protection of Stairs.	11.7	Discharge from Exits	Exits shall terminate directly at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with a safe access to a public way.	Similar
Exit Discharge	1023.6	Access to a public way.	The exit discharge shall provide a direct and unobstructed access to a public way. Exception: Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met: 1. The area shall be of a size to accommodate 5 sq ft per person, 2. The area shall be located on the same property at least 50 ft away, 3. The area shall be permanently maintained and identified, and 4. The area shall be provided with a safe and unobstructed path of travel from the building.	Means of Egress.	11.7.1	Discharge from Exits.	Exits shall terminate directly at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with a safe access to a public way. Exception No. 1: The requirement of 11.7.1 shall not apply to interior exit discharge as otherwise provided in 11.7.2. Exception No. 2: The requirement of 11.7.1 shall not apply to rooftop exit discharge as otherwise provided in 11.7.6. Exception No. 3: Means of egress shall be permitted to terminate in an exterior area of refuge as provided in 21.2.7.1.	Similar
Assembly	1024.1	General.	Occupancies in Group A which contain seats, tables, displays, equipment or other material shall comply with this section.	Assembly Occupancies	16.1.1.1	General Requirements.	The requirements of this chapter shall apply to new buildings or portions thereof used as an assembly occupancy.	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
Assembly	1024.2	Assembly main exit.	Group A occupancies that have an occupant load of greater than 300 shall be provided with a main exit. The main exit shall be of sufficient width to accommodate not less than one-half of the occupant load, but such width shall not be less than the total required width of all means of egress leading to the exit. Where the building is classified as a Group A occupancy, the main exit shall front on at least one street or an unoccupied space of not less than 10 feet (3048 mm) in width that adjoins a street or public way. Exception: In assembly occupancies where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width.	Capacity of Means of Egress.	16.2.3.3	Main Entrance/Exit.	Every assembly occupancy shall be provided with a main entrance/exit. The main entrance/exit shall be of sufficient width to accommodate one-half of the total occupant load and shall be at the level of exit discharge or shall connect to a stairway or ramp leading to a street. Each level of an assembly occupancy shall have access to the main entrance/exit, and such access shall have sufficient capacity to accommodate 50 percent of the occupant load of such levels. Where the main entrance/exit from an assembly occupancy is through a lobby or foyer, the aggregate capacity of all exits from the lobby or foyer shall be permitted to provide the required capacity of the main entrance/exit, regardless of whether all such exits serve as entrances to the building... Exception No. 2: In assembly occupancies where there is no well-defined main entrance/exit, exits shall be permitted to be distributed around the perimeter of the building, provided that the total exit width furnishes a minimum of 100 percent of the width needed to accommodate the permitted occupant load.	Similar
Assembly	1024.3	Assembly other exits.	In addition to having access to a main exit, each level of an occupancy in Group A having an occupant load of greater than 300 shall be provided with additional exits that shall provide an egress capacity for at least one-half of the total occupant load served by that level and comply with Section 1014.2. Exception: In assembly occupancies where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width.	Capacity of Means of Egress.	16.2.3.3	Main Entrance/Exit.	Every assembly occupancy shall be provided with a main entrance/exit. The main entrance/exit shall be of sufficient width to accommodate one-half of the total occupant load and shall be at the level of exit discharge or shall connect to a stairway or ramp leading to a street. Each level of an assembly occupancy shall have access to the main entrance/exit, and such access shall have sufficient capacity to accommodate 50 percent of the occupant load of such levels. Where the main entrance/exit from an assembly occupancy is through a lobby or foyer, the aggregate capacity of all exits from the lobby or foyer shall be permitted to provide the required capacity of the main entrance/exit, regardless of whether all such exits serve as entrances to the building...Exception No. 2: In assembly occupancies where there is no well-defined main entrance/exit, exits shall be permitted to be distributed around the perimeter of the building, provided that the total exit width furnishes a minimum of 100 percent of the width needed to accommodate the permitted occupant load.	Similar
Assembly	1024.4	Foyers and lobbies.	In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available and are allowed to wait in a lobby or similar space, such use of lobby or similar space shall not encroach upon the required clear width of the means of egress. Such waiting areas shall be separated from the required means of egress by substantial permanent partitions or by fixed rigid railings not less than 42 inches (1067 mm) high. Such foyer, if not	Occupant Load.	16.1.6.1	Waiting Spaces.	In theaters and other assembly occupancies where persons are admitted to the building at times when seats are not available to them, or when the permitted occupant load has been reached based on 16.1.6 and persons are allowed to wait in a lobby or similar space until seats or space is available, such use of a lobby or similar space shall not encroach upon the required clear width of exits. Such waiting shall be restricted to areas other than the required	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.				means of egress. Exits shall be provided for such waiting spaces on the basis of one person for each 3 ft <sup>2</sup> (0.28 m <sup>2</sup> ) of waiting space area. Such exits shall be in addition to the exits specified for the main auditorium area and shall conform in construction and arrangement to the general rules for exits given in this chapter.	
Assembly	1024.5	Interior balcony and gallery means of egress.	For balconies or galleries having a seating capacity of over 50 located in Group A occupancies, at least two means of egress shall be provided, one from each side of every balcony or gallery, with at least one leading directly to an exit.	Means of Egress Requirements.	16.2.4.3	Number of Exits.	Balconies or mezzanines having an occupant load not greater than 50 shall be permitted to be served by a single means of egress, and such means of egress shall be permitted to lead to the floor below.	Similar
Assembly	1024.6	Width of means of egress for assembly.	The clear width of aisles and other means of egress shall comply with Section 1024.6.1 where smoke-protected seating is not provided and with Section 1024.6.2 or 1024.6.3 where smoke-protected seating is provided. The clear width shall be measured to walls, edges of seating and tread edges except for permitted projections.	Arrangement of Means of Egress.	16.2.5.4.4	General Requirements for Access and Egress Routes within Assembly Areas.	The width of aisle access ways and aisles shall provide sufficient egress capacity for the number of persons accommodated by the catchment area served by the aisle access way or aisle in accordance with 16.2.3.1 or, for smoke-protected assembly seating, in accordance with 16.4.2. Where aisle access ways or aisles converge to form a single path of egress travel, the required egress capacity of that path shall not be less than the combined required capacity of the converging aisle access ways and aisles.	Similar
Assembly	1024.6.1	Without smoke protection.	The clear width of the means of egress shall provide sufficient capacity in accordance with all of the following, as applicable: 1. At least 0.3 inch of width for each occupant served shall be provided on stairs having riser heights 7 inches or less and tread depths 11 inches or greater, measured horizontally between tread nosing. 2. At least 0.005 inch of additional stair width for each occupant shall be provided for each 0.10 inch of riser height above 7 inches. 3. Where egress requires stair descent, at least 0.075 inch of additional width for each occupant shall be provided on those portions of stair width having no handrail within a horizontal distance of 30 inches. 4. Ramped means of egress, where slopes are steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.22 inch of clear width for each occupant served. Level or ramped means of egress, where slopes are not steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.20 inch of clear width for each occupant served.	Capacity of Means of Egress.	16.2.3.1	General.	The capacity of means of egress shall be in accordance with Section 11.3 or, for means of egress serving theater-type seating or similar seating arranged in rows, in accordance with 16.2.3.2, or, for smoke-protected assembly seating, in accordance with 16.4.2.	Similar
Assembly	1024.7	Travel distance.	Exits and aisles shall be so located that the travel distance to an exit door shall not be greater than 200 feet (60 960 mm) measured along the line of travel in nonsprinklered buildings. Travel distance shall not be more than 250 feet (76 200 mm) in sprinklered buildings. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle access way without travel over or on the seats. Exceptions: 1. Smoke-protected assembly seating: The travel distance from each seat to the nearest	Means of Egress Requirements.	16.2.6	Travel Distance to Exits.	Exits shall be arranged so that the total length of travel from any point to reach an exit does not exceed 200 ft (60 m) in any assembly occupancy. Exception No. 1: The travel distance shall not exceed 250 ft (75 m) in assembly occupancies protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3. Exception No. 2: The requirement of 16.2.6 shall not apply to smoke-protected assembly seating as	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The travel distance from the entrance to the vomitory or concourse to a stair, ramp or walk on the exterior of the building shall not exceed 200 feet (60 960 mm). 2. Open-air seating: The travel distance from each seat to the building exterior shall not exceed 400 feet (122 m). The travel distance shall not be limited in facilities of Type I or II construction.				permitted by 16.4.2.8 and its exception.	
Assembly	1024.8	Common path of travel.	The common path of travel shall not exceed 30 feet (9144 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits. Exceptions: 1. For areas serving not more than 50 occupants, the common path of travel shall not exceed 75 feet (22 860 mm). 2. For smoke-protected assembly seating, the common path of travel shall not exceed 50 feet (15 240 mm).	Arrangement of Means of Egress.	16.2.5.5.4	Aisle Access ways Serving Seating Not at Tables.	Rows of seating served by an aisle or doorway at one end only shall have a path of travel not exceeding 30 ft (9.1 m) in length from any seat to an aisle. The 12-in. (30.10-cm) minimum clear width of aisle access way between such rows shall be increased by 0.6 in. (15 mm) for every seat over a total of seven. Exception: The requirements of 16.2.5.5.4 shall not apply to smoke-protected assembly seating as permitted by 16.4.2.5 and 16.4.2.6.	Similar
	Chapter 26	Plastic						
Definitions	2602.1	General.	2602.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein. FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (pcf) (320 kg/m <sup>3</sup> ).	Special Definitions.	48.2.1	Foam Plastic Insulation.	A cellular plastic used for thermal insulating or acoustical applications, having a density of 20 lb/ft <sup>3</sup> (320 kg/m <sup>3</sup> ) or less, containing open or closed cells, formed by a foaming agent.	Similar
Foam Plastic Insulation	2603.1	General.	The provisions of this section shall govern the requirements and uses of foam plastic insulation in buildings and structures.	Plastics.	48.1	Scope.	All plastic materials used in or on buildings or structures shall meet the requirements in this chapter.	Similar
Foam Plastic Insulation	2603.2	Labeling and identification.	Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.	General Criteria—Foam Plastic Insulation.	48.3.1.1	Product Identification.	A label of an approved agency shall appear on foam plastic insulation products, packages, or containers and components delivered to a job site.	Similar
Foam Plastic Insulation	2603.3	Surface-burning characteristics	Unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index. Exceptions.	General Criteria—Foam Plastic Insulation.	48.3.2.1	Surface-burning Characteristics.	Unless otherwise permitted by 48.3.2.3, foam plastic insulation or foam plastic cores of manufactured assemblies and components shall be tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials, at the maximum thickness intended for use and shall have a flame spread index of 75 or less and a smoke developed index of 450 or less.	Similar
Foam Plastic Insulation	2603.4	Thermal barrier.	Except as provided for in Sections 2603.4.1 and 2603.8, foam plastic shall be separated from the interior of a building by an approved thermal barrier of 0.5-inch (12.7mm) gypsum wallboard or equivalent thermal barrier material that will limit the average	General Criteria—Foam Plastic Insulation.	48.3.3.1	Thermal Barrier.	Foam plastic insulation and components shall be separated from the interior of a building and from plenums by an approved thermal barrier of 0.5-in. (12.7-mm) gypsum wallboard or equivalent material that will limit the average temperature rise of the	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			temperature rise of the unexposed surface to not more than 250°F (120°C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E 119. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on FM 4880, UL 1040, NFPA 286 (added - editor note) or UL 1715. Combustible concealed spaces shall comply with Section 717.				unexposed surface to not more than 250°F (139°C) after 15 minutes of fire exposure complying with the standard time-temperature curve of NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials.	
Foam Plastic Insulation	2603.4.1.4	Exterior walls-one-story buildings.	For one-story buildings, foam plastic having a flame spread index of 25 or less, and a smoke-developed index of not more than 450, shall be permitted without thermal barriers in or on exterior walls in a thickness not more than 4 inches (102 mm) where the foam plastic is covered by a thickness of not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm) and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.	General Criteria—Foam Plastic Insulation.	48.3.3.4	Thermal Barrier.	The requirements of 48.3.3.1 through 48.3.3.3 shall not apply where otherwise permitted by the following: (refer to section 48.3.3.4 for the complete list of 12 conditions)	Similar
Foam Plastic Insulation	2603.8	Special approval.	Foam plastic shall not be required to comply with the requirements of Sections 2603.4 through 2603.7, where specifically approved based on large-scale tests such as, but not limited to, FM 4880, UL 1040, NFPA 286 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall also conform to the flame spread requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use	Specific Application Requirements—Foam Plastic Insulation.	48.4.4.1	Alternate Testing and Approval.	The requirements of 48.3.3 through 48.4.3 shall be permitted to be replaced by special testing, and the approval of foam plastic shall be based on large-scale tests such as, but not limited to, the following: (1) UL 1715, Standard for Safety for Fire Test of Interior Finish Material (2) UL 1040, Standard for Fire Test of Insulated Wall Construction (3) FM 4880, Approval Standard for Class 1 Insulated Wall or Wall and Roof/Ceiling Panels; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems (4) NFPA 286, Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	Similar
Interior Finish and Trim	2604.1	General.	Plastic materials installed as interior finish or trim shall comply with Chapter 8. Foam plastics shall only be installed as interior finish where approved in accordance with the special provisions of Section 2603.8. Foam plastics that are used as interior finish shall also meet the flame spread index requirements for interior finish in accordance with Chapter 8. Foam plastics installed as interior trim shall comply with Section 2604.2.	Plastics.	48.5.1	Specific Requirements — Interior Finish and Trim.	All plastic materials installed as interior finish or trim shall comply with requirements of Chapter 10.	Similar
Interior Finish and Trim	2604.2	Interior trim.	Foam plastic used as interior trim shall comply with Sections 2604.2.1 through 2604.2.4.	Plastics.	48.5.1	Specific Requirements — Interior Finish and Trim.	All plastic materials installed as interior finish or trim shall comply with requirements of Chapter 10.	Similar
Interior Finish and Trim	2604.2.1	Interior trim.	The minimum density of the interior trim shall be 20 pcf (320 kg/m3).	Plastics.	48.5.3	Specific Requirements — Interior Finish and Trim.	Foam plastics used, as interior trim shall meet all of the following requirements: (1) They shall have a minimum density of 20 lb/ft3 (320 kg/m3). (2) They shall have a maximum thickness of 0.5 in.	Similar

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
							(12.7 mm) and a maximum width of 8 in. (204 mm). (3) They shall constitute no more than 10 percent of the total wall and ceiling area of any room or space. (4) They shall have a flame spread index of 75 or less when tested per NFPA 255.	
Interior Finish and Trim	2604.2.2	Thickness.	The maximum thickness of the interior trim shall be 0.5 inch (12.7 mm) and the maximum width shall be 8 inches (204 mm).	Plastics.	48.5.3	Specific Requirements — Interior Finish and Trim.	Foam plastics used as interior trim shall meet all of the following requirements: (1) They shall have a minimum density of 20 lb/ft3 (320 kg/m3). (2) They shall have a maximum thickness of 0.5 in. (12.7 mm) and a maximum width of 8 in. (204 mm). (3) They shall constitute no more than 10 percent of the total wall and ceiling area of any room or space. (4) They shall have a flame spread index of 75 or less when tested per NFPA 255.	Similar
Interior Finish and Trim	2604.2.3	Area limitation.	The interior trim shall not constitute more than 10 percent of the aggregate wall and ceiling area of any room or space.	Plastics.	48.5.3	Specific Requirements — Interior Finish and Trim.	Foam plastics used as interior trim shall meet all of the following requirements: (1) They shall have a minimum density of 20 lb/ft3 (320 kg/m3).(2) They shall have a maximum thickness of 0.5 in. (12.7 mm) and a maximum width of 8 in. (204 mm).(3) They shall constitute no more than 10 percent of the total wall and ceiling area of any room or space.(4) They shall have a flame spread index of 75 or less when tested per NFPA 255.	Similar
Interior Finish and Trim	2604.2.4	Flame spread.	The flame spread index shall not exceed 75 where tested in accordance with ASTM E 84. The smoke-developed index shall not be limited.	Plastics.	48.5.3	Specific Requirements — Interior Finish and Trim.	Foam plastics used as interior trim shall meet all of the following requirements: (1) They shall have a minimum density of 20 lb/ft3 (320 kg/m3). (2) They shall have a maximum thickness of 0.5 in. (12.7 mm) and a maximum width of 8 in. (204 mm). (3) They shall constitute no more than 10 percent of the total wall and ceiling area of any room or space. (4) They shall have a flame-spread index of 75 or less when tested per NFPA 255.	Similar
	Chapter 34	Existing Structures						
Existing Structures - General	3401.1	Scope	The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing structures. Exception: Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300-02.	Administration.	15.1.1.1	Purpose and Intent.	The purpose of this chapter is to encourage the continued use or reuse of legally existing buildings and structures. The intent of this chapter is to permit repairs, renovations, modifications, reconstructions, additions, and changes of use that maintain or improve the health, safety, and welfare of occupants in existing buildings, without requiring full compliance with the other sections of this Code, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, except for proportional additional work as specified in this chapter.	Similar
Existing Structures - General	3401.2	Maintenance.	Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or safeguards, which are required by this code, shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of	Maintenance of Buildings and Property	1.7.5.2.2	Existing Installations.	Buildings in existence at the time of the adoption of this Code shall be permitted to have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of this Code, provided such continued use is not dangerous to life.	

IBC Section Title	IBC Section Number	IBC Number Title	Text	NFPA 5000 Section Title	NFPA 5000 Section Number	NFPA 5000 Number Title	Text	Analysis
			buildings and structures. To determine compliance with this subsection, the building official shall have the authority to require a building or structure to be re-inspected. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures.					
Existing Structures - General	3401.3	Compliance with other codes.	Alterations, repairs, additions and changes of occupancy to existing structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy in the International Fire Code, International Fuel Gas Code, International Plumbing Code, International Property Maintenance Code, International Private Sewage Disposal Code, International Mechanical Code, International Residential Code and ICC Electrical Code.	Compliance.	15.1.2.4	Compliance with Other Codes.	Buildings, elements, components, or systems in compliance with other sections of this Code, or the current edition of the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, shall not be required to comply with any more restrictive requirement of this chapter.	Similar
Existing Structures - Additions, Alterations or Repairs	3403.1	Existing buildings or structures.	Additions or alterations to any building or structure shall conform to the requirements of the code for new construction. Additions or alterations shall not be made to an existing building or structure, which will cause the existing building, or structure to be in violation of any provisions of this code. An existing building plus additions shall comply with the height and area provisions of for a new structure. Exception: For buildings and structures in flood hazard areas established in Section 1612.3, any additions, alterations or repairs that constitute substantial improvement of the existing structure, as defined in Section 1612.2, shall comply with the flood design requirements for new construction and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.	Additions.	15.8.1.1	General Requirements.	An addition to a building or structure shall comply with other sections of this Code, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, and accessibility code without requiring the existing building or structure to comply with any requirements of those codes or of this Code.	Similar
Existing Structures - Additions, Alterations or Repairs	3403.3	Nonstructural.	Nonstructural. Nonstructural alterations or repairs to an existing building or structure are permitted to be made of the same materials of which the building or structure is constructed, provided that they do not adversely affect any structural member or the fire-resistance rating of any part of the building or structure.	Compliance.	15.1.2.4	Compliance with Other Codes.	Buildings, elements, components, or systems in compliance with other sections of this Code, or the current edition of the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, shall not be required to comply with any more restrictive requirement of this chapter.	Similar
Existing Buildings - Compliance Alternatives	3410.1	Compliance.	The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings while permitting repair, alteration, addition and change of occupancy without requiring full compliance with Chapters 2 through 33, or Sections 3401.3, and 3403 through 3407, except where compliance with other provisions of this code is specifically required in this section.	Administration.	15.1.1.1	Purpose and Intent.	The purpose of this chapter is to encourage the continued use or reuse of legally existing buildings and structures. The intent of this chapter is to permit repairs, renovations, modifications, reconstructions, additions, and changes of use that maintain or improve the health, safety, and welfare of occupants in existing buildings, without requiring full compliance with the other sections of this Code, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, except for proportional additional work as specified in this chapter.	Different-NFPA 5000 requires compliance with NFPA 101 Existing Building provisions.

## K.2 Code Comparison of IFC [3] and NFPA 1 [4]

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
	Chapter 1	Administration						
General	101.01	Title	These regulations shall be known as the Fire Code of [NAME OF JURISDICTION], hereinafter referred to as "this code."	Title	1.01.02	Title.	The title of this Code shall be NFPA 1, Uniform Fire Code™, of the National Fire Protection Association.	Similar
General	101.02	Scope.	This code establishes regulations affecting or relating to structures, processes, premises and safeguards regarding: 1. The hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices; 2. Conditions hazardous to life, property or public welfare in the occupancy of structures or premises; 3. Fire hazards in the structure or on the premises from occupancy or operation; 4. Matters related to the construction, extension, repair, alteration or removal of fire suppression or alarm systems.	Scope	1.01.01		The scope includes, but is not limited to, the following: (1) Inspection of permanent and temporary buildings... (2) Investigation of fires ... (3) Review of design and construction plans, drawings, and specifications ... (4) Fire and life safety education ... (5) Existing occupancies and conditions, the design and construction of new buildings, remodeling of existing buildings, and additions to existing buildings (6) Design, alteration, modification, construction, maintenance, and testing of fire protection systems and equipment (7) ... (8) ... (9) Regulation and control of special events including, but not limited to, assemblage of people, exhibits, trade shows, amusement parks, haunted houses, outdoor events, and other similar special temporary and permanent occupancies (10) Interior finish, decorations, furnishings, and other combustibles that contribute to fire spread, fire load, and smoke production (11) ... (12) ... (13) ... (14) ...	Similar
General	101.03	Intent	The purpose of this code is to establish the minimum requirements consistent with nationally recognized good practice for providing a reasonable level of life safety and property protection from the hazards of fire, explosion or dangerous conditions in new and existing buildings, structures and premises and to provide safety to fire fighters and emergency responders during emergency operations.	Purpose	1.02	Purpose	The purpose of this Code is to prescribe minimum requirements necessary to establish a reasonable level of fire and life safety and property protection from the hazards created by fire, explosion, and dangerous conditions.	Similar
Applicability	102.01	Construction and design provisions.	The construction and design provisions of this code shall apply to: 1. Structures, facilities and conditions arising after the adoption of this code. 2. Existing structures, facilities and conditions not legally in existence at the time of adoption of this code. 3. Existing structures, facilities and conditions when identified in specific sections of this code. 4. Existing structures, facilities and conditions that, in the opinion of the code official, constitute a distinct hazard to life or property.	Application	1.03.01	Application	This Code shall apply to both new and existing conditions.	Similar, NFPA 1 applies to all existing buildings. IFC only applies if conditions 1 through 4 exist.
				Occupancy	10.03.02		Existing buildings that are occupied at the time of adoption of this Code shall remain in use provided that the following conditions are met: (1) The occupancy classification remains the same. (2) No condition deemed hazardous to life or property exists that would constitute an imminent danger	Similar
Applicability	102.04	Application of building code	The design and construction of new structures shall comply with the <i>International Building Code</i> . Repairs, alterations and additions to existing structures shall comply with the <i>International Existing Building Code</i> .	Building Code	10.01.03	Building Code	Where a building code has been adopted, all new construction shall comply with this Code and with the building code adopted by the AHJ.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
General Authority and Responsibility	104.02	Applications and permits	The fire code official is authorized to receive applications, review construction documents and issue permits for construction regulated by this code, issue permits for operations regulated by this code, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.	Permits and Approvals	1.12.01		The AHJ shall be authorized to establish and issue permits, certificates, notices, approvals, or orders pertaining to fire control and fire hazards pursuant to Section 1.12.	Similar
General Authority and Responsibility	104.03	Right of Entry	Whenever it is necessary to make an inspection to enforce the provisions of this code, or whenever the fire code official has reasonable cause to believe that there exists in a building or upon any premises any conditions or violations of this code which make the building or premises unsafe, dangerous or hazardous, the fire code official shall have the authority to enter the building or premises at all reasonable times to inspect or to perform the duties imposed upon the fire code official by this code. If such building or premises is occupied, the fire code official shall present credentials to the occupant and request entry. If such building or premises is unoccupied, the fire code official shall first make a reasonable effort to locate the owner or other person having charge or control of the building or premises and request entry. If entry is refused, the fire code official has recourse to every remedy provided by law to secure entry.	Inspection	1.07.05.03		To the full extent permitted by law, any AHJ engaged in fire prevention and inspection work shall be authorized at all reasonable times to enter and examine any building, structure, marine vessel, vehicle, or premises for the purpose of making fire safety inspections.	Similar
General Authority and Responsibility	104.03.01	Warrant	When the fire code official has first obtained a proper inspection warrant or other remedy provided by law to secure entry, an owner or occupant or person having charge, care or control of the building or premises shall not fail or neglect, after proper request is made as herein provided, to permit entry therein by the fire code official for the purpose of inspection and examination pursuant to this code.	Inspection	1.07.05.04		Before entering, the AHJ shall obtain the consent of the occupant thereof or obtain a court warrant authorizing entry for the purpose of inspection except in those instances where an emergency exists.	Similar
General Authority and Responsibility	104.04	Identification	The fire code official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.	Inspection	1.07.05.06		Persons authorized to enter and inspect buildings, structures, marine vessels, vehicles, and premises as herein set forth shall be identified by credentials issued by the governing authority.	Similar
Permits	104.06.01	Approvals	A record of approvals shall be maintained by the fire code official and shall be available for public inspection during business hours in accordance with applicable laws.	Records and Reports	1.11.01		A record of examinations, approvals, equivalencies, and alternates shall be maintained by the AHJ and shall be available for public inspection during business hours in accordance with applicable laws.	Similar
Permits	104.06.02	Inspections.	The fire code official shall keep a record of each inspection made, including notices and orders issued, showing the findings and disposition of each.	Records and Reports	1.11.02		The AHJ shall keep a record of all fire prevention inspections, including the date of such inspections and a summary of any violations found to exist, the date of the services of notices, and a record of the final disposition of all violations.	Similar
General Authority and Responsibility	104.06.04	Administrative	Application for modification, alternative methods or materials and the final decision of the fire code official shall be in writing and shall be officially	Equivalencies, Alternatives, and Modifications	1.4.1	Equivalencies	Nothing in this Code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance,	Similar

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			recorded in the permanent records of the fire code official.				effectiveness, durability, and safety to those prescribed by this Code, provided technical documentation is submitted to the AHJ to demonstrate equivalency and the system, method, or device is approved for the intended purpose.	
Permits	105.01.01	Permits required	Permits required by this code shall be obtained from the fire code official. Permit fees, if any, shall be paid prior to issuance of the permit. Issued permits shall be kept on the premises designated therein at all times and shall be readily available for inspection by the fire code official.	Permits and Approvals	1.12.02.01		Applications for permits shall be accompanied by such data as required by the AHJ and fees as required by the jurisdiction.	Similar
Permits	105.02	Application	Application for a permit required by this code shall be made to the fire code official in such form and detail as prescribed by the fire code official. Applications for permits shall be accompanied by such plans as prescribed by the fire code official.	Permits and Approvals	1.12.02		Applications for permits shall be made to the AHJ on forms provided by the jurisdiction and shall include the applicant's answers in full to inquiries set forth on such forms.	Similar
Permits	105.02.04	Action on application	The fire code official shall examine or cause to be examined applications for permits and amendments hereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the fire code official shall reject such application in writing, stating the reasons therefore. If the fire code official is satisfied that the proposed work or operation conforms to the requirements of this code and laws and ordinances applicable thereto, the fire code official shall issue a permit therefore as soon as practicable.	Permits and Approvals	1.12.02.02		The AHJ shall review all applications submitted and issue permits as required.	Similar
				Permits and Approvals	1.12.02.03		If an application for a permit is rejected by the AHJ, the applicant shall be advised of the reasons for such rejection.	Similar
Conditions of Permit	105.03.03	Occupancy prohibited before approval	The building or structure shall not be occupied prior to the fire code official issuing a permit that indicates that applicable provisions of this code have been met.	Occupancy	10.03.01		No new construction or existing building shall be occupied in whole or in part in violation of the provisions of this Code.	Similar
Permits	105.06	Required operational permits.	The fire code official is authorized to issue operational permits for the operations set forth in Sections 105.6.1 through 105.6.47.	Permits and Approvals.	1.12.19		Permits shall be required in accordance with Table 1.12.19(a).	Similar
Permits	105.06.37	Pyrotechnic special effects material.	An operational permit is required for use and handling of pyrotechnic special effects material.	Display Fireworks	65.02.03	Permits.	Permits, where required, shall comply with 1.12.19.	Similar
Inspections.	106.01	Inspection authority.	The fire code official is authorized to enter and examine any building, structure, marine vessel, vehicle or premises in accordance with Section 104.3 for the purpose of enforcing this code.	Inspection	1.07.05.03		To the full extent permitted by law, any AHJ engaged in fire prevention and inspection work shall be authorized at all reasonable times to enter and examine any building, structure, marine vessel, vehicle, or premises for the purpose of making fire safety inspections.	Similar
Inspections	106.02	Inspections.	The fire code official is authorized to conduct such inspections as are deemed necessary to determine the extent of compliance with the provisions of this code and to approve reports of inspection by approved agencies or individuals. All reports of such inspections shall be prepared and submitted in writing for review and approval.	Inspection	1.07.05.01		The AHJ shall be authorized to inspect, at all reasonable times, any building or premises for dangerous or hazardous conditions or materials as set forth in this Code.	Similar

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			Inspection reports shall be certified by a responsible officer of such approved agency or by the responsible individual. The fire code official is authorized to engage such expert opinion as deemed necessary to report upon unusual, detailed or complex technical issues subject to the approval of the governing body.					
Inspections	106.03	Concealed work	Whenever any installation subject to inspection prior to use is covered or concealed without having first been inspected, the fire code official shall have the authority to require that such work be exposed for inspection.	Inspection of Construction and Installation	1.07.11.02		Whenever any installation subject to inspection prior to use is covered or concealed without having first been inspected, the AHJ shall have the authority to require that such work be exposed for inspection.	Similar
Maintenance	107.02.01	Test and inspection records	Required test and inspection records shall be available to the fire code official at all times or such records as the fire code official designates shall be filed with the fire code official.	Owner/Occupant Responsibilities	10.02.02		The AHJ shall be permitted to require the owner, operator, or occupant to provide tests or test reports, without expense to the AHJ, as proof of compliance with the intent of this Code.	Similar
Maintenance	107.02.02	Reinspection and testing	Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the fire code official for inspection and testing.	Owner/Occupant Responsibilities	10.02.03		The owner, operator, or occupant of a building that is deemed unsafe by the AHJ shall abate, through corrective action approved by the AHJ, the condition causing the building to be unsafe either by repair, rehabilitation, demolition, or other corrective action approved by the AHJ.	Similar
Maintenance	107.05	Owner/Occupant responsibility	Correction and abatement of violations of this code shall be the responsibility of the owner. If an occupant creates, or allows to be created, hazardous conditions in violation of this code, the occupant shall be held responsible for the abatement of such hazardous conditions.	Owner/Occupant Responsibilities	10.02.01		The owner, operator, or occupant shall be responsible for compliance with this Code.	Similar
Violations	109.02	Notice of violation	When the fire code official finds a building, premises, vehicle, storage facility or outdoor area that is in violation of this code, the fire code official is authorized to prepare a written notice of violation describing the conditions deemed unsafe and, when compliance is not immediate, specifying a time for reinspection.	Notice of Violations and Penalties	1.16.01		Whenever the AHJ determines violations of this Code, a written notice shall be issued to confirm such findings.	Similar
Violations	109.02.01	Service	A notice of violation issued pursuant to this code shall be served upon the owner, operator, occupant, or other person responsible for the condition or violation, either by personal service, mail, or by delivering the same to, and leaving it with, some person of responsibility upon the premises. For unattended or abandoned locations, a copy of such notice of violation shall be posted on the premises in a conspicuous place at or near the entrance to such premises and the notice of violation shall be mailed by certified mail with return receipt requested or a certificate of mailing, to the last known address of the owner, occupant or both.	Serving Notice	1.16.02.01		Any order or notice issued pursuant to this Code shall be served upon the owner, operator, occupant, or other person responsible for the condition or violation, either by personal service, by mail, or by delivering the same to, and leaving it with, some person of responsibility upon the premises.	Similar
Violations	109.02.03	Prosecution of violations	If the notice of violation is not complied with promptly, the fire code official is authorized to request the legal counsel of the jurisdiction to institute the appropriate legal proceedings at law or in equity to restrain, correct or abate such	Serving Notice	1.16.04		Any person who fails to comply with the provisions of this Code or who fails to carry out an order made pursuant of this Code or violates any condition attached to a permit, approval, or certificate shall be subject to the penalties established by the	Similar

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			violation or to require removal or termination of the unlawful occupancy of the structure in violation of the provisions of this code or of the order or direction made pursuant hereto.				jurisdiction.	
Violations	109.03	Violation penalties	Persons who shall violate a provision of this code or shall fail to comply with any of the requirements thereof or who shall erect, install, alter, repair or do work in violation of the approved construction documents or directive of the fire code official, or of a permit or certificate used under provisions of this code, shall be guilty of a [SPECIFY OFFENSE], punishable by a fine of not more than [AMOUNT] dollars or by imprisonment not exceeding [NUMBER OF DAYS], or both such fine and imprisonment. Each day that a violation continues after due notice has been served shall be deemed a separate offense.	Serving Notice	1.16.05		Failure to comply with the time limits of an abatement notice or other corrective notice issued by the AHJ shall result in each day that such violation continues being regarded as a new and separate offense.	Similar
Unsafe Buildings	110.01	General.	If during the inspection of a premises, a building or structure or any building system, in whole or in part, constitutes a clear and inimical threat to human life, safety or health, the fire code official shall issue such notice or orders to remove or remedy the conditions as shall be deemed necessary in accordance with this section and shall refer the building to the building department for any repairs, alterations, remodeling, removing or demolition required.	Inspection of Construction and Installation	1.07.11.03		When any construction or installation work is being performed in violation of the plans and specifications as approved by the AHJ, a written notice shall be issued to the responsible party to stop work on that portion of the work that is in violation.	Similar
Unsafe Buildings	110.01	General	If during the inspection of a premises, a building or structure or any building system, in whole or in part, constitutes a clear and inimical threat to human life, safety or health, the fire code official shall issue such notice or orders to remove or remedy the conditions as shall be deemed necessary in accordance with this section and shall refer the building to the building department for any repairs, alterations, remodeling, removing or demolition required.	Inspection	1.07.05.02		The AHJ shall have authority to order any person(s) to remove or remedy such dangerous or hazardous condition or material. Any person(s) failing to comply with such order shall be in violation of this Code.	Similar
				Inspection	1.07.06		Where conditions exist and are deemed hazardous to life and property by the AHJ, the AHJ shall have the authority to summarily abate such hazardous conditions that are in violation of this Code.	Similar
Unsafe Buildings	110.01.01	Unsafe conditions.	Structures or existing equipment that are or hereafter become unsafe or deficient because of inadequate means of egress or which constitute a fire hazard, or are otherwise dangerous to human life or the public welfare, or which involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. A vacant structure, which is not secured against unauthorized entry as required by Section 311, shall be deemed unsafe.	Inspection	1.07.06		Where conditions exist and are deemed hazardous to life and property by the AHJ, the AHJ shall have the authority to summarily abate such hazardous conditions that are in violation of this Code.	Similar
Stop Work Order	111.01	Order	Whenever the fire code official finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the fire code official is authorized to issue a stop work order.	Inspection of Construction and Installation	1.07.11.03		When any construction or installation work is being performed in violation of the plans and specifications as approved by the AHJ, a written notice shall be issued to the responsible party to stop work on that portion of the work that is in violation.	Similar

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Stop Work Order	111.02	Issuance	A stop work order shall be in writing and shall be given to the owner of the property, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work is authorized to resume.	Inspection of Construction and Installation.	1.07.11.04		The notice shall state the nature of the violation, and no work shall be continued on that portion until the violation has been corrected.	Similar
	Chapter 2	Definitions.						
Occupancy Classification	202	Occupancy Classification	For the purposes of this code, certain occupancies are defined as follows: A-2 Assembly uses intended for food and/or drink consumption including, but not limited to: Banquet halls Night clubs Restaurants Taverns and bars.	Assembly Occupancy	3.03.138.02	Assembly Occupancy	An occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load. [101:3.3]	Similar
	Chapter 3	General Precautions Against Fire						
General	301.01	Scope.	The provisions of this chapter shall govern the occupancy and maintenance of all structures and premises for precautions against fire and the spread of fire. other approved means.	Fundamental Requirements	10.01.01		Every new and existing building or structure shall be constructed, arranged, equipped, maintained, and operated in accordance with this Code so as to provide a reasonable level of life safety, property protection, and public welfare from the actual and potential hazards created by fire, explosion, and other hazardous conditions.	Similar
Ignition Sources	305.01	Clearance from ignition sources.	Clearance between ignition sources, such as light fixtures, heaters and flame-producing devices, and combustible materials shall be maintained in an approved manner.	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following: (1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material. (b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants: (a)* For ceremonial or religious purposes (b) On stages and platforms where part of a performance...	Similar
Open Flames	308.01	General.	This section shall control open flames, fire and burning on all premises.	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following:(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a	Similar

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							demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material.(b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:(a)* For ceremonial or religious purposes(b) On stages and platforms where part of a performance...	
Open Flames	308.02	Where prohibited.	A person shall not take or utilize an open flame or light in a structure, vessel, boat or other place where highly flammable, combustible or explosive material is utilized or stored. Lighting appliances shall be well secured in a glass globe and wire mesh cage or a similar approved device.	General Fire Safety	10.1.5	Fundamental Requirements.	The AHJ shall have the authority to prohibit any or all open flames or other sources of ignition where circumstances make such conditions hazardous.	Similar
Open Flames	308.03	Open flame.	A person shall not utilize or allow to be utilized, an open flame in connection with a public meeting or gathering for purposes of deliberation, worship, entertainment, amusement, instruction, education, recreation, awaiting transportation or similar purpose in assembly or educational occupancies without first obtaining a permit in accordance with Section 105.6.	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following:(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material. (b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:(a)* For ceremonial or religious purposes (b) On stages and platforms where part of a performance...	Similar
Open Flames	308.03.02	Open-flame decorative devices.	'Open-flame decorative devices shall comply with all of the following restrictions: .... 4. The device or holder shall be designed so that it will return to the upright position after being tilted to an angle of 45 degrees from vertical. Exception: Devices that self-extinguish if tipped over and do not spill	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following:(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a	Similar

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			fuel or wax at the rate of more than 0.25 teaspoon per minute (1.26 ml per minute) if tipped over. 5. The flame shall be enclosed except where openings on the side are not more than 0.375 inch (9.5mm) diameter or where openings are on the top and the distance to the top is such that a piece of tissue paper placed on the top will not ignite in 10 seconds. 6. Chimneys shall be made of noncombustible materials and securely attached to the open-flame device. Exception: A chimney is not required to be attached to any open-flame device that will self-extinguish if the device is tipped over. 7. Fuel canisters shall be safely sealed for storage. ... 9. Shades, where used, shall be made of noncombustible materials and securely attached to the open-flame device holder or chimney. 10. Candelabras with flame-lighted candles shall be securely fastened in place to prevent overturning, and shall be located away from occupants using the area and away from possible contact with drapes, curtains or other combustibles.				demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material.(b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:(a)* For ceremonial or religious purposes(b) On stages and platforms where part of a performance...	
Open Flames	308.03.03	Location near combustibles.	Open flames such as from candles, lanterns, kerosene heaters, and gas-fired heaters shall not be located on or near decorative material or similar combustible materials.	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following:(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material. (b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:(a)* For ceremonial or religious purposes (b) On stages and platforms where part of a performance...	Similar
Open Flames	308.03.07	Group A occupancies.	Open-flame devices shall not be used in a Group A occupancy. Exceptions: 1. Open-flame devices are allowed to be used in the following situations, provided approved precautions are taken to prevent ignition of a combustible material or injury to occupants: 1.1. Where necessary for ceremonial or religious purposes in accordance with Section 308.3.5. 1.2. On stages and	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following:(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a demonstration in exhibits, or as part of a performance, provided that both of the following	Similar

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			platforms as a necessary part of a performance in accordance with Section 308.3.6. 1.3. Where candles on tables are securely supported on substantial noncombustible bases and the candle flames are protected. 2. Heat-producing equipment complying with Chapter 6 and the International Mechanical Code. 3. Gas lights are allowed to be used provided adequate precautions satisfactory to the fire code official are taken to prevent ignition of combustible materials.				criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material.(b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:(a)* For ceremonial or religious purposes(b) On stages and platforms where part of a performance...	
Open Flames	308.05	Open-flame devices.	Torches and other devices, machines or processes liable to start or cause fire shall not be operated or used in or upon hazardous fire areas, except by a permit in accordance with Section 105.6 secured from the fire code official. Exception: Use within inhabited premises or designated campsites which are a minimum of 30 feet (9144 mm) from grass-, grain-, brush- or forest-covered areas.	Permits	20.01.04.02	Open Flame Devices and Pyrotechnics	No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by the following:(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met: (a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material. (b) Use of the pyrotechnic device complies with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience. (2) Flame effects before an audience shall be permitted in accordance with NFPA 160, Standard for Flame Effects Before an Audience. (3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:(a)* For ceremonial or religious purposes (b) On stages and platforms where part of a performance...	Similar
Indoor Displays	314.03	Highly combustible goods.	The display of highly combustible goods, including but not limited to fireworks, flammable or combustible liquids, liquefied flammable gases, oxidizing materials, pyroxylin plastics and agricultural goods, in main exit access aisles, corridors, covered malls, or within 5 feet (1524 mm) of entrances to exits and exterior exit doors is prohibited when a fire involving such goods would rapidly prevent or obstruct egress.	Operating Features	20.1.4.3.3	Furnishings, Decorations, and Scenery	Furnishings or decorations of an explosive or highly flammable character shall not be used.	Similar
	Chapter 4	Emergency Planning and Preparedness						
Public Assemblages and Events	403.01	General.	When, in the opinion of the fire code official, it is essential for public safety in a place of assembly or any other place where people congregate, because of the number of persons, or the nature	Standby fire personnel	1.7.13.1	Not addressed	The AHJ shall have the authority to require standby fire personnel or an approved fire watch when potentially hazardous conditions or a reduction in a life safety feature exist due to the	Similar

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			of the performance, exhibition, display, contest or activity, the owner, agent or lessee shall provide one or more fire watch personnel, as required and approved, to remain on duty during the times such places are open to the public, or when such activity is being conducted. The fire watch personnel shall keep diligent watch for fires, obstructions to means of egress and other hazards during the time such place is open to the public or such activity is being conducted and take prompt measures for remediation of hazards, extinguishment of fires that occur and assist in the evacuation of the public from the structures.				type of performance, display, exhibit, occupancy, contest or activity, an impairment to a fire protection feature, or the number of persons present.	
Public Assemblages and Events	403.01.02	Contents.	The public safety plan, where required by Section 403.1.1, shall address such items as emergency vehicle ingress and egress, fire protection, emergency medical services, public assembly areas and the directing of both attendees and vehicles (including the parking of vehicles), vendor and food concession distribution, and the need for the presence of law enforcement, and fire and emergency medical services personnel at the event.	Emergency Plans	10.9.2	Plan Requirements	Emergency plans shall be developed in accordance with NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs, and shall include the procedures for reporting of emergencies; occupant and staff response to emergencies; the type and coverage of building fire protection systems; and other items required by the AHJ.	Similar
Fire Safety and Evacuation Plans	404.01	General.	Fire safety and evacuation plans shall comply with the requirements of this section.	Emergency Plans	10.9.1	Where Required	Emergency plans shall be provided for high-rise, health care, ambulatory health care, residential board and care, assembly, day care centers, special amusement buildings, detention and correctional occupancies, underground and windowless structures, facilities storing or handling materials covered by Chapter 20, or where required by the AHJ.	Similar
Fire Safety and Evacuation Plans	404.02	Where required.	An approved fire safety and evacuation plan shall be prepared and maintained for the following occupancies and buildings. 1. Group A, other than Group A occupancies used exclusively for purposes of religious worship that have an occupant load less than 2,000. 2. Group E. 3. Group H. 4. Group I. 5. Group R-1. 6. Group R-4. 7. High-rise buildings. 8. Group M buildings having an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge. 9. Covered malls exceeding 50,000 square feet (4645 m2) in aggregate floor area. 10. Underground buildings. 11. Buildings with an atrium and having an occupancy in Group A, E or M.	Where Required	10.09.01	Where Required	Emergency plans shall be provided for high-rise, health care, ambulatory health care, residential board and care, assembly, day care centers, special amusement buildings, detention and correctional occupancies, underground and windowless structures, facilities storing or handling materials covered by Chapter 20, or where required by the AHJ.	Similar
Fire Safety and Evacuation Plans	404.03	Contents.	Fire safety and evacuation plan contents shall be in accordance with Sections 404.3.1 and 404.3.2.	Plan Requirements	10.09.02	Plan Requirements	Emergency plans shall be developed in accordance with NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs, and shall include the procedures for reporting of emergencies; occupant and staff response to emergencies; type and coverage of building fire protection systems; other items required by AHJ.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Fire Safety and Evacuation Plans	404.03.01	Fire evacuation plans.	Fire evacuation plans shall include the following: 1. Emergency egress or escape routes and whether evacuation of the building is to be complete or, where approved, by selected floors or areas only. 2. Procedures for employees who must remain to operate critical equipment before evacuating. 3. Procedures for accounting for employees and occupants after evacuation has been completed. 4. Identification and assignment of personnel responsible for rescue or emergency medical aid. 5. The preferred and any alternative means of notifying occupants of a fire or emergency. 6. The preferred and any alternative means of reporting fires and other emergencies to the fire department or designated emergency response organization. 7. Identification and assignment of personnel who can be contacted for further information or explanation of duties under the plan. 8. A description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages, where provided.	Emergency Plans	10.9.2	Plan Requirements.	Emergency plans shall be developed in accordance with NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs, and shall include the procedures for reporting of emergencies; occupant and staff response to emergencies; the type and coverage of building fire protection systems; and other items required by the AHJ.	Similar
Fire Safety and Evacuation Plans	404.03.02	Fire safety plans.	Fire safety plans shall include the following: 1. The procedure for reporting a fire or other emergency. 2. The life safety strategy and procedures for notifying, relocating, or evacuating occupants. 3. Site plans indicating the following: 3.1. The occupancy assembly point. 3.2. The locations of fire hydrants. 3.3. The normal routes of fire department vehicle access. 4. Floor plans identifying the locations of the following: 4.1. Exits. 4.2. Primary evacuation routes. 4.3. Secondary evacuation routes. 4.4. Accessible egress routes. 4.5. Areas of refuge. 4.6. Manual fire alarm boxes. 4.7. Portable fire extinguishers. 4.8. Occupant-use hose stations. 4.9. Fire alarm annunciators and controls. 5. A list of major fire hazards associated with the normal use and occupancy of the premise. 6. Identification and assignment of personnel responsible for maintenance of systems and equipment installed to prevent or control fires. 7. Identification and assignment of personnel responsible for maintenance, housekeeping and controlling fuel hazard sources.	Emergency Plans.	10.9.2	Plan Requirements	Emergency plans shall be developed in accordance with NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs, and shall include the procedures for reporting of emergencies; occupant and staff response to emergencies; the type and coverage of building fire protection systems; and other items required by the AHJ.	Similar
Fire Safety and Evacuation Plans	404.04	Maintenance.	Fire safety and evacuation plans shall be reviewed or updated annually or as necessitated by changes in staff assignments, occupancy, or the physical arrangement of the building.	Maintenance	10.09.02.02	Maintenance.	Emergency plans shall be reviewed and updated annually. Revised plans shall be submitted for review and updates shall be provided whenever changes are made in the occupancy or physical arrangement of the building or fire protection systems or features.	Similar
Fire Safety and Evacuation	404.05	Availability.	Fire safety and evacuation plans shall be available in the workplace for reference and review by employees, and copies shall be	Plan Requirements	10.09.02	Plan Requirements	Emergency plans shall be developed in accordance with NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs,	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Plans			furnished to the fire code official for review upon request.				and shall include the procedures for reporting of emergencies; occupant and staff response to emergencies; the type and coverage of building fire protection systems; and other items required by the AHJ.	
Emergency Evacuation Drills	405.01	General.	Emergency evacuation drills complying with the provisions of this section shall be conducted in the occupancies listed in Section 404.2 or when required by the fire code official. Drills shall be designed in cooperation with the local authorities.	Where Required	10.06.01	Where Required	Emergency egress and relocation drills conforming to the provisions of this Code shall be conducted as specified by the provisions of Chapter 20 of this Code or Chapters 10 through 71 of NFPA 101®, Life Safety Code®, or by appropriate action of the AHJ. Drills shall be designed in cooperation with the local authorities. [101:4.7.1]	Similar
Emergency Evacuation Drills	405.02	Frequency.	Required emergency evacuation drills shall be held at the intervals specified in Table 405.2 or more frequently where necessary to familiarize all occupants with the drill procedure.	Drill Frequency	10.06.02	Drill Frequency	Emergency egress and relocation drills, where required by Chapter 20 of this Code or Chapters 10 through 71 of NFPA 101®, Life Safety Code®, or the AHJ, shall be held with sufficient frequency to familiarize occupants with the drill procedure and to establish conduct of the drill as a matter of routine. Drills shall include suitable procedures to ensure that all persons subject to the drill participate. [101:4.7.2]	Similar
Emergency Evacuation Drills	405.02	Table 0405.02.	<p>FIRE AND EVACUATION DRILL FREQUENCY AND PARTICIPATION GROUP OR OCCUPANCY - FREQUENCY PARTICIPATION</p> <p>Group A - Quarterly Employees  Group E - Monthly All occupants  Group I - Quarterly on each shift Employees  Group R-1 - Quarterly on each shift Employees  Group R-4 - Quarterly on each shift Employees.</p> <p>a. The frequency shall be allowed to be modified in accordance with Section 408.3.2  b. Fire and evacuation drills in residential care assisted living facilities shall include complete evacuation of the premises in accordance with Section 408.10.5. Where occupants receive habilitation or rehabilitation training, fire prevention and fire safety practices shall be included as part of the training program.</p>	Drills	20.1.4.6	Drills	20.1.4.6.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.6.1; 101:13.7.6.1] 20.1.4.6.2 Employees or attendants of assembly occupancies shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment where provided. [101:12.7.6.2; 101:13.7.6.2]	Similar
Emergency Evacuation Drills	405.03	Leadership.	Responsibility for the planning and conduct of drills shall be assigned to competent persons designated to exercise leadership.	Competency	10.06.03	Competency	Responsibility for the planning and conducting of drills shall be assigned only to competent persons qualified to exercise leadership.	Similar
Emergency Evacuation Drills	405.04	Time.	Drills shall be held at unexpected times and under varying conditions to simulate the unusual conditions that occur in case of fire.	Fire Drills	10.06.05	Simulated Conditions	Drills shall be held at expected and unexpected times and under varying conditions to simulate the unusual conditions that can occur in an actual emergency. [101:4.7.4]	Similar
Emergency Evacuation Drills	405.05	Record keeping.	. Records shall be maintained of required emergency evacuation drills and include the following information: 1. Identity of the person conducting the drill. 2. Date and time of the drill.	Fire Drills	10.06.07		A written record of each drill shall be completed by the person responsible for conducting the drill and maintained in an approved manner. [101:4.7.6]	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			3. Notification method used. 4. Staff members on duty and participating. 5. Number of occupants evacuated. 6. Special conditions simulated. 7. Problems encountered. 8. Weather conditions when occupants were evacuated. 9. Time required to accomplish complete evacuation.					
Employee Training and Response Procedures	406.01	General.	Employees in the occupancies listed in Section 404.2 shall be trained in the fire emergency procedures described in their fire evacuation and fire safety plans. Training shall be based on these plans and as described in Section 404.3.	Operating Features	20.01.04.06.01	Drills	20.1.4.6.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.6.1; 101:13.7.6.1]	Similar
Employee Training and Response Procedures	406.02	Frequency.	Employees shall receive training in the contents of fire safety and evacuation plans and their duties as part of new employee orientation and at least annually thereafter. Records shall be kept and made available to the fire code official upon request.	Operating Features	20.01.04.06.01	Drills	20.1.4.6.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.6.1; 101:13.7.6.1]	Similar
Employee Training and Response Procedures	406.03	Employee training program.	Employees shall be trained in fire prevention, evacuation and fire safety in accordance with Sections 406.3.1 through 406.3.3.	Operating Features	20.01.04.06.01	Drills	20.1.4.6.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.6.1; 101:13.7.6.1]	Similar
Employee Training and Response Procedures	406.03.01	Fire prevention training.	Employees shall be apprised of the fire hazards of the materials and processes to which they are exposed. Each employee shall be instructed in the proper procedures for preventing fires in the conduct of their assigned duties.	Operating Features	20.01.04.06.01	Drills	20.1.4.6.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.6.1; 101:13.7.6.1]	Similar
Employee Training and Response Procedures	406.03.02	Evacuation training.	Employees shall be familiarized with the fire alarm and evacuation signals, their assigned duties in the event of an alarm or emergency, evacuation routes, areas of refuge, exterior assembly areas, and procedures for evacuation.	Operating Features	20.01.04.06.01	Drills	20.1.4.6.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.6.1; 101:13.7.6.1]	Similar
Employee Training and Response Procedures	406.03.03	Fire safety training.	Employees assigned fire-fighting duties shall be trained to know the locations and proper use of portable fire extinguishers or other manual fire-fighting equipment and the protective clothing or equipment required for its safe and proper use.	Operating Features	20.01.04.06.02	Drills	Employees or attendants of assembly occupancies shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment where provided. [101:12.7.6.2; 101:13.7.6.2]	Similar
Use and Occupancy-Related Requirements	408.02	Group A occupancies.	Group A occupancies shall comply with the requirements of Sections 408.2.1 and 408.2.2 and Sections 401 through 406.	Assembly Occupancies	20.01.01	Application	New and existing assembly occupancies shall comply with Section 20.1 and the referenced edition of NFPA 101.	Similar
Use and Occupancy-Related Requirements	408.02.01	Seating plan.	The fire safety and evacuation plans for assembly occupancies shall include the information required by Section 404.3 and a detailed seating plan, occupant load, and occupant load limit. Deviations from the approved plans shall be allowed provided the occupant load limit for the occupancy is not exceeded and the aisles and exit access ways remain unobstructed.	Emergency Plans.	10.9.2	Plan Requirements	Emergency plans shall be developed in accordance with NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs, and shall include the procedures for reporting of emergencies; occupant and staff response to emergencies; the type and coverage of building fire protection systems; and other items required by the AHJ.	Similar
Use and Occupancy-Related Requirements	408.02.02	Announcements	In theaters, motion picture theaters, auditoriums and similar assembly occupancies in Group A used for noncontinuous programs, an audible announcement shall be made not more than 10	Operating Features	20.01.04.06.03	Drills	In the following assembly occupancies, an audible announcement shall be made, or a projected image shall be shown, prior to the start of each program that notifies occupants of the location of the exits to	Similar

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			minutes prior to the start of each program to notify the occupants of the location of the exits to be used in the event of a fire or other emergency. Exception: In motion picture theaters, the announcement is allowed to be projected upon the screen in a manner approved by the fire code official.				be used in case of a fire or other emergency: (1) Theaters (2) Motion picture theaters (3) Auditoriums (4) Other similar assembly occupancies with occupant loads exceeding 300 where there are noncontinuous programs [101:12.7.6.3; 101:13.7.6.3]	
	Chapter 8	Interior Finish, Decorative Materials and Furnishings						
General	801.01	Scope	The provisions of this chapter shall govern furniture and furnishings, interior finishes, interior trim, decorative materials and decorative vegetation in buildings. Sections 803, 804 and 805 shall be applicable to new and existing buildings. Section 806 shall be applicable to existing buildings.	General	12.01	General	This chapter shall apply to new, existing, permanent, or temporary buildings.	Similar
				Interior Finish	12.05	Interior Finish	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
				Furnishings, Contents, Decorations, and Treated Finishes	12.06	Furnishings, Contents, Decorations, and Treated Finishes	Furnishings, contents, decorations, and treated finishes in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
Furnishings	803.01	General requirements.	The provisions of Sections 803.1.1 through 803.1.3 shall be applicable to all occupancies covered by Sections 803.2 through 803.7.	Interior Finish	12.05	Interior Finish.	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
Furnishings	803.01.01	Explosive and highly flammable materials.	Furnishings or decorations of an explosive or highly flammable character shall not be used.	Furnishings, Decorations, and Scenery	20.01.04.03.03	Furnishings, Decorations, and Scenery	Furnishings or decorations of an explosive or highly flammable character shall not be used. [101:10.3.5]	Similar
Furnishings	803.02	Group A.	The requirements in Sections 803.2.1 and 803.2.2 shall apply to occupancies in Group A.	Operating Features	20.1.4.3.6	Furnishings, Decorations, and Scenery	Exposed foamed plastic materials and unprotected materials containing foamed plastic used for decorative purposes or stage scenery shall have a heat release rate not exceeding 100 kW where tested in accordance with UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes.	Similar
Furnishings	803.02.01	Foam plastics.	Exposed foam plastic materials and unprotected materials containing foam plastic used for decorative purposes or stage scenery or exhibit booths shall have a maximum heat release rate of 100 kilowatts (kW) when tested in accordance with UL 1975. Exceptions: 1. Individual foam plastic items or items containing foam plastic where the foam plastic does not exceed 1 pound (0.45 kg) in weight. 2. Cellular or foam plastic shall be allowed for trim not in excess of 10 percent of the wall or ceiling area, provided it is not less than 20 pounds per cubic foot (320 kg per cubic meter) in density, is limited to 0.5 inch (12.7 mm) in thickness and 4 inches (102 mm) in width, and complies with the requirements for Class B interior wall and ceiling finish, except that the smoke-developed index shall not be limited. Egress width is maintained.	Furnishings, Decorations, and Scenery	20.01.04.03.06		Exposed foamed plastic materials and unprotected materials containing foamed plastic used for decorative purposes or stage scenery shall have a heat release rate not exceeding 100 kW where tested in accordance with UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes. [101:12.7.3.3; 101:13.7.3.3]	Similar
Decorations and Trim	805.03	Foam plastics.	Foam plastic used as interior trim shall comply with Sections 805.3.1 through 805.3.4	Flame-Retardant Requirements	20.01.02.02		Foamed plastics (see definition of cellular or foamed plastic in 3.3.30 of NFPA 101) shall be permitted to be used only by specific approval of	Different

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Interior Finish and Decorative Materials	806.01	General.	The provisions of this section shall limit the allowable flame spread and smoke development of interior finishes and decorative materials in existing buildings based on location and occupancy classification. Exceptions: 1. Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls and ceilings. 2. Exposed portions of structural members complying with the requirements of buildings of Type IV construction in accordance with the International Building Code shall not be subject to interior finish requirements	Features of Fire Protection	12.5	Interior Finish	the AHJ. [101:12.4.5.11.2; 101:13.4.5.11.2] Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar. The NFPA 1 requirements cite NFPA 101 provisions which track closely with NFPA 5000.
Interior Finish and Decorative Materials	806.01.02	Foam plastics.	Cellular or foam plastics shall not be used as interior finish or trim. Exceptions: 1. Cellular or foam plastic materials shall be permitted on the basis of fire tests that substantiate their combustibility characteristics for the use intended under actual fire conditions. 2. Cellular or foam plastic shall be permitted for trim not in excess of 10 percent of the wall or ceiling area, provided such trim is not less than 20 pounds per cubic foot (320 kg/m3) in density, is limited to 0.5 inch (12.7 mm) in thickness and 8 inches (203 mm) in width, and complies with the requirements for Class A or B interior wall and ceiling finish except that the smoke rating shall not be limited.	Features of Fire Protection	12.5	Interior Finish	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
Interior Finish and Decorative Materials	806.01.03	Obstruction of means of egress.	No decorations or other objects shall be placed to obstruct exits, access thereto, egress there from, or visibility thereof.	Means of Egress Reliability	14.4.2.1	Furnishings and Decorations in Means of Egress	No furnishings, decorations, or other objects shall obstruct exits, access thereto, egress therefrom, or visibility thereof.	Similar. NFPA has processed a Tentative Interium Amendment requiring inspection of the means of egress everyday by facility staff.
Interior Finish and Decorative Materials	806.02	Wall and ceiling finish.	Interior wall and ceiling finishes shall be classified in accordance with Section 803 of the International Building Code. Such interior finishes shall be grouped in the following classes in accordance with their flame spread and smoke-developed index. Class A: Flame spread index 0-25 Smoke-developed index 0-450 Class B: Flame spread index 26-75 Smoke-developed index 0-450 Class C: Flame spread index 76-450 Smoke-developed index 0-450 Exception: Materials, other than textiles, tested in accordance with Section 806.2.1.	Features of Fire Protection	12.5	Interior Finish	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
Interior Finish and Decorative Materials	806.02.01	Interior wall and ceiling finishes other than textiles.	Interior wall or ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Finishes tested in accordance with NFPA 286 shall comply with Section	Features of Fire Protection	12.5	Interior Finish	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			806.2.1.1.					
Interior Finish and Decorative Materials	806.02.01.01	Acceptance criteria.	During the 40 Kw exposure, the interior finish shall comply with Item 1. During the 160 Kw exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Item 3. 1. During the 40 Kw exposure, flames shall not spread to the ceiling. 2. During the 160 Kw exposure, the interior finish shall comply with the following: 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling. 2.2. Flashover, as defined in NFPA 286, shall not occur. 3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m2.	Features of Fire Protection	12.5	Interior Finish	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
Interior Finish and Decorative Materials	806.02.02	Stability.	Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner that such materials will not readily become detached when subjected to a room temperature of 200°F (93°C) for not less than 30 minutes.	Features of Fire Protection	12.5	Interior Finish.	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
Interior Finish and Decorative Materials	806.03	Wall and ceiling finish requirements.	Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 806.3 for the group and location designated. Interior wall and ceiling finish materials, other than textiles, tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 806.2.1.1, shall be permitted to be used where a Class A classification in accordance with ASTM E84 is required.	Features of Fire Protection	12.5	Interior Finish	Interior finish in buildings and structures shall meet the requirements of NFPA 101®, Life Safety Code®, and this Code.	Similar
	Chapter 9	Fire Protection Systems						
Fire Protection Systems	901.01	Scope.	The provisions of this chapter shall specify where fire protection systems are required and shall apply to the design, installation, inspection, operation, testing and maintenance of all fire protection systems.	General	12.01	General	This chapter shall apply to new, existing, permanent, or temporary buildings.	Similar
Fire Protection Systems	901.08	Removal of or tampering with equipment	It shall be unlawful for any person to remove, tamper with or otherwise disturb any fire hydrant, fire detection and alarm system, fire suppression system, or other fire appliance required by this code except for the purpose of extinguishing fire, training purposes, recharging or making necessary repairs, or when approved by the fire code official.	Tampering with Fire Safety Equipment	10.08.01		No person shall render any portable or fixed fire-extinguishing system or device or any fire warning system inoperative or inaccessible.	Similar
				Tampering with Fire Safety Equipment	10.08.01.01		As necessary during emergencies, maintenance, drills, prescribed testing, alterations, or renovations, portable or fixed fire-extinguishing systems or devices or any fire warning system shall be permitted to be made inoperative or inaccessible.	Similar
Automatic Sprinkler Systems	903.02	Where required.	Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in this section. Exception: Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided those spaces or areas are equipped throughout with an automatic fire alarm system and are separated from the remainder of	Automatic Sprinklers	13.03.02.01	Where Required	Where required by this Code or the referenced codes and standards listed in Chapter 2, automatic sprinkler systems shall be installed in accordance with 13.3.1.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			the building by a wall with a fire-resistance rating of not less than 1 hour and a floor/ceiling assembly with a fire-resistance rating of not less than 2 hours.					
Automatic Sprinkler Systems	903.02.01	Group A.	An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section. For Group A-1, A-2, A-3, and A-4 occupancies, the automatic sprinkler system shall be provided throughout the floor area where the Group A-1, A-2, A-3 or A-4 occupancy is located, and in all floors between the Group A occupancy and the level of exit discharge. For group A-5 occupancies, the automatic sprinkler system shall be provided in the spaces indicated in Section 903.2.1.5.	Automatic Sprinklers	13.03.02.04.01	New Assembly Occupancies	Buildings containing assembly occupancies with occupant loads of more than 300 shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 9.7 of NFPA 101 as follows (see also 12.1.6, 12.2.6, 12.3.2, and 12.3.6 of NFPA 101): (1) Throughout the story containing the assembly occupancy (2) Throughout all stories below the story containing the assembly occupancy (3) In the case of an assembly occupancy located below the level of exit discharge, throughout all stories intervening between that story and the level of exit discharge, including the level of exit discharge [101:12.3.5.1] (See TIAs)	Similar
Automatic Sprinkler Systems	903.02.01.02	Group A-2.	An automatic sprinkler system shall be provided for Group A-2 occupancies where one of the following conditions exists: 1. The fire area exceeds 5,000 square feet (464.5m <sup>2</sup> ); 2. The fire area has an occupant load of 300 or more; or 3. The fire area is located on a floor other than the level of exit discharge.	Automatic Sprinklers	13.03.02.04.01	New Assembly Occupancies	Buildings containing assembly occupancies with occupant loads of more than 300 shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 9.7 of NFPA 101 as follows (see also 12.1.6, 12.2.6, 12.3.2, and 12.3.6 of NFPA 101): (1) Throughout the story containing the assembly occupancy (2) Throughout all stories below the story containing the assembly occupancy (3) In the case of an assembly occupancy located below the level of exit discharge, throughout all stories intervening between that story and the level of exit discharge, including the level of exit discharge [101:12.3.5.1] NFPA has processed a Tentative Interim Amendment reduces the occupant load threshold from 300 persons to 100 persons. (See TIAs)	Similar
Portable Fire Extinguishers	906.01	Where required.	Portable fire extinguishers shall be installed in the following locations. 1. In all Group A, B, E, F, H, I, M, R-1, R-2, R-4 and S occupancies. Exception: In all Group A, B and E occupancies equipped throughout with quick-response sprinklers, fire extinguishers shall be required only in special-hazard areas. 2. Within 30 feet (9144 mm) of commercial cooking equipment. 3. In areas where flammable or combustible liquids are stored, used or dispensed. 4. On each floor of structures under construction, except Group R-3 occupancies, in accordance with Section 1415.1. 5. Where required by the sections indicated in Table 906.1. 6. Special-hazard areas, including but not limited to laboratories, computer rooms and generator rooms, where required by the fire code official.	Portable Extinguishers	13.06.01.02	Where Required.	Fire extinguishers shall be provided where required by this Code as specified in Table 13.6.1.2 and the referenced codes and standards listed in Chapter 2.	Similar

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Portable Fire Extinguishers	906.02	General requirements.	Fire extinguishers shall be selected, installed and maintained in accordance with this section and NFPA 10. Exception: The travel distance to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.	Portable Extinguishers	13.06.01.01	General Requirements	The installation, maintenance, selection, and distribution of portable fire extinguishers shall be in accordance with NFPA 10, Standard for Portable Fire Extinguishers, and Section 13.6.	Similar
Portable Fire Extinguishers	906.03	Size and Distribution	For occupancies that involve primarily Class A fire hazards, the minimum sizes and distribution shall comply with Table 906.3(1). Fire extinguishers for occupancies involving flammable or combustible liquids with depths of less than or equal to 0.25-inch (6.35 mm) shall be selected and placed in accordance with Table 906.3(2). Fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25-inch (6.35mm) or involving combustible metals shall be selected and placed in accordance with NFPA 10. Extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or Class B hazard.	Distribution of Fire Extinguishers	13.06.06.02.01	Fire Extinguisher Size and Placement for Class A Hazards	Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 13.6.6.2.1, except as modified by 13.6.6.2.2. Fire extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 13.6.6.2.1, except as modified by 13.6.6.2.2. (See Annex E of NFPA 10.) [10:5.2.1]	Similar
				Distribution of Fire Extinguishers	13.06.06.03.01	Fire Extinguisher Size and Placement for Class B Fires Other Than for Fires in Flammable Liquids of Appreciable Depth	Minimal sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of Table 13.6.6.3.1. Fire extinguishers shall be located so that the maximum travel distances do not exceed those specified in the table used. (See Annex E of NFPA 10.) [10:5.3.1]	Similar
				Distribution of Fire Extinguishers	13.06.06.04.02	Fire Extinguisher Size and Placement for Class B Fires in Flammable Liquids of Appreciable Depth	For flammable liquid hazards of appreciable depth, a Class B fire extinguisher shall be provided on the basis of at least two numerical units of Class B extinguishing potential per ft <sup>2</sup> (0.0929 m <sup>2</sup> ) of flammable liquid surface of the largest hazard area. AFFF- or FFFP-type fire extinguishers shall be permitted to be provided on the basis of 1-B of protection per ft <sup>2</sup> (0.09 m <sup>2</sup> ) of hazard. (For fires involving cooking grease or water-soluble flammable liquids, see 13.6.5.3 and 4.3.4 of NFPA 10.) [10:5.4.2]	Similar
				Distribution of Fire Extinguishers	13.06.06.05	Fire Extinguisher Size and Placement for Class C Hazards	Fire extinguishers with Class C ratings shall be required where energized electrical equipment can be encountered. This requirement includes situations where fire either directly involves or surrounds electrical equipment. Since the fire itself is a Class A or Class B hazard, the fire extinguishers shall be sized and located on the basis of the anticipated Class A or Class B hazard. [10:5.5]	Similar
Portable Fire Extinguishers	906.03	Table 0906.03.	FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS	Distribution of Fire Extinguishers.	13.6.6.2.1	Fire Extinguisher Size and Placement for Class A Hazards	Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 13.6.6.2.1, except as modified by 13.6.6.2.2. Fire extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 13.6.6.2.1, except as modified by 13.6.6.2.2. (See Annex E of NFPA 10.)	Similar
Portable Fire Extinguishers	906.05	Conspicuous location.	Extinguishers shall be located in conspicuous locations where they will be readily accessible and immediately available for use. These locations shall be along normal paths of travel,	Portable Extinguishers.	13.06.03.03	General Requirements.	Fire extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of fire. Preferably, they shall be located along normal	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			unless the fire code official determines that the hazard posed indicates the need for placement away from normal paths of travel.				paths of travel, including exits from areas. [10:1.5.3]	
Portable Fire Extinguishers	906.06	Unobstructed and unobscured.	Fire extinguishers shall not be obstructed or obscured from view. In rooms or areas in which visual obstruction cannot be completely avoided, means shall be provided to indicate the locations of extinguishers.	Portable Extinguishers.	13.06.03.06	General Requirements	Fire extinguishers shall not be obstructed or obscured from view. In large rooms, and in certain locations where visual obstructions cannot be completely avoided, means shall be provided to indicate the extinguisher location. [10:1.5.6]	Similar
Portable Fire Extinguishers	906.07	Hangers and brackets.	Hand-held portable fire extinguishers, not housed in cabinets, shall be installed on the hangers or brackets supplied. Hangers or brackets shall be securely anchored to the mounting surface in accordance with the manufacturer's installation instructions.	Portable Extinguishers.	13.06.03.07	General Requirements	Portable fire extinguishers other than wheeled extinguishers shall be installed securely on the hanger, or in the bracket supplied by the extinguisher manufacturer, or in a listed bracket approved for such purpose, or placed in cabinets or wall recesses. Wheeled fire extinguishers shall be located in a designated location. [10:1.5.7]	Similar
Fire Alarm and Detection Systems	907.01	General.	This section covers the application, installation, performance and maintenance of fire alarm systems and their components in new and existing buildings and structures. The requirements of Section 907.2 are applicable to new buildings and structures. The requirements of Section 907.3 are applicable to existing buildings and structures.	Detection, Alarm, and Communication Systems	13.07.01.01	General	Where building fire alarm systems or automatic fire detectors are required by other sections of this Code, they shall be provided in accordance with NFPA 72®, National Fire Alarm Code® and Section 13.7.	Similar
Fire Alarm and Detection Systems	907.02	Where required- new buildings and structures.	An approved manual, automatic, or manual and automatic fire alarm system shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23. Where automatic sprinkler protection installed in accordance with Section 903.3.1.1 or 903.3.1.2 is provided and connected to the building fire alarm system, automatic heat detection required by this section shall not be required. An approved automatic fire detection system shall be installed in accordance with the provisions of this code and NFPA72. Devices, combinations of devices, appliances and equipment shall comply with Section 907.1.2. The automatic fire detectors shall be smoke detectors, except that an	Detection, Alarm, and Communication Systems	13.07.02.01	Where Required	New Assembly Occupancies. Assembly occupancies with occupant loads of more than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with 13.7.1 of this Code and 12.3.4 of NFPA 101, unless otherwise permitted by the following: (1) Assembly occupancies that are a part of a multiple occupancy protected by a mixed occupancy (see 6.1.14 of NFPA 101) shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met. (2) Voice communication or public address systems complying with 12.3.4.3.3 of NFPA 101 shall not be required to comply with 13.7.1.4 of the Code. [101:12.3.4.1]	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			approved alternative type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.	Detection, Alarm, and Communication Systems	13.07.02.02	Where Required	Existing Assembly Occupancies. Assembly occupancies with occupant loads of more than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with 13.7.1.4 of this Code and 13.3.4 of NFPA 101, unless otherwise permitted by the following: (1) Assembly occupancies that are a part of a multiple occupancy protected as a mixed occupancy (see 6.1.14 of NFPA 101) shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met. (2) Voice communication or public address systems complying with 13.3.4.3.3 of NFPA 101 shall not be required to comply with 13.7.1.4 of this Code. (3) This requirement shall not apply to assembly occupancies where, in the judgment of the AHJ, adequate alternative provisions exist or are provided for the discovery of a fire and for alerting the occupants promptly. [101:13.3.4.1]	Similar
Fire Alarm and Detection Systems	907.02.01	Group A.	A manual fire alarm system shall be installed in accordance with NFPA 72 in Group A occupancies having an occupant load of 300 or more. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy. Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system and the alarm notification appliances will activate upon sprinkler water flow.	Detection, Alarm, and Communication Systems	13.07.01.04.08.01	Signal Initiation	Where required by other sections of this Code, actuation of the complete fire alarm system shall occur by any or all of the following means of initiation, but shall not be limited to such means: (1) Manual fire alarm initiation(2) Automatic detection(3) Extinguishing system operation [101:9.6.2.1]	Similar
Fire Alarm and Detection Systems	907.03	Where required-retroactive in existing buildings and structures.	An approved manual, automatic or manual and automatic fire alarm system shall be installed in existing buildings and structures in accordance with Sections 907.3.1 through 907.3.1.8. Where automatic sprinkler protection is provided in accordance with Section 903.3.1.1 or 903.3.1.2 and connected to the building fire alarm system, automatic heat detection required by this section shall not be required. An approved automatic fire detection system shall be installed in accordance with the provisions of this code and NFPA 72. Devices, combinations of devices, appliances and equipment shall be approved. The automatic fire detectors shall be smoke detectors, except an approved alternative type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector. fire alarm system shall be installed in existing Group R-1 boarding and rooming houses. Exception: Buildings that have single-station smoke alarms meeting or	Detection, Alarm, and Communication Systems	13.07.02.02	Where Required	Existing Assembly Occupancies. Assembly occupancies with occupant loads of more than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with 13.7.1.4 of this Code and 13.3.4 of NFPA 101, unless otherwise permitted by the following: (1) Assembly occupancies that are a part of a multiple occupancy protected as a mixed occupancy (see 6.1.14 of NFPA 101) shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met. (2) Voice communication or public address systems complying with 13.3.4.3.3 of NFPA 101 shall not be required to comply with 13.7.1.4 of this Code. (3) This requirement shall not apply to assembly occupancies where, in the judgment of the AHJ, adequate alternative provisions exist or are provided for the discovery of a fire and for alerting the occupants promptly. [101:13.3.4.1]	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			exceeding the requirements of Section 907.2.10.1 and where the fire alarm system includes at least one manual fire alarm box per floor arranged to initiate the alarm.					
	Chapter 10	Means of Egress						
General	1001.01	General.	Buildings or portions thereof shall be provided with a means of egress system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof. Sections 1003 through 1025 shall apply to new construction. Sections 1026 and 1027 shall apply to existing buildings. Exception: Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the International Residential Code.	Means of Egress	14.01	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
General	1001.02	Minimum requirements.	It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the capacity of the means of egress to less than required by this code.	Number of Means of Egress	14.9.1.2	General.	The number of means of egress from any story or portion thereof, other than for existing buildings as permitted in Chapter 12 through Chapter 42 of NFPA 101, shall be as follows: (1) Occupant load more than 500 but not more than 1000 - not less than 3(2) Occupant load more than 1000 - not less than 4	Similar
General Means of Egress	1003.01	Applicability.	The general requirements specified in Sections 1003 through 1012 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
General Means of Egress	1003.03	Protruding objects.	Protruding objects shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.	Means of Egress	14.4.1	Means of Egress Reliability	Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in case of fire or other emergency. See TIAs	Similar
General Means of Egress	1003.03.02	Free-standing objects.	A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 12 inches (305 mm) where the lowest point of the leading edge is more than 27 inches (686mm) and less than 80 inches (2032 mm) above the walking surface. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (685 mm) maximum or 80 inches (2030 mm) minimum above the finish floor or ground. Exception: This requirement shall not apply to sloping portions of handrails serving stairs and ramps.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
General Means of	1003.03.03	Horizontal projections.	Structural elements, fixtures or furnishings shall not project horizontally from either side more	Capacity of Means of Egress	14.8.2.2	Measurement of Means of	Projections within the means of egress of not more than 4½ in. (114 mm) on each side shall be	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Egress			than 4 inches (102 mm) over any walking surface between the heights of 27 inches (686 mm) and 80 inches (2032 mm) above the walking surface. Exception: Handrails serving stairs and ramps are permitted to protrude 4.5 inches (114 mm) from the wall.			Egress	permitted at a height of 38 in. (965 mm) and below.	
General Means of Egress	1003.04	Floor surface.	Walking surfaces of the means of egress shall have a slip-resistant surface and be securely attached.	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
General Means of Egress	1003.05	Elevation change.	Where changes in elevation of less than 12 inches (305 mm) exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal (5-percent slope), ramps complying with Section 1010 shall be used. Where the difference in elevation is 6 inches (152 mm) or less, the ramp shall be equipped with either handrails or floor finish materials that contrast with adjacent floor finish materials. Exceptions: 1. ... 2. A stair with a single riser or with two risers and a tread is permitted at locations not required to be accessible by Chapter 11 of the International Building Code, provided that the risers and treads comply with Section 1009.3, the minimum depth of the tread is 13 inches (330 mm) and at least one handrail complying with Section 1009.11 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the stair. 3. ...	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Occupant Load	1004.01	Design occupant load.	In determining means of egress requirements, the number of occupants for whom means of egress facilities shall be provided shall be established by the largest number computed in accordance with Sections 1004.1.1 through 1004.1.3.	Capacity of Means of Egress	14.08.01.02	Occupant Load Factor	The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified in Table 14.8.1.2 and Figure 14.8.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified and by applying the net area figure to the net area of the portion of the building devoted to the use for which the net area figure is specified. [101:7.3.1.2]	Similar
Occupant Load	1004.01.01	Actual number.	The actual number of occupants for whom each occupied space, floor or building is designed.	Occupant Load.	14.8.1.2	Occupant Load Factor.	The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified in Table 14.8.1.2 and Figure 14.8.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified and by applying the net area figure to the net area of the portion of the building devoted to the use for which	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Occupant Load	1004.01.02	Number by Table 1004.1.2.	The number of occupants computed at the rate of one occupant per unit of area as prescribed in Table 1004.1.2.	Capacity of Means of Egress	14.08.01.02	Occupant Load Factor	the net area figure is specified. The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified in Table 14.8.1.2 and Figure 14.8.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified and by applying the net area figure to the net area of the portion of the building devoted to the use for which the net area figure is specified. [101:7.3.1.2]	Similar. The IFC factor for standing space is smaller than the NFPA 1 factor.
Occupant Load	1004.03	Posting of occupant load.	Every room or space that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.	Occupant Load Posting	20.01.04.08.03.01		Every room constituting an assembly occupancy and not having fixed seats shall have the occupant load of the room posted in a conspicuous place near the main exit from the room. [101:12.7.8.3.1; 101:13.7.8.3.1]	Similar
				Occupant Load Posting	20.01.04.08.03.02		Approved signs shall be maintained in a legible manner by the owner or authorized agent. [101:12.7.8.3.2; 101:13.7.8.3.2]	Similar
				Occupant Load Posting	20.01.04.08.03.03		Signs shall be durable and shall indicate the number of occupants permitted for each room use. [101:12.7.8.3.3; 101:13.7.8.3.3]	Similar
Egress Width	1005.01	Minimum required egress width.	The means of egress width shall not be less than required by this section. The total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by the factors in Table 1005.1 and not less than specified elsewhere in this code. Multiple means of egress shall be sized such that the loss of any one means of egress shall not reduce the available capacity to less than 50 percent of the required capacity. The maximum capacity required from any story of a building shall be maintained to the termination of the means of egress. Exception: Means of egress complying with Section 1024.	Capacity of Means of Egress	14.08.03.03.01	Minimum Width	The width of any means of egress, unless otherwise provided in 14.8.3.3.1.1 through 14.8.3.3.1.3, shall be as follows: (1) Not less than that required for a given egress component in Chapter 7 or Chapter 12 through Chapter 42 of NFPA 101 (2) Not less than 36 in. (915 mm) [101:7.3.4.1]	Similar
Egress Width	1005.01	Table 1005.1.	EGRESS WIDTH PER OCCUPANT SERVED	Egress Capacity	TABLE 14.8.3.1	Capacity Factors		For non sprinkler protected buildings the factors are the same. For sprinkler protected buildings IFC allows a increase in the number of persons per inch.

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Means of Egress Illumination	1006.01	Illumination required.	The means of egress, including the exit discharge, shall be illuminated at all times the building space served by the means of egress is occupied. Exceptions: 1. Occupancies in Group U. 2. Aisle accessways in Group A. 3. Dwelling units and sleeping units in Groups R-1, R-2 and R-3. 4. Sleeping units of Group I occupancies.	Illumination of Means of Egress	14.12.01.02	General	Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use, unless otherwise provided in 14.12.1.2.2. [101:7.8.1.2]	Similar
Means of Egress Illumination	1006.02	Illumination level.	The means of egress illumination level shall not be less than 1 foot-candle (11 lux) at the floor level. Exception: For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the floor level is permitted to be reduced during performances to not less than 0.2 foot-candle (2.15 lux) provided that the required illumination is automatically restored upon activation of a premise's fire alarm system where such system is provided.	Illumination of Means of Egress	14.12.01.03	General	The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 14.12.1.1 shall be illuminated as follows: (1) During conditions of stair use, the minimum illumination for new stairs shall be at least 10 ft-candle (108 lux), measured at the walking surfaces.(2) The minimum illumination for floors and walking surfaces, other than new stairs, shall be to values of at least 1 ft-candle (10.8 lux) measured at the floor.(3) In assembly occupancies, the illumination of the floors of exit access shall be at least 0.2 ft-candle (2.2 lux) during periods of performances or projections involving directed light.(4)* The minimum illumination requirements shall not apply where operations or processes require low lighting levels. [101:7.8.1.3]	Similar
Means of Egress Illumination	1006.03	Illumination emergency power.	The power supply for means of egress illumination shall normally be provided by the premise's electrical supply. In the event of power supply failure, an emergency electrical system shall automatically illuminate the following areas: 1. Exit access corridors, passageways and aisles in rooms and spaces, which require two or more means of egress. 2. Exit access corridors and exit stairways located in buildings required to have two or more exits. 3. Exterior egress components at other than the level of exit discharge until exit discharge is accomplished for buildings required to have two or more exits. 4. Interior exit discharge elements, as permitted in Section 1023.1, in buildings required to have two or more exits. 5. The portion of the exterior exit discharge immediately adjacent to exit discharge doorways in buildings required to have two or more exits. The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 604.	Emergency Lighting	14.13.01.01	General	Emergency lighting facilities for means of egress shall be provided in accordance with Section 14.13 for the following: (1) Buildings or structures where required in Chapter 11 through Chapter 42 of NFPA 101 (2) Underground and limited access structures as addressed in Section 11.7 of NFPA 101 (3) High-rise buildings as required by NFPA 101 (4) Doors equipped with delayed-egress locks (5) Stair shaft and vestibule of smokeproof enclosures, for which the following also apply: (a) The stair shaft and vestibule shall be permitted to include a standby generator that is installed for the smokeproof enclosure mechanical ventilation equipment. (b) The standby generator shall be permitted to be used for the stair shaft and vestibule emergency lighting power supply. [101:7.9.1.1]	Similar
Doors, Gates and Turnstiles	1008.01	Doors.	Means of egress doors shall meet the requirements of this section. Doors serving a means of egress system shall meet the requirements of this section and Section 1017.2.	Means of Egress Reliability	14.04.02.01	Furnishings and Decorations in Means of Egress	No furnishings, decorations, or other objects shall obstruct exits, access thereto, egress therefrom, or visibility thereof. [101:7.1.10.2.1]	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			Doors provided for egress purposes in numbers greater than required by this code shall meet the requirements of this section. Means of egress doors shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.	Means of Egress Reliability	14.04.02.03	Furnishings and Decorations in Means of Egress	Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of egress. [101:7.1.10.2.3]	Similar
Doors, Gates and Turnstiles	1008.01.01.01	Projections into clear width.	There shall not be projections into the required clear width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).	Capacity of Means of Egress.	14.8.2.2	Measurement of Means of Egress.	Projections within the means of egress of not more than 4½ in. (114 mm) on each side shall be permitted at a height of 38 in. (965 mm) and below.	Similar
Doors, Gates and Turnstiles	1008.01.02	Door swing.	Egress doors shall be side-hinged swinging. Exceptions: 1. .... The opening force for interior side-swinging doors without closers shall not exceed a 5-pound (22 N) force. For other side-swinging, sliding and folding doors, the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force. Forces shall be applied to the latch side. 7. The door assembly power supply shall be electrically supervised. 8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.	Doors	14.05.01.01	Swing and Force to Open	Any door in a means of egress shall be of the side-hinged or pivoted-swinging type, and shall be installed to be capable of swinging from any position to the full required width of the opening in which it is installed, unless otherwise specified in 14.5.1.1.1 through 14.5.1.1.8. [101:7.2.1.4.1]	Similar
Doors, Gates and Turnstiles	1008.01.04	Floor elevation.	There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope). Exceptions: 1... 2. Exterior doors as provided for in Section 1003.5, Exception 1, and Section 1017.2, which are not on an accessible route. 3. In Group R-3 occupancies, the landing at an exterior doorway shall not be more than 7¼ inches (197 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door, does not swing over the landing. 4. Variations in elevation due to differences in finish materials, but not more than 0.5 inch (12.7 mm). 5. Exterior decks, patios or balconies that are part of Type B dwelling units and have impervious surfaces, and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the dwelling unit.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Doors, Gates and	1008.01.05	Landings at doors.	Landings shall have a width not less than the width of the stairway or the door, whichever is the	Doors.	14.5.1.4	Swing and Force to Open	During its swing, any door in a means of egress shall leave not less than one-half of the required	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Turnstiles			greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). When a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than one-half its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm). Exception: Landing length in the direction of travel in Group R-3 as applicable in Section 1001.1 and Group U and within individual units of Group R-2 as applicable in Section 1001.1, need not exceed 36 inches (914 mm).				width of an aisle, a corridor, a passageway, or a landing unobstructed and shall project not more than 7 in. (180 mm) into the required width of an aisle, a corridor, a passageway, or a landing, when fully open, unless both of the following conditions are met: (1) The door provides access to a stair in an existing building. (2) The door meets the requirement that limits projection to not more than 7 in. (180 mm) into the required width of a stair or landing when the door is fully open.	
Doors, Gates and Turnstiles	1008.01.06	Thresholds.	Thresholds at doorways shall not exceed 0.75 inch (19.1 mm) in height for sliding doors serving dwelling units or 0.5 inch (12.7 mm) for other doors. Raised thresholds and floor level changes greater than 0.25 inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-percent slope). Exception: The threshold height shall be limited to 7 3/4 inches (197 mm) where the occupancy is Group R-2 or R-3 as applicable in Section 1001.1, the door is an exterior door that is not a component of the required means of egress and the doorway is not on an accessible route.	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Doors, Gates and Turnstiles	1008.01.07	Door arrangement.	. Space between two doors in series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in series shall swing either in the same direction or away from the space between doors. Exceptions: 1. The minimum distance between horizontal sliding power-operated doors in a series shall be 48 inches (1219 mm). 2. Storm and screen doors serving individual dwelling units in Groups R-2 and R-3 as applicable in Section 1001.1 need not be spaced 48 inches (1219 mm) from the other door. 3. Doors within individual dwelling units in Groups R-2 and R-3 as applicable in Section 1001.1 other than within Type A dwelling units.	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Doors, Gates and Turnstiles	1008.01.09	Panic and fire exit hardware.	Where panic and fire exit hardware is installed, it shall comply with the following: 1. The actuating portion of the releasing device shall extend at least one-half of the door leaf width. 2. A maximum unlatching force of 15 pounds (67 N). Each door in a means of egress from an occupancy of Group A or E having an occupant load of 100 or more and any occupancy of Group H-1, H-2, H-3 or H-5 shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware. If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend more than one-half the width of the door	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Doors, Gates and Turnstiles	1008.03	Turnstiles.	measured from the latch side. Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required means of egress. Exception: Each turnstile or similar device shall be credited with no more than a 50-person capacity where all of the following provisions are met: 1. Each device shall turn free in the direction of egress travel when primary power is lost, and upon the manual release by an employee in the area. 2. Such devices are not given credit for more than 50 percent of the required egress capacity. 3. Each device is not more than 39 inches (991 mm) high. 4. Each device has at least 16.5 inches (419 mm) clear width at and below a height of 39 inches (991 mm) and at least 22 inches (559 mm) clear width at heights above 39 inches (991 mm). Where located as part of an accessible route, turnstiles shall have at least 36 inches (914 mm) clear at and below a height of 34 inches (864 mm), at least 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032mm) and shall consist of a mechanism other than a revolving device.	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Doors, Gates and Turnstiles	1008.03.01	High turnstile.	Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Ramps	1010.01	Scope.	The provisions of this section shall apply to ramps used as a component of a means of egress. Exceptions: 1. Other than ramps that are part of the accessible routes providing access in accordance with Sections 1108.2.2 through 1108.2.4.1 of the International Building Code, ramped aisles within assembly rooms or spaces shall conform to the provisions in Section 1024.11. 2. Curb ramps shall comply with ICC A117.1. 3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with Sections 1010.3 through 1010.9 when they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exit Signs	1011.01	Where required.	Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. Access to exits shall be marked by readily visible exit signs in cases where the exit or the path of egress travel is not immediately visible to the occupants. Exit sign placement shall be such that no point in an exit access corridor is more than 100 feet (30 480 mm) or the listed viewing distance for the sign, whichever is less, from the nearest visible exit sign. Exceptions: 1. Exit signs are not required in	Marking of Means of Egress	14.14.1.1	Where Required	Means of egress shall be marked in accordance with Section 14.14 where required in Chapter 11 through Chapter 42 of NFPA 101.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			rooms or areas which require only one exit or exit access. 2. Main exterior exit doors or gates which obviously and clearly are identifiable as exits need not have exit signs where approved by the fire code official. 3. Exit signs are not required in occupancies in Group U and individual sleeping units or dwelling units in Group R-1, R-2 or R-3. 4. Exit signs are not required in sleeping areas in occupancies in Group I-3. 5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.					
Exit Signs	1011.02	Illumination.	Exit signs shall be internally or externally illuminated. Exception: Tactile signs required by Section 1011.3 need not be provided with illumination.	Illumination of Signs	14.14.5.1	General	Every sign required by 14.14.1.2 or 14.14.1.4, other than where operations or processes require low lighting levels, shall be suitably illuminated by a reliable light source. Externally and internally illuminated signs shall be legible in both the normal and emergency lighting mode.	Similar
Exit Signs	1013.01	General.	The exit access arrangement shall comply with Sections 1013 through 1016 and the applicable provisions of Sections 1003 through 1012.	Marking of Means of Egress	14.14.1.5.1	Exit Access	Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants.	Similar
Exit Access	1013.02	Egress through intervening spaces.	Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas are accessory to the area served; are not a high-hazard occupancy and provide a discernible path of egress travel to an exit. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes. An exit access shall not pass through a room that can be locked to prevent egress. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms. Exceptions: 1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit. 2. Means of egress are not prohibited through adjoining or intervening rooms or spaces in a Group H occupancy when the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.	Arrangement of Means of Egress	14.10.2.1	Impediments to Egress	Access to an exit shall not be through kitchens, storerooms other than as provided in Chapter 36 and Chapter 37 of NFPA 101, restrooms, workrooms, closets, bedrooms or similar spaces, or other rooms or spaces subject to locking, unless passage through such rooms or spaces is permitted for the occupancy by Chapter 18, Chapter 19, Chapter 22, and Chapter 23 of NFPA 101.	Similar
Exit and Exit Access Doorways	1014.01	Exit or exit access doorways required.	Two exits or exit access doorways from any space shall be provided where one of the following conditions exists: 1. The occupant load of the space exceeds the values in Table 1014.1. 2. The common path of egress travel exceeds the limitations of Section 1013.3. 3. Where required by Sections 1014.3, 1014.4 and 1014.5.	Number of Means of Egress.	14.9.1.1	General.	The number of means of egress from any balcony, mezzanine, story, or portion thereof shall be not less than two, except under one of the following conditions: (1) Where a single means of egress is permitted in Chapter 11 through Chapter 42 of NFPA 101 (2) Where a single means of egress is permitted for	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			Exception: Group I-2 occupancies shall comply with Section 1013.2.2.				a mezzanine or balcony and the common path of travel limitations of Chapter 12 through Chapter 42 of NFPA 101 are met	
Exit and Exit Access Doorways	1014.01	Table 1014.1.	SPACES WITH ONE MEANS OF EGRESS	Number of Means of Egress	14.9.1.1	General	The number of means of egress from any balcony, mezzanine, story, or portion thereof shall be not less than two, except under one of the following conditions: (1) Where a single means of egress is permitted in Chapter 11 through Chapter 42 of NFPA 101 (2) Where a single means of egress is permitted for a mezzanine or balcony and the common path of travel limitations of Chapter 12 through Chapter 42 of NFPA 101 are met	Similar
Exit and Exit Access Doorways	1014.02	Exit or exit access doorway arrangement.	Required exits shall be located in a manner that makes their availability obvious. Exits shall be unobstructed at all times. Exit and exit access doorways shall be arranged in accordance with Sections 1014.2.1 and 1014.2.2	Arrangement of Means of Egress	14.10.2.2	Impediments to Egress	Exit access and exit doors shall be designed and arranged to be clearly recognizable.	Similar
Exit and Exit Access Doorways	1014.02.01	Two exits or exit access doorways.	Where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access doorways shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways. Interlocking or scissor stairs shall be counted as one exit stairway. Exceptions: 1. Where exit enclosures are provided as a portion of the required exit and are interconnected by a 1-hour fire-resistance-rated corridor conforming to the requirements of Section 1016, the required exit separation shall be measured along the shortest direct line of travel within the corridor. 2. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served.	Number of Means of Egress	14.10.1.3.2	General	Where two exits or exit access doors are required, they shall be placed at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors, unless otherwise provided in 14.10.1.3.3 through 14.10.1.3.5.	Similar. NFPA 1 contains a provision that allows the means of egress to be closer, if it can be shown that a single event is not likely to block both means of egress.
Exit Access Travel Distance	1015.01	Travel distance limitations.	Exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story to the entrance to an exit along the natural and unobstructed path of egress travel, shall not exceed the distances given in Table 1015.1. Where the path of exit access includes unenclosed stairways or ramps within the exit access or includes unenclosed exit ramps or stairways as permitted in Section 1019.1, the distance of travel on such means of egress components shall also be included in the travel distance measurement. The measurement along stairways shall be made on a plane parallel and	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			tangent to the stair tread nosings in the center of the stairway. Exceptions: 1. Travel distance in open parking garages is permitted to be measured to the closest riser of open stairs. 2. In outdoor facilities with open exit access components and open exterior stairs or ramps, travel distance is permitted to be measured to the closest riser of a stair or the closest slope of the ramp. 3. ...					
Exit Access Travel Distance	1015.01	Table 1015.1.	EXIT ACCESS TRAVEL DISTANCE	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exits	1017.01	General.	Exits shall comply with Sections 1017 through 1022 and the applicable requirements of Sections 1003 through 1012. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Number of Exits and Continuity	1018.01	Minimum number of exits.	All rooms and spaces within each story shall be provided with and have access to the minimum number of approved independent exits as required by Table 1018.1 based on the occupant load, except as modified in Section 1014.1 or 1018.2. For the purposes of this chapter, occupied roofs shall be provided with exits as required for stories. The required number of exits from any story, basement or individual space shall be maintained until arrival at grade or the public way.					Similar
Number of Exits and Continuity	1018.01	Table 1018.01.	MINIMUM NUMBER OF EXITS FOR OCCUPANT LOAD		Table 14.8.1.2		Occupant Load Factor	Similar
Exterior Exit Ramps and Stairways	1022.01	Exterior exit ramps and stairways.	Exterior exit ramps and stairways serving as an element of a required means of egress shall comply with this section. Exception: Exterior exit ramps and stairways for outdoor stadiums complying with Section 1019.1, Exception 2.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exterior Exit Ramps and Stairways	1022.02	Use in a means of egress.	Exterior exit ramps and stairways shall not be used as an element of a required means of egress for occupancies in Group I-2. For occupancies in other than Group I-2, exterior exit ramps and stairways shall be permitted as an element of a required means of egress for buildings not exceeding six stories or 75 feet (22 860 mm) in height.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exit Discharge	1023.01	General.	Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter a building. Exceptions: 1. A maximum of 50 percent of the number and capacity of the exit enclosures is permitted to egress through areas on the level of	Discharge from Exits	14.11.2	Discharge through Areas on Level of Exit Discharge	Not more than 50 percent of the capacity of the required number of exits, and not more than 50 percent of the required egress capacity, shall be permitted to discharge through areas on the level of exit discharge, unless otherwise permitted in 14.11.2.1 and 14.11.2.2, provided that the criteria of 14.11.2.3 through 14.11.2.6 are met.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			discharge provided all of the following are met: ....					
Exit Discharge	1023.02	Exit discharge capacity.	The capacity of the exit discharge shall be not less than the required discharge capacity of the exits being served.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exit Discharge	1023.03	Exit discharge location.	Exterior balconies, stairways and ramps shall be located at least 10 feet (3048 mm) from adjacent lot lines and from other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 704 of the International Building Code based on fire separation distance.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exit Discharge	1023.04	Exit discharge components.	Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Exit Discharge	1023.06	Access to a public way.	The exit discharge shall provide a direct and unobstructed access to a public way. Exception: Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met: 1. The area shall be of a size to accommodate at least 5 square feet (0.28 m2) for each person. 2. The area shall be located on the same property at least 50 feet (15 240 mm) away from the building requiring egress. 3. The area shall be permanently maintained and identified as a safe dispersal area. 4. The area shall be provided with a safe and unobstructed path of travel from the building.	Discharge from Exits	14.11.1	Exit Termination	Exits shall terminate directly, at a public way or at an exterior exit discharge, unless otherwise provided in 14.11.1.2 through 14.11.1.4.	Similar
Assembly	1024.01	General.	Occupancies in Group A which contain seats, tables, displays, equipment or other material shall comply with this section.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Assembly	1024.02	Assembly main exit.	Group A occupancies that have an occupant load of greater than 300 shall be provided with a main exit. The main exit shall be of sufficient width to accommodate not less than one-half of the occupant load, but such width shall not be less than the total required width of all means of egress leading to the exit. Where the building is classified as a Group A occupancy, the main exit shall front on at least one street or an unoccupied space of not less than 10 feet (3048 mm) in width that adjoins a street or public way. Exception: In assembly occupancies where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Assembly	1024.03	Assembly other exits.	In addition to having access to a main exit, each level of an occupancy in Group A having an occupant load of greater than 300 shall be provided with additional exits that shall provide an egress capacity for at least one-half of the	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			total occupant load served by that level and comply with Section 1014.2. Exception: In assembly occupancies where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width.					
Assembly	1024.04	Foyers and lobbies.	In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available and are allowed to wait in a lobby or similar space, such use of lobby or similar space shall not encroach upon the required clear width of the means of egress. Such waiting areas shall be separated from the required means of egress by substantial permanent partitions or by fixed rigid railings not less than 42 inches (1067 mm) high. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Assembly	1024.06	Width of means of egress for assembly.	The clear width of aisles and other means of egress shall comply with Section 1024.6.1 where smoke-protected seating is not provided and with Section 1024.6.2 or 1024.6.3 where smoke-protected seating is provided. The clear width shall be measured to walls, edges of seating and tread edges except for permitted projections.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Assembly	1024.06.01	Without smoke protection.	The clear width of the means of egress shall provide sufficient capacity in accordance with all of the following, as applicable: 1. At least 0.3 inch (7.6 mm) of width for each occupant served shall be provided on stairs having riser heights 7 inches (178 mm) or less and tread depths 11 inches (279 mm) or greater, measured horizontally between tread nosing. 2. At least 0.005 inch (0.127 mm) of additional stair width for each occupant shall be provided for each 0.10 inch (2.5mm) of riser height above 7 inches (178 mm). 3. Where egress requires stair descent, at least 0.075 inch (1.9 mm) of additional width for each occupant shall be provided on those portions of stair width having no handrail within a horizontal distance of 30 inches (762 mm). 4. Ramped means of egress, where slopes are steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.22 inch (5.6 mm) of clear width for each occupant served. Level or ramped means of egress, where slopes are not steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.20 inch (5.1 mm) of clear width for each occupant served.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Assembly	1024.07	Travel distance.	Exits and aisles shall be so located that the travel distance to an exit door shall not be greater than 200 feet (60 960 mm) measured along the line of travel in nonsprinklered buildings. Travel distance shall not be more than 250 feet (76 200 mm) in sprinklered buildings. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle accessway without travel over or on the seats. Exceptions: 1. Smoke-protected assembly seating: The travel distance from each seat to the nearest entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The travel distance from the entrance to the vomitory or concourse to a stair, ramp or walk on the exterior of the building shall not exceed 200 feet (60 960 mm). 2. Open-air seating: The travel distance from each seat to the building exterior shall not exceed 400 feet (122 m). The travel distance shall not be limited in facilities of Type I or II construction.	Means of Egress	14.1	Application.	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Assembly	1024.08	Common path of travel.	The common path of travel shall not exceed 30 feet (9144 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits. Exceptions: 1. For areas serving not more than 50 occupants, the common path of travel shall not exceed 75 feet (22 860 mm). 2. For smoke-protected assembly seating, the common path of travel shall not exceed 50 feet (15 240 mm).	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Means of Egress for Existing Buildings	1026.01	General.	Means of egress in existing buildings shall comply with Sections 1003 through 1025, except as amended in Section 1026. Exception: Mean of egress conforming to the requirements of the building code under which they were constructed shall be considered as complying means of egress if, in the opinion of the fire code official, they do not constitute a distinct hazard to life.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Means of Egress for Existing Buildings	1026.03	Exit sign illumination.	Exit signs shall be internally or externally illuminated. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 foot-candles (54 lux). Internally illuminated signs shall provide equivalent luminance and be listed for the purpose. Exception: Approved self-luminous signs that provide evenly illuminated letters shall have a minimum luminance of 0.06 foot-lamberts (0.21 cd/m2).	Marking of Means of Egress	14.14.5.1	Illumination of Signs	Every sign required by 14.14.1.2 or 14.14.1.4, other than where operations or processes require low lighting levels, shall be suitably illuminated by a reliable light source. Externally and internally illuminated signs shall be legible in both the normal and emergency lighting mode.	Similar
Means of Egress for Existing Buildings	1026.04	Power source.	Where emergency illumination is required in Section 1026.5, exit signs shall be visible under emergency illumination conditions. Exception: Approved signs that provide continuous illumination independent of external power sources are not required to be connected to an emergency electrical system.	Marking of Means of Egress	14.14.5.2.1	Illumination of Signs	Every sign required to be illuminated by 14.14.6.3 and 14.14.6.4 shall be continuously illuminated as required under the provisions of Section 7.8 of NFPA 101 unless otherwise provided in 14.14.5.2.2.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Means of Egress for Existing Buildings	1026.05	Illumination emergency power.	The power supply for means of egress illumination shall normally be provided by the premises' electrical supply. In the event of power supply failure, illumination shall be automatically provided from an emergency system for the following occupancies where such occupancies require two or more means of egress: 1. Group A having more than 50 occupants. Exception: Assembly occupancies used exclusively as a place of worship and having an occupant load of less than 300. 2. ...	Marking of Means of Egress	14.14.5.2.1	Illumination of Signs	Every sign required to be illuminated by 14.14.6.3 and 14.14.6.4 shall be continuously illuminated as required under the provisions of Section 7.8 of NFPA 101 unless otherwise provided in 14.14.5.2.2.	Similar
Means of Egress for Existing Buildings	1026.07	Size of doors.	The minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of not less than 28 inches (711 mm). Where this section requires a minimum clear width of 28 inches (711 mm) and a door opening includes two doors leaves without a mullion, one leaf shall provide a clear opening width of 28 inches (711 mm). The maximum width of a swinging door leaf shall be 48 inches (1219 mm) nominal. Means of egress doors in occupancy in Group I-2 used for the movement of beds shall provide a clear width not less than 41.5 inches (1054 mm). The height of doors shall not be less than 80 inches (2032 mm). Exceptions: 1. ... 2. ... 3. Width of door leaves in revolving doors that comply with Section 1003.3.1.3.1 shall not be limited. 4. ... 5. Exterior door openings in dwelling units, other than the required exit door, shall not be less than 76 inches (1930 mm) in height. 6. Exit access doors serving a room not larger than 70 square feet (6.5 m <sup>2</sup> ) shall be not less than 24 inches (610 mm) in door width.	Egress Capacity	14.8.3.3.1.1	Minimum Width	The width of any means of egress, unless otherwise provided in 14.8.3.3.1.1 through 14.8.3.3.1.3, shall be as follows: (1) Not less than that required for a given egress component in Chapter 7 or Chapter 12 through Chapter 42 of NFPA 101 (2) Not less than 36 in. (915 mm)	Similar
Means of Egress for Existing Buildings	1026.08	Opening force for doors.	The opening force for interior side-swinging doors without closers shall not exceed a 5-pound (22 N) force. For other side-swinging, sliding and folding doors, the door latch shall release when subjected to a force of not more than 15 pounds (66 N). The door shall be set in motion when subjected to a force not exceeding a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a force of not more than 50 pounds (222 N). Forces shall be applied to the latch side.	Doors.	14.5.1.5	Swing and Force to Open.	The forces required to fully open any door manually in a means of egress shall not exceed 15 lbf (67 N) to release the latch, 30 lbf (133 N) to set the door in motion, and 15 lbf (67 N) to open the door to the minimum required width, unless otherwise specified in 14.5.1.5.2 through 14.5.1.5.5.	Similar
Means of Egress for Existing Buildings	1026.1	Stair dimensions for existing stairs.	Existing stairs in buildings shall be permitted to remain if the rise does not exceed 8.25 inches (210 mm) and the run is not less than 9 inches (229 mm). Existing stairs can be rebuilt. Exception: Other stairs approved by the fire code official.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Means of Egress for Existing	1026.14	Slope of ramps.	Ramp runs utilized as part of a means of egress shall have a running slope not steeper than one unit vertical in ten units horizontal (10-percent	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
Buildings			slope). The slope of other ramps shall not be steeper than one unit vertical in eight units horizontal (12.5-percent slope).					
Means of Egress for Existing Buildings	1026.15	Width of ramps.	Existing ramps are permitted to have a minimum width of 30 inches (762 mm) but not less than the width required for the number of occupants served as determined by Section 1005.1	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Means of Egress for Existing Buildings	1026.17.02	Table 1026.17.2.	COMMON PATH, DEAD-END AND TRAVEL DISTANCE LIMITS (by occupancy).	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Maintenance of the Means of Egress	1027.01	General.	The means of egress for buildings or portions thereof shall be maintained in accordance with this section.	Means of Egress	14.4.1	Means of Egress Reliability	Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.	Similar
Maintenance of the Means of Egress	1027.02	Reliability.	Required exit accesses, exits or exit discharges shall be continuously maintained free from obstructions or impediments to full instant use in the case of fire or other emergency. Security devices affecting means of egress shall be subject to approval of the fire code official.	Means of Egress	14.4.1	Means of Egress Reliability	Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.	Similar
Maintenance of the Means of Egress	1027.03	Obstructions.	A means of egress shall be free from obstructions that would prevent its use, including the accumulation of snow and ice.	Means of Egress	14.1	Application	Means of egress in new and existing buildings shall comply with this Code and the referenced edition of NFPA 101®, Life Safety Code®.	Similar
Maintenance of the Means of Egress	1027.04	Furnishings and decorations.	Furnishings, decorations or other objects shall not be placed so as to obstruct exits, access thereto, egress there from, or visibility thereof. Hangings and draperies shall not be placed over exit doors or otherwise be located to conceal or obstruct an exit. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.	Means of Egress	14.4.2.1	Furnishings and Decorations in Means of Egress	No furnishings, decorations, or other objects shall obstruct exits, access thereto, egress therefrom, or visibility thereof.	Similar
	Chapter 33	Explosives and Fireworks						
General	3301.01	Scope.	The provisions of this chapter shall govern the possession, manufacture, storage, handling, sale and use of explosives, explosive materials, fireworks and small arms ammunition.	General	65.01.01		The storage, use, and handling of explosives, fireworks and model rocketry shall comply with the requirements of this chapter, NFPA standards referenced within this chapter and Section 60.1 and Section 60.2 of this Code.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			Exceptions: 1. The Armed Forces of the United States, Coast Guard or National Guard. 2. Explosives in forms prescribed by the official United States Pharmacopoeia. 3. The possession, storage and use of small arms ammunition when packaged in accordance with DOTn packaging requirements. 4. The possession, storage, and use of not more than 1 pound (0.454 kg) of commercially manufactured sporting black powder, 20 pounds (9 kg) of smokeless powder and 10,000 small arms primers for hand loading of small arms ammunition for personal consumption. 5. The use of explosive materials by federal, state and local regulatory, law enforcement and fire agencies acting in their official capacities. 6. Special industrial explosive devices, which in the aggregate contain less than 50 pounds (23 kg) of explosive materials. 7. The possession, storage and use of blank industrial- power load cartridges when packaged in accordance with DOTn packaging regulations. 8. Transportation in accordance with DOTn 49 CFR Parts 100-178. 9. Items preempted by federal regulations.	General	65.01.02		Where the provisions of this chapter or NFPA standards referenced herein conflict with the provisions of Chapter 60, the provisions of this chapter and referenced NFPA standards shall apply.	Similar
General	3301.01.03	Fireworks.	The possession, manufacture, storage, sale, handling and use of fireworks are prohibited. Exceptions: 1. Storage and handling of fireworks as permitted in Section 3304. 2. Manufacture, assembly and testing of fireworks as permitted in Section 3305. 3. The use of fireworks for display as permitted in Section 3308. 4. The possession, storage, sale, handling and use of specific types of Division 1.4G fireworks where allowed by applicable local or state laws, ordinances and regulations provided such fireworks comply with CPSC 16 CFR, Parts 1500 and 1507, and DOTn 49 CFR, Parts 100-178, for consumer fireworks.	General Requirements for Retail Sales of Consumer Fireworks	65.11.2.1	Display Fireworks and Pyrotechnic Articles	Retail sales of display fireworks and pyrotechnic articles, including the related storage and display for sale of such fireworks and articles, shall be prohibited at a consumer fireworks retail sales facility or store.	Similar
General	3301.02	Permit required.	Permits shall be required as set forth in Section 105.6 and regulated in accordance with this section.	Flame Effects Before an Audience	65.04.02		Permits, where required, shall comply with 1.12.19.	Similar
General	3301.02.03	Permit restrictions.	The fire code official is authorized to limit the quantity of explosives, explosive materials, or fireworks permitted at a given location. No person, possessing a permit for storage of explosives at any place, shall keep or store an amount greater than authorized in such permit. Only the kind of explosive specified in such a permit shall be kept or stored.	Display Fireworks	65.2.3	Permits	Permits, where required, shall comply with 1.12.19.	Similar
General	3301.02.04	Financial responsibility.	Before a permit is issued, as required by Section 3301.2, the applicant shall file with the jurisdiction a corporate surety bond in the principal sum of \$100,000 or a public liability insurance policy for the same amount, for the purpose of the payment of all damages to persons or property which arise	Display Fireworks	65.2.3	Permits	Permits, where required, shall comply with 1.12.19.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			from, or are caused by, the conduct of any act authorized by the permit upon which any judicial judgment results. The fire code official is authorized to specify a greater or lesser amount when, in his or her opinion, conditions at the location of use indicate a greater or lesser amount is required. Government entities shall be exempt from this bond requirement.					
General	3301.02.04.02	Fireworks display.	The permit holder shall furnish a bond or certificate of insurance in an amount deemed adequate by the fire code official for the payment of all potential damages to a person or persons or to property by reason of the permitted display, and arising from any acts of the permit holder, the agent, employees or subcontractors.	Display Fireworks	65.2.3	Permits	Permits, where required, shall comply with 1.12.19.	Similar
General	3301.04	Qualifications.	Persons in charge of magazines, blasting, fireworks display, or pyrotechnic special effect operations shall not be under the influence of alcohol or drugs which impair sensory or motor skills, shall be at least 21 years of age, and shall demonstrate knowledge of all safety precautions related to the storage, handling or use of explosives, explosive materials or fireworks.	Display Fireworks	65.2.1		The construction, handling, and use of fireworks intended solely for outdoor display as well as the general conduct and operation of the display shall comply with the requirements of NFPA 1123, Code for Fireworks Display.	Similar
General	3301.05	Supervision.	The fire code official is authorized to require operations permitted under the provisions of Section 3301.2 to be supervised at any time by the fire code official in order to determine compliance with all safety and fire regulations.	Display Fireworks	65.2.3	Permits	Permits, where required, shall comply with 1.12.19.	Similar
General	3301.06	Notification.	Whenever a new explosive material storage or manufacturing site is established, including a temporary job site, the local law enforcement agency, fire department, and local emergency planning committee shall be notified 48 hours in advance, not including Saturdays, Sundays and holidays, of the type, quantity and location of explosive materials at the site.	Display Fireworks	65.2.3	Permits	Permits, where required, shall comply with 1.12.19.	Similar
General	3301.07	Seizure.	The fire code official is authorized to remove or cause to be removed or disposed of in an approved manner, at the expense of the owner, explosives, explosive materials or fireworks offered or exposed for sale, stored, possessed or used in violation of this chapter.	Display Fireworks	65.2.3	Permits	Permits, where required, shall comply with 1.12.19.	Similar
Definitions	3302.01	Definitions.	The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.	General.	3.01		The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not included, common usage of the terms shall apply.	Similar
Definitions	3302.01	Fireworks.	Any composition or device for the purpose of producing a visible or an audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.4G fireworks or 1.3G fireworks as set forth herein.	Fireworks	3.03.91	Fireworks	Any composition or device for the purpose of producing a visible or an audible effect by combustion, deflagration, or detonation, and that meets the definition of Consumer Fireworks or Display Fireworks as set forth in this Code. [1124:3.3]	Similar
Definitions	3302.01	Fireworks 1.4G.	Formerly known as Class C, Common Fireworks.) Small fireworks devices containing restricted amounts of pyrotechnic composition	General Definitions	3.03.91.01	Consumer Fireworks	Any small fireworks device designed primarily to produce visible effects by combustion or deflagration that complies with the construction,	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			designed primarily to produce visible or audible effects by combustion. Such 1.4G fireworks which comply with the construction, chemical composition and labeling regulations of the DOTn for Fireworks, UN 0336, and the U.S. Consumer Product Safety Commission as set forth in CPSC 16 CFR: Parts 1500 and 1507, are not explosive materials for the purpose of this code.				chemical composition, and labeling regulations of the U.S. Consumer Product Safety Commission, as set forth in 16 CFR 1500 and 1507. [1124:3.3]	
Definitions	3302.01	Fireworks 1.3G.	(Formerly Class B, Special Fireworks.) Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or detonation. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition, and other display pieces, which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks, are also described as Fireworks, UN0335 by the DOTn.	Display Fireworks	3.03.91.02	Display Fireworks	Large fireworks articles designed to produce visible or audible effects for entertainment purposes by combustion, deflagration, or detonation. [1124:3.3]	Similar
Definitions	3302.01	Fireworks Display.	A presentation of fireworks for a public or private gathering.	Definitions	3.3.91.2	Display Fireworks	Large fireworks articles designed to produce visible or audible effects for entertainment purposes by combustion, deflagration, or detonation.	Similar
Fireworks Display	3308.01	General.	The display of fireworks, including proximate audience displays and pyrotechnic special effects in motion picture, television, theatrical, and group entertainment productions, shall comply with this chapter and NFPA 1123 or NFPA 1126.	Pyrotechnics Before a Proximate Audience	65.03.01		The use of pyrotechnic special effects in the performing arts in conjunction with theatrical, musical, or any similar productions before a proximate audience, performers, or support personnel shall comply with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.	Similar
				Flame Effects Before an Audience	65.04.01		The use of flame effects before an audience shall comply with NFPA 160, Standard for Flame Effects Before an Audience.	Similar
Fireworks Display	3308.02	Permit application.	Prior to issuing permits for fireworks display, plans for the display, inspections of the display site, and demonstrations of the display operations shall be approved.	Permits	65.03.03	Permits	Where any of the following conditions exit, they shall comply with NFPA 1126: (1) Any indoor display of pyrotechnic special effects (2) Any outdoor use of pyrotechnic special effects at distances less than those required by NFPA 1123, Code for Fireworks Display (3) The use of pyrotechnic special effects during any videotaping, audio taping, or filming of any television, radio, or movie production if such production is before a proximate audience (4) The rehearsal of any production in which pyrotechnic special effects are used	Similar
Fireworks Display	3308.02.02	Proximate audience displays.	Where the separation distances required by Section 3308.4 and NFPA 1123 are unavailable or cannot be secured, only proximate audience displays conducted in accordance with NFPA 1126 shall be allowed. Applications for proximate audience displays shall include plans indicating the required clearances for spectators and combustibles, crowd control measures, smoke	Pyrotechnics Before a Proximate Audience	65.03.01		The use of pyrotechnic special effects in the performing arts in conjunction with theatrical, musical, or any similar productions before a proximate audience, performers, or support personnel shall comply with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.	Similar

IFC Section Title	IFC Section Number	IFC Number Title	Text	NFPA 1 Section Title	NFPA 1 Section Number	NFPA 1 Number Title	Text	Analysis
			control measures, and requirements for standby personnel and equipment when provision of such personnel or equipment is required by the fire code official.					
Fireworks Display	3308.03	Approved displays.	Approved displays shall include only the approved Division 1.3G, Division 1.4G, and Division 1.4S fireworks, shall be handled by an approved competent operator, and the fireworks shall be arranged, located, discharged and fired in a manner that will not pose a hazard to property or endanger any person.	Pyrotechnics Before a Proximate Audience	65.03.01		The use of pyrotechnic special effects in the performing arts in conjunction with theatrical, musical, or any similar productions before a proximate audience, performers, or support personnel shall comply with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.	Similar
Fireworks Display	3308.04	Clearance.	Spectators, spectator parking areas, and dwellings, buildings or structures shall not be located within the display site. Exceptions: 1. This provision shall not apply to pyrotechnic special effects and displays using Division 1.4G materials before a proximate audience in accordance with NFPA 1126. 2. This provision shall not apply to unoccupied dwellings, buildings and structures with the approval of the building owner and the fire code official.	Pyrotechnics Before a Proximate Audience	65.03.01		The use of pyrotechnic special effects in the performing arts in conjunction with theatrical, musical, or any similar productions before a proximate audience, performers, or support personnel shall comply with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.	Similar
Fireworks Display	3308.05	Storage of fireworks at display site.	The storage of fireworks at the display site shall comply with the requirements of this section and NFPA 1123 or NFPA 1126.	Pyrotechnics Before a Proximate Audience	65.03.01		The use of pyrotechnic special effects in the performing arts in conjunction with theatrical, musical, or any similar productions before a proximate audience, performers, or support personnel shall comply with NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.	

### **K.3 REFERENCES FOR APPENDIX K**

- [1] *2003 International Building Code*, International Code Council, Inc., Country Club Hills, IL, 2002.
- [2] *NFPA 5000, Building Construction and Safety Code*, National Fire Protection Association, Quincy, MA, 2002
- [3] *2003 International Fire Code*, International Code Council, Inc., Country Club Hills, IL, 2002.
- [4] *NFPA 1, Uniform Fire Code*, National Fire Protection Association, Quincy, MA, 20

# APPENDIX L. COMPUTER SIMULATION INPUT FILES

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## L1. EVACUATION SIMULATIONS

### L1.1 Model 1: buildingEXODUS, Version 4.0

(Note: buildingEXODUS is a commercial code which cannot be distributed by NIST)

#### (i) Scenario 1 (all doors, kitchen limited):

- External exits were placed at all doorways leading to the outside (kitchen door, platform door, bar door – all 36”, and main door (72”)).
- Internal exit was placed at 36” door opening (mid door) at the center of the ticket taker area only
  - A unit flow rate was defined for each doorway (external and internal exits). This flow rate was used to compensate for the fact that two 0.5 by 0.5 m nodes (totaling 1 m) were used to represent a doorway, whereas an actual 36” doorway measured 0.91 m in length. Also 4 nodes (2 m) were used to simulate a 72” doorway measuring 1.8 m in length.
  - All 36” doorways (internal and external) were assigned a 1.22 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
  - The 72” doorway (external) was assigned a 1.2 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
- Event times were specified at certain external exits
  - Event times at external exits: Kitchen door closed after 5 seconds so only those beginning in the kitchen can use this door
- Two sets of steps were placed inside the nightclub area
  - One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5” in height)
  - One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7” diagonal length of steps)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:
  - Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
  - Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
  - Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
  - Behind both bars = 2-3 people for each station
  - Office space = 3 people

- Restrooms = 3 people each, 1 person for the office restroom
- Kitchen = 3 people
- Bathroom corridor = 4 people
- Dressing room = 3 people
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits
- Occupant characteristics chosen by the default, random generator function
- Local potential chosen

**(ii) Scenario 2 (trapped scenario):**

- External exits were placed at all doorways leading to the outside (kitchen door, platform door, bar door – all 36”, and main door (72’’)).
- Internal exits were placed at the 36” and 32” entrances to the ticket taker area and the 36” mid door at the center of the ticket taker area
  - A unit flow rate was defined for most doorways (external and internal exits) specified below. This flow rate was used to compensate for the fact that two 0.5 by 0.5 m nodes (totaling 1 m) were used to represent a doorway, whereas an actual 36” doorway measured 0.91 m in length. Also 4 nodes (2 m) were used to simulate a 72” doorway measuring 1.8 m in length.
  - The 36” doorways (the mid internal door and external doors) were assigned a 1.22 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
  - The 72” doorway (external) was assigned a 1.2 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
- Event times were specified at certain external exits and internal exits
  - Event times at external exits: Kitchen door closed after 5 seconds to simulate only those originating in the kitchen will use that door; platform door closed after 30 seconds; main door (2 36” doors) closed after 90 seconds
  - Event times at internal exits: 36” and 32” internal exits into the ticket taker area closed after 90 seconds; 36” mid door in center of ticket taker area remained open throughout entire evacuation
- Two sets of steps were placed inside the nightclub area
  - One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5” in height)
  - One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7” diagonal length of steps)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:

- Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
- Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
- Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
- Behind both bars = 2-3 people for each station
- Office space = 3 people
- Restrooms = 3 people each, 1 person for the office restroom
- Kitchen = 3 people
- Bathroom corridor = 4 people
- Dressing room = 3 people
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits, unless an exit closed, in which case the occupants traveled to the next closest exit
- Occupant characteristics chosen by the default, random generator function
- Local potential chosen

**(iii) Scenario 2\* (single door):**

- External exits were placed at all doorways leading to the outside (kitchen door, platform door, bar door – all 36”, and main door (72’’)).
- Internal exits were placed at the 36” and 32” entrances to the ticket taker area and the 36” mid door at the center of the ticket taker area
  - A unit flow rate was defined for each doorway (external and internal exits). This flow rate was used to compensate for the fact that two 0.5 by 0.5 m nodes (totaling 1 m) were used to represent a doorway, whereas an actual 36” doorway measured 0.91 m in length. Also 4 nodes (2 m) were used to simulate a 72” doorway measuring 1.8 m in length.
  - All 36” doorways (internal and external) were assigned a 1.22 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
  - The 32” doorway (internal) was assigned a 1.08 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
  - The 72” doorway (external) was assigned a 1.2 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
- Event times were specified at certain external exits
  - Event times at external exits: Kitchen door closed after 5 seconds to simulate only those originating in the kitchen will use that door; platform door closed after 30 seconds; all others remained open throughout the entire evacuation
- Two sets of steps were placed inside the nightclub area

- One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5" in height)
- One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7" diagonal length of steps)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:
  - Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
  - Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
  - Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
  - Behind both bars = 2-3 people for each station
  - Office space = 3 people
  - Restrooms = 3 people each, 1 person for the office restroom
  - Kitchen = 3 people
  - Bathroom corridor = 4 people
  - Dressing room = 3 people
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits, unless an exit closed, in which case the occupants traveled to the next closest exit
- Occupant characteristics chosen by the default, random generator function
- Local potential chosen

**(iv) Scenario 3 (double door):**

- External exits were placed at all doorways leading to the outside (kitchen door, platform door, bar door – all 36", and main door (72")).
- Internal exits were placed at the 36" and 32" entrances to the ticket taker area and the 72" mid door (double door) at the center of the ticket taker area
  - A unit flow rate was defined for each doorway (external and internal exits). This flow rate was used to compensate for the fact that two 0.5 by 0.5 m nodes (totaling 1 m) were used to represent a doorway, whereas an actual 36" doorway measured 0.91 m in length. Also 4 nodes (2 m) were used to simulate a 72" doorway measuring 1.8 m in length.
  - All 36" doorways (internal and external) were assigned a 1.22 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
  - The 32" doorway (internal) was assigned a 1.08 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)
  - All 72" doorways (internal and external) were assigned a 1.2 occ/m/s flow rate (in order to equate to the default of 1.33 occ/m/s)

- Event times were specified at certain external exits
  - Event times at external exits: Kitchen door closed after 5 seconds to simulate only those originating in the kitchen will use that door; platform door closed after 30 seconds; all others remained open throughout the entire evacuation
- Two sets of steps were placed inside the nightclub area
  - One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5" in height)
  - One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7" diagonal length of steps)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:
  - Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
  - Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
  - Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
  - Behind both bars = 2-3 people for each station
  - Office space = 3 people
  - Restrooms = 3 people each, 1 person for the office restroom
  - Kitchen = 3 people
  - Bathroom corridor = 4 people
  - Dressing room = 3 people
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits, unless an exit closed, in which case the occupants traveled to the next closest exit
- Occupant characteristics chosen by the default, random generator function
- Local potential chosen

#### **L.1.2 Model 2: Simulex, Version 11.1.3**

**(Simulex is a commercial code which cannot be distributed by NIST)**

##### **(i) Scenario 1 (all doors, kitchen limited):**

- Exits were placed at all doorways leading to the outside (kitchen door – only those beginning in the kitchen used this door, platform door, main door, bar door). For these, the width of the doorway was specified.
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits

- Occupant characteristics chosen as Commuters (also ran each simulation with 60% men and 40% women only and found no difference in results)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:
  - Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
  - Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
  - Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
  - Behind both bars = 2-3 people for each station
  - Office space = 3 people
  - Restrooms = 3 people each, 1 person for the office restroom
  - Kitchen = 3 people
  - Bathroom corridor = 4 people
  - Dressing room = 3 people
- Two sets of steps were placed inside the nightclub area
  - One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5" in height)
  - One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7" diagonal length of steps)

**(ii) Inputs used for Scenario 2\* (single door):**

- Exits were placed at all doorways leading to the outside (kitchen door – only those beginning in the kitchen used this door, platform door – 39 people specified to use this door only to simulate a door that stays open for 30 seconds, main door, bar door). For these, the width of the doorway was specified.
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits, other than the 39 occupants specified to use the platform door only
- Occupant characteristics chosen as Commuters (also ran each simulation with 60% men and 40% women only and found no difference in results)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:
  - Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
  - Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
  - Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
  - Behind both bars = 2-3 people for each station
  - Office space = 3 people

- Restrooms = 3 people each, 1 person for the office restroom
- Kitchen = 3 people
- Bathroom corridor = 4 people
- Dressing room = 3 people
- Two sets of steps were placed inside the nightclub area
  - One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5" in height)
  - One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7" diagonal length of steps)

**(iii) Scenario 3 (double door):**

- Exits were placed at all doorways leading to the outside (kitchen door – only those beginning in the kitchen used this door, platform door – 39 people specified to use this door only to simulate a door that stays open for 30 seconds, main door, bar door). For these, the width of the doorway was specified.
- Pre-evacuation time/delay time = 0 seconds
- Shortest route chosen to exits, other than the 39 occupants specified to use the platform door only
- Occupant characteristics chosen as Commuters (also ran each simulation with 60% men and 40% women only and found no difference in results)
- CAD drawings were used to provide accurate opening distances throughout the space
- 420 people were placed throughout the nightclub in the following pattern:
  - Main bar and surrounding open areas = 5 ft<sup>2</sup>/person
  - Raised dining area, Sunroom = 7 ft<sup>2</sup>/person
  - Main Bar, Open area left of Side Bar = 15 ft<sup>2</sup>/person
  - Behind both bars = 2-3 people for each station
  - Office space = 3 people
  - Restrooms = 3 people each, 1 person for the office restroom
  - Kitchen = 3 people
  - Bathroom corridor = 4 people
  - Dressing room = 3 people
- Two sets of steps were placed inside the nightclub area
  - One set was used to connect the raised dining area to the main floor = 1 simulated step (7.5" in height)
  - One set was used to connect the stage/platform to the main floor = 3 simulated steps (36.7" diagonal length of steps)

## L2. FIRE DYNAMIC SIMULATOR VERSION 4.0

(Note: Executable FDS 4.0 computer code included on accompanying DVD)

In order to allow the combustion gases to be exhausted into an instrumented hood, the real-scale mock-up experiments were conducted with the platform section oriented to the east of the dance floor. In the actual nightclub, the platform section was west of the dance floor. In order to be consistent, the mock-up data was discussed in Chapter 4 using the orientation of the actual nightclub. However, in the FDS runs for the mock-up simulations, the original orientation of the mock-up was used. For example, in the mock-up the “front” of the nightclub was the south wall, but in the actual nightclub, the “front” of the nightclub faced north. Therefore, in the FDS data input file, a reference to the “north wall” should be interpreted as the north wall of the mock-up experiment, but the south wall of the actual nightclub.

### L2.1 Platform Area Mockup, Un-sprinklered

```
&HEAD CHID='rifs250',TITLE='Stage ' /
&GRID IBAR=120, JBAR=70, KBAR=38 /
&PDIM XBAR0=0.0,XBAR=12.00,YBAR0=0.00,YBAR=7.00,ZBAR=3.80 /
&TIME TWFIN=200. /
&MISC SURF_DEFAULT='GYPSUM BOARD',NFRAMES=1800,REACTION='POLYURETHANE'/
```

```
&SURF ID='FOAM'
FYI= 'Test Data'
RGB=0.451, 0.3568, 0.3647
HEAT_OF_VAPORIZATION=1350.
BACKING='PANELING'
KS=0.034
DX_SOLID=0.00005
C_P=1.4
DELTA=0.018
DENSITY=22.0
TMPIGN=370.
BURNING_RATE_MAX=0.008/
```

```
&SURF ID = 'PANELING'
FYI = 'Charring material'
RGB = 0.5,0.2,0.1
PHASE = 'CHAR'
MOISTURE_FRACTION = 0.01
DELTA = 0.005
TMPIGN = 360.0
HEAT_OF_VAPORIZATION = 500.
DENSITY = 450.
RAMP_KS = 'KS'
RAMP_C_P = 'CPV'
RAMP_C_P_CHAR = 'CPC'
RAMP_KS_CHAR = 'KSC'
CHAR_DENSITY = 120.
WALL_POINTS = 30
BACKING = 'EXPOSED'/
&RAMP ID = 'KS', T = 20., F = 0.13 /
&RAMP ID = 'KS', T = 500., F = 0.29 /
&RAMP ID = 'KSC', T = 20., F = 0.077 /
&RAMP ID = 'KSC', T = 900., F = 0.16 /
&RAMP ID = 'CPV', T = 20., F = 1.2 /
&RAMP ID = 'CPV', T = 500., F = 3.0 /
&RAMP ID = 'CPC', T = 20., F = 0.68 /
&RAMP ID = 'CPC', T = 400., F = 1.5 /
&RAMP ID = 'CPC', T = 900., F = 1.8 /
```

```
&SURF ID = 'GYPSUM BOARD'
RGB = 0.80,0.80,0.70
HRRPUA = 100.
RAMP_Q = 'GB'
KS = 0.48
ALPHA = 4.1E-7
```

DELTA = 0.013  
 TMPIGN = 400. /  
 &RAMP ID='GB',T= 0.0,F=0.0 /  
 &RAMP ID='GB',T= 1.0,F=0.5 /  
 &RAMP ID='GB',T= 2.0,F=1.0 /  
 &RAMP ID='GB',T=10.0,F=1.0 /  
 &RAMP ID='GB',T=20.0,F=0.0 /  
 &RAMP ID='GB',T=30.0,F=0.0 /  
  
 &SURF ID = 'CARPET'  
 RGB = 0.60,0.80,1.00  
 C\_DELTA\_RHO = 1.29  
 BACKING = 'INSULATED'  
 TMPIGN = 280.  
 SURFACE\_DENSITY = 0.3  
 BURNING\_RATE\_MAX = 0.01  
 HEAT\_OF\_COMBUSTION = 20000.  
 HEAT\_OF\_VAPORIZATION= 3000. /  
  
 &REAC ID='POLYURETHANE'  
 FYI='C\_6.3 H\_7.1 N O\_2.1, NFPA Handbook, Babrauskas'  
 SOOT\_YIELD = 0.05  
 MW\_FUEL = 130.3  
 FUEL\_N2 = 0.5  
 NU\_CO2 = 6.3  
 NU\_H2O = 3.55  
 NU\_O2 = 7.025 /  
  
 &SURF ID='FIRE',HRRPUA=1500.,RGB=1,0,0 /  
  
 &VENT XB= 9.60, 9.60, 4.30, 4.40, 1.90, 2.10, SURF\_ID='FIRE' /  
 &VENT XB= 9.60, 9.70, 4.30, 4.30, 1.90, 2.00, SURF\_ID='FIRE' /  
 &VENT XB= 9.60, 9.60, 1.10, 1.20, 1.90, 2.10, SURF\_ID='FIRE' /  
 &VENT XB= 9.60, 9.70, 1.20, 1.20, 1.90, 2.00, SURF\_ID='FIRE' /  
  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='INCIDENT\_HEAT\_FLUX',LABEL='Top Flux' /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='BURNING\_RATE',LABEL='Top Burn' /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='WALL\_TEMPERATURE',LABEL='Top Temp' /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='INSIDE\_WALL\_TEMPERATURE',LABEL='2 mm',DEPTH=0.002 /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='INSIDE\_WALL\_TEMPERATURE',LABEL='4 mm',DEPTH=0.004 /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='CHAR\_DEPTH',LABEL='Top Char Depth' /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='BURN\_DEPTH',LABEL='Top Burn Depth' /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='PYROLYSIS',LABEL='Top Pyro' /  
 &THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='CONDUCTION',LABEL='Top Cond' /  
  
 &OBST XB= 1.20, 1.20, 0.00, 2.28, 0.00, 3.80 / south of door  
 &OBST XB= 1.20, 1.20, 2.29, 3.19, 2.00, 3.80 / above door  
 &OBST XB= 1.20, 1.20, 3.20, 7.00, 0.00, 3.80 / north of door  
 &OBST XB= 7.16, 9.60, 0.00, 7.00, 0.00, 0.40, SURF\_ID='CARPET' / stage  
 &OBST XB= 7.16, 9.60, 6.90, 7.00, 0.40, 3.80, SURF\_ID='FOAM' / North Stage Wall  
 &OBST XB= 4.75, 7.16, 6.90, 7.00, 1.35, 3.80, SURF\_ID='FOAM' / Upper North Wall Foam  
 &OBST XB= 4.75, 7.16, 6.90, 7.00, 0.00, 1.35, SURF\_ID='PANELING' / Lower North Wall Paneling  
 &OBST XB= 3.53, 4.75, 6.90, 7.00, 0.00, 3.80, SURF\_ID='PANELING' / North Wall Paneling  
 &OBST XB= 9.60, 12.00, 4.30, 7.00, 0.00, 3.80, SURF\_ID='FOAM' / box north of drummers alcove  
 &OBST XB= 9.60, 12.00, 0.00, 1.20, 0.00, 3.80, SURF\_ID='FOAM' / box south of drummers alcove  
 &OBST XB= 9.60, 12.00, 1.20, 4.30, 0.00, 0.74, SURF\_ID='CARPET' / step up to drummers alcove  
 &OBST XB= 9.60, 12.00, 1.20, 4.30, 2.70, 3.80, SURF\_ID='FOAM' / cEILING OF DRUMMERS ALCOVE  
 &OBST XB= 11.75, 12.00, 1.20, 4.30, 0.74, 2.70, SURF\_ID='FOAM' / EAST WALL OF DRUMMERS ALCOVE  
 &OBST XB= 7.16, 9.60, 0.00, 0.10, 0.40, 3.80, SURF\_ID='PANELING' / SOUTH Stage Wall  
 &VENT CB='XBAR0',SURF\_ID='OPEN' /  
  
 &PL3D DTSAM=20. /  
  
 &BNDF QUANTITY='WMPUA' /  
 &BNDF QUANTITY='GAUGE\_HEAT\_FLUX' /  
 &BNDF QUANTITY='WALL\_TEMPERATURE' /  
 &BNDF QUANTITY='BURNING\_RATE' /  
  
 &SLCF PBX=4.11,QUANTITY='TEMPERATURE' /  
 &SLCF PBX=4.11,QUANTITY='HRRPUV' /  
 &SLCF PBX=4.11,QUANTITY='MIXTURE\_FRACTION' /  
 &SLCF PBX=4.11,QUANTITY='RADIANT\_INTENSITY' /  
 &SLCF PBX=4.11,QUANTITY='ABSORPTION\_COEFFICIENT' /  
 &SLCF PBX=7.77,QUANTITY='TEMPERATURE' /  
 &SLCF PBX=7.77,QUANTITY='HRRPUV' /  
 &SLCF PBX=7.77,QUANTITY='MIXTURE\_FRACTION' /

&SLCF PBX=7.77,QUANTITY='RADIANT\_INTENSITY' /  
&SLCF PBX=7.77,QUANTITY='ABSORPTION\_COEFFICIENT' /  
&SLCF PBY=2.74,QUANTITY='VELOCITY' /  
&SLCF PBY=2.74,QUANTITY='TEMPERATURE' /  
&SLCF PBY=2.74,QUANTITY='oxygen' /

&SLCF PBZ=1.4,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=1.4,QUANTITY='oxygen' /

&THCP XYZ=10.8,4.28,2.40,QUANTITY='TEMPERATURE' / Drummers Box N3  
&THCP XYZ=10.8,4.28,2.09,QUANTITY='TEMPERATURE' / Drummers Box N4  
&THCP XYZ=10.8,4.28,1.79,QUANTITY='TEMPERATURE' / Drummers Box N5  
&THCP XYZ=10.8,4.28,1.48,QUANTITY='TEMPERATURE' / Drummers Box N6  
&THCP XYZ=10.8,4.28,1.18,QUANTITY='TEMPERATURE' / Drummers Box N7  
&THCP XYZ=10.8,4.28,0.87,QUANTITY='TEMPERATURE' / Drummers Box N8

&THCP XYZ=11.98,2.74,2.40,QUANTITY='TEMPERATURE' / Drummers Box E9  
&THCP XYZ=11.98,2.74,2.09,QUANTITY='TEMPERATURE' / Drummers Box E10  
&THCP XYZ=11.98,2.74,1.79,QUANTITY='TEMPERATURE' / Drummers Box E11  
&THCP XYZ=11.98,2.74,1.48,QUANTITY='TEMPERATURE' / Drummers Box E12  
&THCP XYZ=11.98,2.74,1.18,QUANTITY='TEMPERATURE' / Drummers Box E13  
&THCP XYZ=11.98,2.74,0.87,QUANTITY='TEMPERATURE' / Drummers Box E14

&THCP XYZ=10.8,1.22,2.40,QUANTITY='TEMPERATURE' / Drummers Box S15  
&THCP XYZ=10.8,1.22,2.09,QUANTITY='TEMPERATURE' / Drummers Box S16  
&THCP XYZ=10.8,1.22,1.79,QUANTITY='TEMPERATURE' / Drummers Box S17  
&THCP XYZ=10.8,1.22,1.48,QUANTITY='TEMPERATURE' / Drummers Box S18  
&THCP XYZ=10.8,1.22,1.18,QUANTITY='TEMPERATURE' / Drummers Box S19  
&THCP XYZ=10.8,1.22,0.87,QUANTITY='TEMPERATURE' / Drummers Box S20

&THCP XYZ=8.38,2.74,3.77,QUANTITY='TEMPERATURE' /Stage Center Ceiling21  
&THCP XYZ=8.38,2.74,3.50,QUANTITY='TEMPERATURE' /SC22  
&THCP XYZ=8.38,2.74,3.19,QUANTITY='TEMPERATURE' /SC23  
&THCP XYZ=8.38,2.74,2.89,QUANTITY='TEMPERATURE' /SC24  
&THCP XYZ=8.38,2.74,2.58,QUANTITY='TEMPERATURE' /SC25  
&THCP XYZ=8.38,2.74,2.28,QUANTITY='TEMPERATURE' /SC26  
&THCP XYZ=8.38,2.74,1.97,QUANTITY='TEMPERATURE' /SC27  
&THCP XYZ=8.38,2.74,1.67,QUANTITY='TEMPERATURE' /SC28  
&THCP XYZ=8.38,2.74,1.36,QUANTITY='TEMPERATURE' /SC29  
&THCP XYZ=8.38,2.74,1.06,QUANTITY='TEMPERATURE' /SC30  
&THCP XYZ=8.38,2.74,0.75,QUANTITY='TEMPERATURE' /SC31  
&THCP XYZ=8.38,2.74,0.45,QUANTITY='TEMPERATURE' /SC32

&THCP XYZ=5.58,2.74,3.77,QUANTITY='TEMPERATURE' /Dance Floor East34  
&THCP XYZ=5.58,2.74,3.50,QUANTITY='TEMPERATURE' /DFE35  
&THCP XYZ=5.58,2.74,3.19,QUANTITY='TEMPERATURE' /DFE36  
&THCP XYZ=5.58,2.74,2.89,QUANTITY='TEMPERATURE' /DFE37  
&THCP XYZ=5.58,2.74,2.58,QUANTITY='TEMPERATURE' /DFE38  
&THCP XYZ=5.58,2.74,2.28,QUANTITY='TEMPERATURE' /DFE39  
&THCP XYZ=5.58,2.74,1.97,QUANTITY='TEMPERATURE' /DFE40  
&THCP XYZ=5.58,2.74,1.67,QUANTITY='TEMPERATURE' /DFE41  
&THCP XYZ=5.58,2.74,1.36,QUANTITY='TEMPERATURE' /DFE42  
&THCP XYZ=5.58,2.74,1.06,QUANTITY='TEMPERATURE' /DFE43  
&THCP XYZ=5.58,2.74,0.75,QUANTITY='TEMPERATURE' /DFE44  
&THCP XYZ=5.58,2.74,0.45,QUANTITY='TEMPERATURE' /DFE45  
&THCP XYZ=5.58,2.74,0.14,QUANTITY='TEMPERATURE' /DFE46

&THCP XYZ=3.62,2.74,3.77,QUANTITY='TEMPERATURE' /Dance Floor West47  
&THCP XYZ=3.62,2.74,3.50,QUANTITY='TEMPERATURE' /DFE48  
&THCP XYZ=3.62,2.74,3.19,QUANTITY='TEMPERATURE' /DFE49  
&THCP XYZ=3.62,2.74,2.89,QUANTITY='TEMPERATURE' /DFE50  
&THCP XYZ=3.62,2.74,2.58,QUANTITY='TEMPERATURE' /DFE51  
&THCP XYZ=3.62,2.74,2.28,QUANTITY='TEMPERATURE' /DFE52  
&THCP XYZ=3.62,2.74,1.97,QUANTITY='TEMPERATURE' /DFE53  
&THCP XYZ=3.62,2.74,1.67,QUANTITY='TEMPERATURE' /DFE54  
&THCP XYZ=3.62,2.74,1.36,QUANTITY='TEMPERATURE' /DFE55  
&THCP XYZ=3.62,2.74,1.06,QUANTITY='TEMPERATURE' /DFE56  
&THCP XYZ=3.62,2.74,0.75,QUANTITY='TEMPERATURE' /DFE57  
&THCP XYZ=3.62,2.74,0.45,QUANTITY='TEMPERATURE' /DFE58  
&THCP XYZ=3.62,2.74,0.14,QUANTITY='TEMPERATURE' /DFE59

&THCP XYZ=10.80,2.75,2.65,QUANTITY='TEMPERATURE' /Sprinkler Drummers Box60

&THCP XYZ=7.77,5.33,3.75,QUANTITY='TEMPERATURE' /Sprinkler NE DF61  
&THCP XYZ=7.77,1.67,3.75,QUANTITY='TEMPERATURE' /Sprinkler SE DF62  
&THCP XYZ=4.11,5.33,3.75,QUANTITY='TEMPERATURE' /Sprinkler NW DF63

&THCP XYZ=4.11,1.67,3.75,QUANTITY='TEMPERATURE' /Sprinkler SW DF64

&THCP XYZ=9.56,2.74,3.50,QUANTITY='TEMPERATURE' /NE Stage Wall65  
&THCP XYZ=9.56,3.05,3.50,QUANTITY='TEMPERATURE' /Ne SW66  
&THCP XYZ=9.56,3.35,3.50,QUANTITY='TEMPERATURE' /Ne SW67  
&THCP XYZ=9.56,3.66,3.50,QUANTITY='TEMPERATURE' /Ne SW68  
&THCP XYZ=9.56,3.96,3.50,QUANTITY='TEMPERATURE' /Ne SW69  
&THCP XYZ=9.56,4.27,3.50,QUANTITY='TEMPERATURE' /Ne SW70  
&THCP XYZ=9.56,4.57,3.50,QUANTITY='TEMPERATURE' /Ne SW71  
&THCP XYZ=9.56,4.88,3.50,QUANTITY='TEMPERATURE' /Ne SW72  
&THCP XYZ=9.56,5.18,3.50,QUANTITY='TEMPERATURE' /Ne SW73  
&THCP XYZ=9.56,5.49,3.50,QUANTITY='TEMPERATURE' /Ne SW74  
&THCP XYZ=9.56,5.79,3.50,QUANTITY='TEMPERATURE' /Ne SW75  
&THCP XYZ=9.56,6.10,3.50,QUANTITY='TEMPERATURE' /Ne SW76  
&THCP XYZ=9.56,6.40,3.50,QUANTITY='TEMPERATURE' /Ne SW77  
&THCP XYZ=9.56,6.71,3.50,QUANTITY='TEMPERATURE' /Ne SW78  
&THCP XYZ=9.56,7.01,3.50,QUANTITY='TEMPERATURE' /Ne SW79  
&THCP XYZ=9.56,7.32,3.50,QUANTITY='TEMPERATURE' /Ne SW80

&THCP XYZ=9.26,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling81  
&THCP XYZ=8.95,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling82  
&THCP XYZ=8.65,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling83  
&THCP XYZ=8.34,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling84  
&THCP XYZ=8.04,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling85  
&THCP XYZ=7.73,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling86  
&THCP XYZ=7.43,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling87  
&THCP XYZ=7.12,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling88  
&THCP XYZ=6.82,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling89  
&THCP XYZ=6.51,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling90  
&THCP XYZ=6.21,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling91  
&THCP XYZ=5.90,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling92  
&THCP XYZ=5.60,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling93  
&THCP XYZ=5.29,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling94  
&THCP XYZ=4.99,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling95  
&THCP XYZ=4.68,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling96  
&THCP XYZ=4.38,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling97  
&THCP XYZ=4.08,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling98  
&THCP XYZ=3.77,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling99  
&THCP XYZ=3.47,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling100

&THCP XYZ=1.20,2.58,1.77,QUANTITY='TEMPERATURE' /Drwy STemp1  
&THCP XYZ=1.20,2.58,1.70,QUANTITY='TEMPERATURE' /Drwy STemp2  
&THCP XYZ=1.20,2.58,1.40,QUANTITY='TEMPERATURE' /Drwy STemp3  
&THCP XYZ=1.20,2.58,1.06,QUANTITY='TEMPERATURE' /Drwy STemp4  
&THCP XYZ=1.20,2.58,0.78,QUANTITY='TEMPERATURE' /Drwy STemp5  
&THCP XYZ=1.20,2.58,0.48,QUANTITY='TEMPERATURE' /Drwy STemp6

&THCP XYZ=1.20,2.58,1.77,QUANTITY='VELOCITY' /Drwy SVEL1  
&THCP XYZ=1.20,2.58,1.70,QUANTITY='VELOCITY' /Drwy SVEL2  
&THCP XYZ=1.20,2.58,1.40,QUANTITY='VELOCITY' /Drwy SVEL3  
&THCP XYZ=1.20,2.58,1.06,QUANTITY='VELOCITY' /Drwy SVEL4  
&THCP XYZ=1.20,2.58,0.78,QUANTITY='VELOCITY' /Drwy SVEL5  
&THCP XYZ=1.20,2.58,0.48,QUANTITY='VELOCITY' /Drwy SVEL6

&THCP XYZ=1.20,2.89,1.77,QUANTITY='TEMPERATURE' /Drwy NTemp1  
&THCP XYZ=1.20,2.89,1.70,QUANTITY='TEMPERATURE' /Drwy NTemp2  
&THCP XYZ=1.20,2.89,1.40,QUANTITY='TEMPERATURE' /Drwy NTemp3  
&THCP XYZ=1.20,2.89,1.06,QUANTITY='TEMPERATURE' /Drwy NTemp4  
&THCP XYZ=1.20,2.89,0.78,QUANTITY='TEMPERATURE' /Drwy NTemp5  
&THCP XYZ=1.20,2.89,0.48,QUANTITY='TEMPERATURE' /Drwy NTemp6

&THCP XYZ=1.20,2.89,1.77,QUANTITY='VELOCITY' /Drwy NVEL1  
&THCP XYZ=1.20,2.89,1.70,QUANTITY='VELOCITY' /Drwy NVEL2  
&THCP XYZ=1.20,2.89,1.40,QUANTITY='VELOCITY' /Drwy NVEL3  
&THCP XYZ=1.20,2.89,1.06,QUANTITY='VELOCITY' /Drwy NVEL4  
&THCP XYZ=1.20,2.89,0.78,QUANTITY='VELOCITY' /Drwy NVEL5  
&THCP XYZ=1.20,2.89,0.48,QUANTITY='VELOCITY' /Drwy NVEL6

&THCP XYZ=5.33,2.74,1.50,QUANTITY='oxygen',LABEL='DFNO2'  
&THCP XYZ=3.51,2.74,1.50,QUANTITY='oxygen',LABEL='DFFO2'

&THCP XYZ=8.30,2.74,3.80,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=-3,LABEL='SCRAD' /Stage Ceiling  
&THCP XYZ=8.30,2.74,0.40,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=3,LABEL='SCFLRAD' /Stage Floor  
&THCP XYZ=5.48,2.74,3.80,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=-3,LABEL='DFNCRAD' /DANCE FLOOR NEAR CEIL

&OBST XB= 5.40,5.60,2.70,2.80,1.40,1.60 / GHF block

&OBST XB= 3.40,3.60,2.70,2.80,1.40,1.60 / GHF block  
&THCP XYZ=5.48,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=1,LABEL='DFNsRAD' /DANCE FLOOR NEAR  
&THCP XYZ=5.48,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=3,LABEL='DFNURAD' /DANCE FLOOR NEAR  
&THCP XYZ=3.50,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=1,LABEL='DFFsRAD' /DANCE FLOOR FAR  
&THCP XYZ=3.50,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=3,LABEL='DFFURAD' /DANCE FLOOR FAR  
&THCP XYZ=3.50,2.74,3.80,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=-3,LABEL='DFFCRAD' /DANCE FLOOR FAR CEIL

## L.2.3 Platform Area Mockup, Sprinklered

```
&HEAD CHID='rifs270',TITLE='Stage with sprinklers' /
&GRID IBAR=120, JBAR=70, KBAR=38 /
&PDIM XBAR0=0.0,XBAR=12.00,YBAR0=0.00,YBAR=7.00,ZBAR=3.80 /
&TIME TWFIN=200. /
&MISC SURF_DEFAULT='GYPSUM BOARD',NFRAMES=1000,REACTION='POLYURETHANE', DROP_VERTICAL_VELOCITY=0.5,
SMOKE3D=.TRUE., MAXIMUM_DROPLETS=1000000/
&PART ID='my water droplets', WATER=.TRUE., AGE=15, DROPLETS_PER_SECOND=20000/
```

```
&SURF ID='FOAM'
FYI= 'Test Data'
RGB=0.451, 0.3568, 0.3647
HEAT_OF_VAPORIZATION=1350.
BACKING='PANELING'
KS=0.034
DX_SOLID=0.00005
C_P=1.4
DELTA=0.018
DENSITY=22.0
TMPIGN=370.
BURNING_RATE_MAX=0.008/
```

```
&SURF ID      = 'PANELING'
FYI          = 'Charring material'
RGB         = 0.5,0.2,0.1
PHASE       = 'CHAR'
MOISTURE_FRACTION = 0.01
DELTA       = 0.005
TMPIGN      = 360.0
HEAT_OF_VAPORIZATION = 500.
DENSITY     = 450.
RAMP_KS     = 'KS'
RAMP_C_P    = 'CPV'
RAMP_C_P_CHAR = 'CPC'
RAMP_KS_CHAR = 'KSC'
CHAR_DENSITY = 120.
WALL_POINTS = 30
BACKING     = 'EXPOSED'/
&RAMP ID = 'KS', T = 20., F = 0.13 /
&RAMP ID = 'KS', T = 500., F = 0.29 /
&RAMP ID = 'KSC', T = 20., F = 0.077 /
&RAMP ID = 'KSC', T = 900., F = 0.16 /
&RAMP ID = 'CPV', T = 20., F = 1.2 /
&RAMP ID = 'CPV', T = 500., F = 3.0 /
&RAMP ID = 'CPC', T = 20., F = 0.68 /
&RAMP ID = 'CPC', T = 400., F = 1.5 /
&RAMP ID = 'CPC', T = 900., F = 1.8 /
```

```
&SURF ID = 'GYPSUM BOARD'
RGB = 0.80,0.80,0.70
HRRPUA = 100.
RAMP_Q = 'GB'
KS = 0.48
ALPHA = 4.1E-7
DELTA = 0.013
TMPIGN = 400. /
&RAMP ID='GB',T= 0.0,F=0.0 /
&RAMP ID='GB',T= 1.0,F=0.5 /
&RAMP ID='GB',T= 2.0,F=1.0 /
&RAMP ID='GB',T=10.0,F=1.0 /
&RAMP ID='GB',T=20.0,F=0.0 /
&RAMP ID='GB',T=30.0,F=0.0 /
```

```
&SURF ID      = 'CARPET'
RGB          = 0.60,0.80,1.00
C_DELTA_RHO = 1.29
BACKING     = 'INSULATED'
TMPIGN      = 280.
SURFACE_DENSITY = 0.3
BURNING_RATE_MAX = 0.01
HEAT_OF_COMBUSTION = 20000.
HEAT_OF_VAPORIZATION= 3000. /
```

```
&REAC ID='POLYURETHANE'
```

FYI='C\_6.3 H\_7.1 N O\_2.1, NFPA Handbook, Babrauskas'  
SOOT\_YIELD = 0.05  
MW\_FUEL = 130.3  
FUEL\_N2 = 0.5  
NU\_CO2 = 6.3  
NU\_H2O = 3.55  
NU\_O2 = 7.025 /

&SURF ID='FIRE',HRRPUA=1500.,RAMP\_Q='ramp1', RGB=1,0,0 /

&RAMP ID='ramp1', T=0.0, F=0.0/  
&RAMP ID='ramp1', T=1.0, F=1.0/  
&RAMP ID='ramp1', T=34.0, F=1.0/  
&RAMP ID='ramp1', T=35.0, F=0.0/

&VENT XB= 9.60, 9.60, 4.30, 4.40, 1.90, 2.10, SURF\_ID='FIRE' /  
&VENT XB= 9.60, 9.70, 4.30, 4.30, 1.90, 2.00, SURF\_ID='FIRE' /  
&VENT XB= 9.60, 9.60, 1.10, 1.20, 1.90, 2.10, SURF\_ID='FIRE' /  
&VENT XB= 9.60, 9.70, 1.20, 1.20, 1.90, 2.00, SURF\_ID='FIRE' /

&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='INCIDENT\_HEAT\_FLUX',LABEL='Top Flux' /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='BURNING\_RATE',LABEL='Top Burn' /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='WALL\_TEMPERATURE',LABEL='Top Temp' /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='INSIDE\_WALL\_TEMPERATURE',LABEL='2 mm',DEPTH=0.002 /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='INSIDE\_WALL\_TEMPERATURE',LABEL='4 mm',DEPTH=0.004 /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='CHAR\_DEPTH',LABEL='Top Char Depth' /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='BURN\_DEPTH',LABEL='Top Burn Depth' /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='PYROLYSIS',LABEL='Top Pyro' /  
&THCP XYZ=9.60,4.35,2.15,IOR=-1,QUANTITY='CONDUCTION',LABEL='Top Cond' /

&OBST XB= 1.20, 1.20, 0.00, 2.28, 0.00, 3.80 / south of door  
&OBST XB= 1.20, 1.20, 2.29, 3.19, 2.00, 3.80 / above door  
&OBST XB= 1.20, 1.20, 3.20, 7.00, 0.00, 3.80 / north of door  
&OBST XB= 7.16, 9.60, 0.00, 7.00, 0.00, 0.40, SURF\_ID='CARPET'/ stage  
&OBST XB= 7.16, 9.60, 6.90, 7.00, 0.40, 3.80, SURF\_ID='FOAM'/ North Stage Wall  
&OBST XB= 4.75, 7.16, 6.90, 7.00, 1.35, 3.80, SURF\_ID='FOAM'/ Upper North Wall Foam  
&OBST XB= 4.75, 7.16, 6.90, 7.00, 0.00, 1.35, SURF\_ID='PANELING'/ Lower North Wall Paneling  
&OBST XB= 3.53, 4.75, 6.90, 7.00, 0.00, 3.80, SURF\_ID='PANELING'/ North Wall Paneling  
&OBST XB= 9.60, 12.00, 4.30, 7.00, 0.00, 3.80, SURF\_ID='FOAM' / box north of drummers alcove  
&OBST XB= 9.60, 12.00, 0.00, 1.20, 0.00, 3.80, SURF\_ID='FOAM' / box south of drummers alcove  
&OBST XB= 9.60, 12.00, 1.20, 4.30, 0.00, 0.74, SURF\_ID='CARPET' / step up to drummers alcove  
&OBST XB= 9.60, 12.00, 1.20, 4.30, 2.70, 3.80, SURF\_ID='FOAM' / cEILING OF DRUMMERS ALCOVE  
&OBST XB= 11.75, 12.00, 1.20, 4.30, 0.74, 2.70, SURF\_ID='FOAM' / EAST WALL OF DRUMMERS ALCOVE  
&OBST XB= 7.16, 9.60, 0.00, 0.10, 0.40, 3.80, SURF\_ID='PANELING'/ SOUTH Stage Wall  
&VENT CB='XBAR0',SURF\_ID='OPEN' /

&PL3D DTSAM=20. /

&BNDF QUANTITY='WMPUA' /  
&BNDF QUANTITY='GAUGE\_HEAT\_FLUX' /  
&BNDF QUANTITY='WALL\_TEMPERATURE' /  
&BNDF QUANTITY='BURNING\_RATE' /

&SLCF PBX=4.11,QUANTITY='TEMPERATURE' /  
&SLCF PBX=4.11,QUANTITY='HRRPUV' /  
&SLCF PBX=4.11,QUANTITY='MIXTURE\_FRACTION' /  
&SLCF PBX=4.11,QUANTITY='RADIANT\_INTENSITY' /  
&SLCF PBX=4.11,QUANTITY='ABSORPTION\_COEFFICIENT' /  
&SLCF PBX=7.77,QUANTITY='TEMPERATURE' /  
&SLCF PBX=7.77,QUANTITY='HRRPUV' /  
&SLCF PBX=7.77,QUANTITY='MIXTURE\_FRACTION' /  
&SLCF PBX=7.77,QUANTITY='RADIANT\_INTENSITY' /  
&SLCF PBX=7.77,QUANTITY='ABSORPTION\_COEFFICIENT' /  
&SLCF PBY=2.74,QUANTITY='VELOCITY' /  
&SLCF PBY=2.74,QUANTITY='TEMPERATURE' /  
&SLCF PBY=2.74,QUANTITY='oxygen' /

&SLCF PBZ=1.4,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=1.4,QUANTITY='oxygen' /

&THCP XYZ=10.8,4.28,2.40,QUANTITY='TEMPERATURE' / Drummers Box N3  
&THCP XYZ=10.8,4.28,2.09,QUANTITY='TEMPERATURE' / Drummers Box N4  
&THCP XYZ=10.8,4.28,1.79,QUANTITY='TEMPERATURE' / Drummers Box N5  
&THCP XYZ=10.8,4.28,1.48,QUANTITY='TEMPERATURE' / Drummers Box N6  
&THCP XYZ=10.8,4.28,1.18,QUANTITY='TEMPERATURE' / Drummers Box N7

&THCP XYZ=10.8,4.28,0.87,QUANTITY='TEMPERATURE' / Drummers Box N8

&THCP XYZ=11.98,2.74,2.40,QUANTITY='TEMPERATURE' / Drummers Box E9  
&THCP XYZ=11.98,2.74,2.09,QUANTITY='TEMPERATURE' / Drummers Box E10  
&THCP XYZ=11.98,2.74,1.79,QUANTITY='TEMPERATURE' / Drummers Box E11  
&THCP XYZ=11.98,2.74,1.48,QUANTITY='TEMPERATURE' / Drummers Box E12  
&THCP XYZ=11.98,2.74,1.18,QUANTITY='TEMPERATURE' / Drummers Box E13  
&THCP XYZ=11.98,2.74,0.87,QUANTITY='TEMPERATURE' / Drummers Box E14

&THCP XYZ=10.8,1.22,2.40,QUANTITY='TEMPERATURE' / Drummers Box S15  
&THCP XYZ=10.8,1.22,2.09,QUANTITY='TEMPERATURE' / Drummers Box S16  
&THCP XYZ=10.8,1.22,1.79,QUANTITY='TEMPERATURE' / Drummers Box S17  
&THCP XYZ=10.8,1.22,1.48,QUANTITY='TEMPERATURE' / Drummers Box S18  
&THCP XYZ=10.8,1.22,1.18,QUANTITY='TEMPERATURE' / Drummers Box S19  
&THCP XYZ=10.8,1.22,0.87,QUANTITY='TEMPERATURE' / Drummers Box S20

&THCP XYZ=8.38,2.74,3.77,QUANTITY='TEMPERATURE' /Stage Center Ceiling21  
&THCP XYZ=8.38,2.74,3.50,QUANTITY='TEMPERATURE' /SC22  
&THCP XYZ=8.38,2.74,3.19,QUANTITY='TEMPERATURE' /SC23  
&THCP XYZ=8.38,2.74,2.89,QUANTITY='TEMPERATURE' /SC24  
&THCP XYZ=8.38,2.74,2.58,QUANTITY='TEMPERATURE' /SC25  
&THCP XYZ=8.38,2.74,2.28,QUANTITY='TEMPERATURE' /SC26  
&THCP XYZ=8.38,2.74,1.97,QUANTITY='TEMPERATURE' /SC27  
&THCP XYZ=8.38,2.74,1.67,QUANTITY='TEMPERATURE' /SC28  
&THCP XYZ=8.38,2.74,1.36,QUANTITY='TEMPERATURE' /SC29  
&THCP XYZ=8.38,2.74,1.06,QUANTITY='TEMPERATURE' /SC30  
&THCP XYZ=8.38,2.74,0.75,QUANTITY='TEMPERATURE' /SC31  
&THCP XYZ=8.38,2.74,0.45,QUANTITY='TEMPERATURE' /SC32

&THCP XYZ=5.58,2.74,3.77,QUANTITY='TEMPERATURE' /Dance Floor East34  
&THCP XYZ=5.58,2.74,3.50,QUANTITY='TEMPERATURE' /DFE35  
&THCP XYZ=5.58,2.74,3.19,QUANTITY='TEMPERATURE' /DFE36  
&THCP XYZ=5.58,2.74,2.89,QUANTITY='TEMPERATURE' /DFE37  
&THCP XYZ=5.58,2.74,2.58,QUANTITY='TEMPERATURE' /DFE38  
&THCP XYZ=5.58,2.74,2.28,QUANTITY='TEMPERATURE' /DFE39  
&THCP XYZ=5.58,2.74,1.97,QUANTITY='TEMPERATURE' /DFE40  
&THCP XYZ=5.58,2.74,1.67,QUANTITY='TEMPERATURE' /DFE41  
&THCP XYZ=5.58,2.74,1.36,QUANTITY='TEMPERATURE' /DFE42  
&THCP XYZ=5.58,2.74,1.06,QUANTITY='TEMPERATURE' /DFE43  
&THCP XYZ=5.58,2.74,0.75,QUANTITY='TEMPERATURE' /DFE44  
&THCP XYZ=5.58,2.74,0.45,QUANTITY='TEMPERATURE' /DFE45  
&THCP XYZ=5.58,2.74,0.14,QUANTITY='TEMPERATURE' /DFE46

&THCP XYZ=3.62,2.74,3.77,QUANTITY='TEMPERATURE' /Dance Floor West47  
&THCP XYZ=3.62,2.74,3.50,QUANTITY='TEMPERATURE' /DFE48  
&THCP XYZ=3.62,2.74,3.19,QUANTITY='TEMPERATURE' /DFE49  
&THCP XYZ=3.62,2.74,2.89,QUANTITY='TEMPERATURE' /DFE50  
&THCP XYZ=3.62,2.74,2.58,QUANTITY='TEMPERATURE' /DFE51  
&THCP XYZ=3.62,2.74,2.28,QUANTITY='TEMPERATURE' /DFE52  
&THCP XYZ=3.62,2.74,1.97,QUANTITY='TEMPERATURE' /DFE53  
&THCP XYZ=3.62,2.74,1.67,QUANTITY='TEMPERATURE' /DFE54  
&THCP XYZ=3.62,2.74,1.36,QUANTITY='TEMPERATURE' /DFE55  
&THCP XYZ=3.62,2.74,1.06,QUANTITY='TEMPERATURE' /DFE56  
&THCP XYZ=3.62,2.74,0.75,QUANTITY='TEMPERATURE' /DFE57  
&THCP XYZ=3.62,2.74,0.45,QUANTITY='TEMPERATURE' /DFE58  
&THCP XYZ=3.62,2.74,0.14,QUANTITY='TEMPERATURE' /DFE59

&THCP XYZ=10.80,2.75,2.65,QUANTITY='TEMPERATURE' /Sprinkler Drummers Box60

&THCP XYZ=7.77,5.33,3.75,QUANTITY='TEMPERATURE' /Sprinkler NE DF61  
&THCP XYZ=7.77,1.67,3.75,QUANTITY='TEMPERATURE' /Sprinkler SE DF62  
&THCP XYZ=4.11,5.33,3.75,QUANTITY='TEMPERATURE' /Sprinkler NW DF63  
&THCP XYZ=4.11,1.67,3.75,QUANTITY='TEMPERATURE' /Sprinkler SW DF64

&THCP XYZ=9.56,2.74,3.50,QUANTITY='TEMPERATURE' /NE Stage Wall65  
&THCP XYZ=9.56,3.05,3.50,QUANTITY='TEMPERATURE' /Ne SW66  
&THCP XYZ=9.56,3.35,3.50,QUANTITY='TEMPERATURE' /Ne SW67  
&THCP XYZ=9.56,3.66,3.50,QUANTITY='TEMPERATURE' /Ne SW68  
&THCP XYZ=9.56,3.96,3.50,QUANTITY='TEMPERATURE' /Ne SW69  
&THCP XYZ=9.56,4.27,3.50,QUANTITY='TEMPERATURE' /Ne SW70  
&THCP XYZ=9.56,4.57,3.50,QUANTITY='TEMPERATURE' /Ne SW71  
&THCP XYZ=9.56,4.88,3.50,QUANTITY='TEMPERATURE' /Ne SW72  
&THCP XYZ=9.56,5.18,3.50,QUANTITY='TEMPERATURE' /Ne SW73  
&THCP XYZ=9.56,5.49,3.50,QUANTITY='TEMPERATURE' /Ne SW74  
&THCP XYZ=9.56,5.79,3.50,QUANTITY='TEMPERATURE' /Ne SW75  
&THCP XYZ=9.56,6.10,3.50,QUANTITY='TEMPERATURE' /Ne SW76

&THCP XYZ=9.56,6.40,3.50,QUANTITY='TEMPERATURE' /Ne SW77  
&THCP XYZ=9.56,6.71,3.50,QUANTITY='TEMPERATURE' /Ne SW78  
&THCP XYZ=9.56,7.01,3.50,QUANTITY='TEMPERATURE' /Ne SW79  
&THCP XYZ=9.56,7.32,3.50,QUANTITY='TEMPERATURE' /Ne SW80

&THCP XYZ=9.26,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling81  
&THCP XYZ=8.95,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling82  
&THCP XYZ=8.65,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling83  
&THCP XYZ=8.34,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling84  
&THCP XYZ=8.04,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling85  
&THCP XYZ=7.73,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling86  
&THCP XYZ=7.43,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling87  
&THCP XYZ=7.12,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling88  
&THCP XYZ=6.82,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling89  
&THCP XYZ=6.51,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling90  
&THCP XYZ=6.21,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling91  
&THCP XYZ=5.90,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling92  
&THCP XYZ=5.60,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling93  
&THCP XYZ=5.29,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling94  
&THCP XYZ=4.99,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling95  
&THCP XYZ=4.68,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling96  
&THCP XYZ=4.38,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling97  
&THCP XYZ=4.08,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling98  
&THCP XYZ=3.77,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling99  
&THCP XYZ=3.47,6.85,3.5,QUANTITY='TEMPERATURE' /North Wall Ceiling100

&THCP XYZ=1.20,2.58,1.77,QUANTITY='TEMPERATURE' /Drwy STemp1  
&THCP XYZ=1.20,2.58,1.70,QUANTITY='TEMPERATURE' /Drwy STemp2  
&THCP XYZ=1.20,2.58,1.40,QUANTITY='TEMPERATURE' /Drwy STemp3  
&THCP XYZ=1.20,2.58,1.06,QUANTITY='TEMPERATURE' /Drwy STemp4  
&THCP XYZ=1.20,2.58,0.78,QUANTITY='TEMPERATURE' /Drwy STemp5  
&THCP XYZ=1.20,2.58,0.48,QUANTITY='TEMPERATURE' /Drwy STemp6

&THCP XYZ=1.20,2.58,1.77,QUANTITY='VELOCITY' /Drwy SVEL1  
&THCP XYZ=1.20,2.58,1.70,QUANTITY='VELOCITY' /Drwy SVEL2  
&THCP XYZ=1.20,2.58,1.40,QUANTITY='VELOCITY' /Drwy SVEL3  
&THCP XYZ=1.20,2.58,1.06,QUANTITY='VELOCITY' /Drwy SVEL4  
&THCP XYZ=1.20,2.58,0.78,QUANTITY='VELOCITY' /Drwy SVEL5  
&THCP XYZ=1.20,2.58,0.48,QUANTITY='VELOCITY' /Drwy SVEL6

&THCP XYZ=1.20,2.89,1.77,QUANTITY='TEMPERATURE' /Drwy NTemp1  
&THCP XYZ=1.20,2.89,1.70,QUANTITY='TEMPERATURE' /Drwy NTemp2  
&THCP XYZ=1.20,2.89,1.40,QUANTITY='TEMPERATURE' /Drwy NTemp3  
&THCP XYZ=1.20,2.89,1.06,QUANTITY='TEMPERATURE' /Drwy NTemp4  
&THCP XYZ=1.20,2.89,0.78,QUANTITY='TEMPERATURE' /Drwy NTemp5  
&THCP XYZ=1.20,2.89,0.48,QUANTITY='TEMPERATURE' /Drwy NTemp6

&THCP XYZ=1.20,2.89,1.77,QUANTITY='VELOCITY' /Drwy NVEL1  
&THCP XYZ=1.20,2.89,1.70,QUANTITY='VELOCITY' /Drwy NVEL2  
&THCP XYZ=1.20,2.89,1.40,QUANTITY='VELOCITY' /Drwy NVEL3  
&THCP XYZ=1.20,2.89,1.06,QUANTITY='VELOCITY' /Drwy NVEL4  
&THCP XYZ=1.20,2.89,0.78,QUANTITY='VELOCITY' /Drwy NVEL5  
&THCP XYZ=1.20,2.89,0.48,QUANTITY='VELOCITY' /Drwy NVEL6

&THCP XYZ=5.33,2.74,1.50,QUANTITY='oxygen',LABEL='DFNO2/'  
&THCP XYZ=3.51,2.74,1.50,QUANTITY='oxygen',LABEL='DFFO2/'

&THCP XYZ=8.30,2.74,3.80,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=-3,LABEL='SCRAD' /Stage Ceiling  
&THCP XYZ=8.30,2.74,0.40,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=3,LABEL='SCFLRAD' /Stage Floor  
&THCP XYZ=5.48,2.74,3.80,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=-3,LABEL='DFNCRAD' /DANCE FLOOR NEAR CEIL

&OBST XB= 5.40,5.60,2.70,2.80,1.40,1.60 / GHF block  
&OBST XB= 3.40,3.60,2.70,2.80,1.40,1.60 / GHF block  
&THCP XYZ=5.48,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=1,LABEL='DFNsRAD' /DANCE FLOOR NEAR  
&THCP XYZ=5.48,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=3,LABEL='DFNURAD' /DANCE FLOOR NEAR  
&THCP XYZ=3.50,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=1,LABEL='DFFsRAD' /DANCE FLOOR FAR  
&THCP XYZ=3.50,2.74,1.50,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=3,LABEL='DFFURAD' /DANCE FLOOR FAR  
&THCP XYZ=3.50,2.74,3.80,QUANTITY='GAUGE\_HEAT\_FLUX',IOR=-3,LABEL='DFFCRAD' /DANCE FLOOR FAR CEIL

&SPRK XYZ=10.8,2.74,2.65, MAKE='sk114', PART\_ID='my water droplets/' drummer's alcove sprinkler  
&SPRK XYZ=7.77,1.67,3.75, MAKE='sk114', PART\_ID='my water droplets/' df se sprinkler  
&SPRK XYZ=4.11,1.67,3.75, MAKE='sk114', PART\_ID='my water droplets/' df sw sprinkler  
&SPRK XYZ=7.77,5.33,3.75, MAKE='sk114', PART\_ID='my water droplets/' df ne sprinkler  
&SPRK XYZ=4.11,5.33,3.75, MAKE='sk114', PART\_ID='my water droplets/' df nw sprinkler

## L2.2 Full Nightclub, Un-sprinklered

```
&HEAD CHID='Station210',TITLE='RI Nightclub' /
&GRID IBAR=41,JBAR=108,KBAR=42/
&PDIM XBAR0=-12.47143, XBAR=-8.367733, YBAR0=-7.2096215, YBAR=3.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=-8.367733, XBAR=-4.26404, YBAR0=-19.01335, YBAR=3.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=-4.26404, XBAR=-0.16034775, YBAR0=-19.01335, YBAR=3.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=-0.16034775, XBAR=3.943348, YBAR0=-19.01335, YBAR=3.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=3.943348, XBAR=8.047044, YBAR0=-19.01335, YBAR=3.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=176,KBAR=42/
&PDIM XBAR0=8.047044, XBAR=12.15074025, YBAR0=-19.01335, YBAR=-1.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=176,KBAR=42/
&PDIM XBAR0=12.15074025, XBAR=16.254436, YBAR0=-19.01335, YBAR=-1.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
&GRID IBAR=41,JBAR=176,KBAR=42/
&PDIM XBAR0=16.254436, XBAR=20.35814, YBAR0=-19.01335, YBAR=-1.594107, ZBAR0=-0.3048006, ZBAR=3.797308/
```

```
&TIME TWFIN = 300 , SYNCHRONIZE = .TRUE./
```

```
&MISC SURF_DEFAULT='GYPSUM BOARD',NFRAMES=1200,REACTION='POLYURETHANE', SMOKE3D=.TRUE./
```

```
&REAC ID='POLYURETHANE'
```

```
  FYI='C_6.3 H_7.1 N O_2.1, NFPA Handbook, Babrauskas'
```

```
  SOOT_YIELD = 0.1
```

```
  MW_FUEL = 130.3
```

```
  FUEL_N2 = 0.5
```

```
  NU_CO2 = 6.3
```

```
  NU_H2O = 3.55
```

```
  NU_O2 = 7.025 /
```

```
&SURF ID='FOAM'
```

```
  FYI='Test Data'
```

```
  RGB=0.451, 0.3568, 0.3647
```

```
  HEAT_OF_VAPORIZATION=1350.
```

```
  BACKING='PANELING'
```

```
  KS=0.034
```

```
  DX_SOLID=0.00005
```

```
  C_P=1.4
```

```
  DELTA=0.03
```

```
  DENSITY=22.0
```

```
  TMPIGN=370.
```

```
  BURNING_RATE_MAX=0.008/
```

```
&SURF ID = 'PANELING'
```

```
  FYI = 'Charring material'
```

```
  RGB = 0.5,0.2,0.1
```

```
  PHASE = 'CHAR'
```

```
  MOISTURE_FRACTION = 0.01
```

```
  DELTA = 0.01
```

```
  TMPIGN = 360.0
```

```
  HEAT_OF_VAPORIZATION = 500.
```

```
  DENSITY = 450.
```

```
  RAMP_KS = 'KS'
```

```
  RAMP_C_P = 'CPV'
```

```
  RAMP_C_P_CHAR = 'CPC'
```

```
  RAMP_KS_CHAR = 'KSC'
```

```
  CHAR_DENSITY = 120.
```

```
  WALL_POINTS = 30
```

```
  BACKING = 'EXPOSED'/
```

```
&RAMP ID = 'KS', T = 20., F = 0.13 /
```

```
&RAMP ID = 'KS', T = 500., F = 0.29 /
```

```
&RAMP ID = 'KSC', T = 20., F = 0.077 /
```

```
&RAMP ID = 'KSC', T = 900., F = 0.16 /
```

```
&RAMP ID = 'CPV', T = 20., F = 1.2 /
```

```
&RAMP ID = 'CPV', T = 500., F = 3.0 /
```

```
&RAMP ID = 'CPC', T = 20., F = 0.68 /
```

```
&RAMP ID = 'CPC', T = 400., F = 1.5 /
```

```
&RAMP ID = 'CPC', T = 900., F = 1.8 /
```

```
&SURF ID = 'GYPSUM BOARD'
```

```
  RGB = 0.80,0.80,0.70
```

```
  HRRPUA = 100.
```

```
  RAMP_Q = 'GB'
```

```
  KS = 0.48
```

ALPHA = 4.1E-7  
DELTA = 0.013  
TMPIGN = 400. /  
&RAMP ID='GB',T= 0.0,F=0.0 /  
&RAMP ID='GB',T= 1.0,F=0.5 /  
&RAMP ID='GB',T= 2.0,F=1.0 /  
&RAMP ID='GB',T=10.0,F=1.0 /  
&RAMP ID='GB',T=20.0,F=0.0 /  
&RAMP ID='GB',T=30.0,F=0.0 /

&SURF ID = 'CARPET'  
RGB = 0.60,0.80,1.00  
C\_DELTA\_RHO = 1.29  
BACKING = 'INSULATED'  
TMPIGN = 280.  
SURFACE\_DENSITY = 0.3  
BURNING\_RATE\_MAX = 0.01  
HEAT\_OF\_COMBUSTION = 20000.  
HEAT\_OF\_VAPORIZATION= 3000. /

&SURF ID = 'CEILING TILE'  
FYI = 'Armstrong Ceramaguard (Item 602B)'  
ALPHA = 2.6E-7  
KS = 0.0611  
DELTA = 0.016 /

&SURF ID='FIRE',HRRPUA=1500.,RGB=1,0,0 /

&VENT XB= 17.7558, 17.7558, -6.00928, -6.20928, 2.3, 2.50, SURF\_ID='FIRE'/  
&VENT XB= 17.8558, 17.9558, -6.20928, -6.20928, 2.3, 2.40, SURF\_ID='FIRE' /  
&VENT XB= 17.7558, 17.7558, -9.01024, -9.21024, 2.3, 2.50, SURF\_ID='FIRE' /  
&VENT XB= 17.8558, 17.9558, -9.01024, -9.01024, 2.3, 2.40, SURF\_ID='FIRE' /

&VENT CB='XBAR0' SURF\_ID='OPEN'/  
&VENT CB='XBAR' SURF\_ID='OPEN'/  
&VENT CB='YBAR0' SURF\_ID='OPEN'/  
&VENT CB='YBAR' SURF\_ID='OPEN'/  
&VENT CB='ZBAR0' SURF\_ID='INERT'/  
&VENT CB='ZBAR' SURF\_ID='OPEN'/

&OBST XB=-6.16575,6.74588,-17.31311,-4.70876,-0.3048,-0.3048 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-6.162687,6.705614,-4.73711,-3.648082,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-5.990623,6.705614,-2.597155,0.8509017,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-12.4365,-5.426086,-3.648082,0.8509017,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-6.461138,14.43993,-17.28791,-4.73711,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.45282,17.95598,-12.51145,-10.01059,-0.3048,-0.3048 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.43993,17.89751,-17.28791,-9.991745,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=6.461138,15.45911,-17.92291,-9.991745,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-5.426086,6.772289,-2.597155,0.8509017,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=6.74587,8.04704,-4.80879,-2.508,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=12.15074,16.25444,-4.86022,-2.48486,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=12.15074,12.15074,-4.86022,-2.58384,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,16.25444,-4.86022,-2.58384,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=8.04704,12.15074,-4.86022,-2.48486,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=8.04704,8.04704,-4.90883,-2.60803,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=8.04704,8.04704,-4.90883,-2.60803,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,17.955971,-4.86022,-2.48486,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=6.705614,17.89751,-4.82601,-2.53683,-0.1524003,-0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,16.25444,-5.94892,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35272,16.25444,-5.94892,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,17.855881,-5.94892,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.89751,-5.949962,-4.73711,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35272,16.25444,-10.00681,-9.314,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,17.855881,-10.00681,-9.314,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-10.0362,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-10.0362,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35272,16.25444,-9.314,-5.94892,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,17.855881,-9.314,-5.94892,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-9.281006,-5.949962,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-9.281006,-5.949962,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-5.949962,-4.82601,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,14.60935,-4.82601,-4.73711,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.39548,17.87529,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.39548,17.87529,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.755791,17.955971,-10.10578,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0

&OBST XB=17.87529,17.94196,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.755791,20.358141,-9.70989,-4.95919,0.67189,0.76956 , RGB=0.451, 0.3568, 0.3647 / foam zzz  
&OBST XB=17.89751,17.94196,-12.52857,-5.889637,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-5.96557,6.74588,-2.508,0.89317,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-6.16575,10.44921,-3.60838,-2.508,3.69964,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-6.16575,17.85589,-5.90917,-3.60838,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-6.16575,17.85589,-12.51145,-5.90917,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-0.16035,3.94335,-12.51145,-5.90917,3.69964,3.69964 , SURF\_ID='CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-0.16035,3.94335,-17.31311,-12.51145,3.69964,3.69964 , RGB=1.0, 0.90196, 0.5725/ sunroom ceiling  
&OBST XB=-12.47143,-5.46512,-3.60838,0.89317,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-12.4365,-9.782195,-4.400559,0.8509017,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-12.4365,-9.801245,-7.080265,0.8509017,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.85589,20.358141,-9.41038,-5.90917,3.69964,3.69964 , RGB=0.451, 0.3568, 0.3647,SURF\_ID = 'FOAM' / foam  
&OBST XB=6.74588,17.85589,-5.90917,-2.508,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-5.46512,6.74588,-2.508,3.59411,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=4.34372,10.24903,-11.51111,-4.80879,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=4.34372,10.24903,-12.51145,-11.51111,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=10.34912,10.44921,-12.51145,-4.80879,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=3.94335,6.64579,-11.51111,-4.80879,2.72295,3.40663 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=4.94426,6.64579,-4.80879,-2.70807,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=2.442,6.64579,-4.80879,-2.70807,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=1.24092,6.64579,-8.0099,-2.70807,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=1.24092,6.64579,-9.51042,-4.80879,2.72295,3.5043 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=1.24092,6.64579,-11.41107,-4.80879,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=2.24182,3.94335,-11.41107,-4.80879,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=3.94335,6.64578,-11.41107,-4.80879,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=4.94426,6.64579,-2.70807,3.39404,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-4.36413,2.442,-2.70807,-1.60769,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-5.16485,2.442,-6.60941,-2.70807,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-5.16485,1.24092,-7.00955,-6.60941,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-6.16575,-4.26404,-6.70945,-1.50765,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725 / wall  
&OBST XB=-6.078826,-4.148422,-3.492507,-1.562103,2.743206,2.743206 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-0.16035,2.24182,-11.41107,-9.51042,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-4.26404,-0.16035,-11.41107,-9.51042,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-5.96557,-4.26404,-11.41107,-9.51042,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-5.96557,2.24182,-17.113041,-11.41107,2.72295,2.72295 , SURF\_ID='CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=6.64579,10.44921,-4.80879,-2.70807,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-17.755791,17.755791,-9.41297,-5.94892,0.76956,1.06257 , RGB=0.5921,0.3294,0.0784 , SURF\_ID= 'PANELING' / A-PLAT-RIM-0  
&OBST XB=-12.4365,-12.4365,-7.080265,0.8509017,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-5.426086,0.8509017,0.8509017,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-5.426086,-5.426086,0.8509017,3.559182,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-5.426086,6.772289,3.559182,3.559182,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.772289,6.772289,-2.597155,3.559182,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.705614,14.43993,-4.73711,-4.73711,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-17.755791,17.955971,-12.48113,-10.00681,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=15.45911,15.45911,-17.92291,-17.28791,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.4456,8.04704,-17.913321,-17.913321,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,15.45371,-17.913321,-17.913321,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,15.45371,-17.913321,-17.913321,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.461138,6.461138,-17.92291,-17.28791,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.16575,-4.26404,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=3.94335,6.4456,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-0.16035,3.94335,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-4.26404,-0.16035,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.16575,-6.16575,-17.31311,-3.60838,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.782195,-6.162687,-3.648082,-3.648082,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.782195,-9.782195,-4.400559,-3.648082,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.801245,-9.801245,-7.080265,-4.400559,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-9.801245,-7.080265,-7.080265,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.705614,6.705614,-4.82601,-2.53683,-0.1524003,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.705614,6.705614,-4.82601,-2.53683,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-16.25444,17.855881,-2.58384,-2.58384,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.74587,8.04704,-2.508,-2.508,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.15074,16.25444,-2.58384,-2.58384,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=8.04704,12.15074,-2.58384,-2.58384,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.705614,17.89751,-2.53683,-2.53683,-0.1524003,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-4.82601,-2.53683,-0.1524003,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-14.35103,17.89751,-4.73711,-4.73711,0.2286005,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-5.949962,-4.73711,0.2286005,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.855881,17.955971,-9.314,-5.94892,0.18355,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.855881,17.955971,-11.39243,-9.314,0.18355,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.78639,20.32322,-5.889637,-5.889637,0.7874016,1.092202 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=20.358141,20.358141,-9.11605,-5.84994,0.76956,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-12.4365,-7.080265,0.8509017,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-5.426086,0.8509017,0.8509017,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-5.426086,-5.426086,0.8509017,3.559182,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1

&OBST XB=-5.426086,6.772289,3.559182,3.559182,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.772289,6.772289,-2.53683,3.559182,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-5.889637,-2.53683,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,20.32322,-5.889637,-5.889637,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=20.32322,20.32322,-9.099635,-5.889637,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.94196,17.94196,-12.52857,-9.413134,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.94196,-12.52857,-12.52857,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-17.28791,-12.52857,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,16.25444,-17.330811,-17.330811,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.16575,-4.26404,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=8.04704,12.15074,-17.330811,-17.330811,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-4.26404,-0.16035,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=3.94335,8.04704,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=16.25444,17.855881,-17.330811,-17.330811,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-0.16035,3.94335,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.162687,-6.162687,-17.28791,-3.648082,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.782195,-6.162687,-3.648082,-3.648082,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.801245,-9.801245,-7.080265,-4.400559,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-14.43993,14.43993,-9.991745,-7.080265,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.705614,6.705614,-2.67653,-2.597155,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=6.705614,6.705614,-4.73711,-2.67653,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.43993,14.43993,-4.82601,-4.73711,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.43993,14.43993,-9.991745,-4.82601,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.43993,17.83719,-9.991745,-9.991745,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=17.83719,17.94196,-9.991745,-9.991745,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=6.705614,17.89751,-4.82601,-4.82601,-0.1524003,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=12.15074,16.25444,-4.76124,-4.76124,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=8.04704,12.15074,-4.76124,-4.76124,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=6.74587,8.04704,-4.80879,-4.80879,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=16.25444,17.855881,-4.76124,-4.76124,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=17.80226,17.94196,-10.08065,-10.08065,0.2286005,0.5334011 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.39548,17.80226,-10.08065,-10.08065,0.2286005,0.5334011 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.35272,14.35272,-10.00681,-4.76124,0.18355,0.57422 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.35103,14.35103,-4.82601,-4.73711,0.2286005,0.5334011 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS

&OBST XB=17.89751,17.94196,-12.52857,-5.889637,3.797308,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.4365,-5.426086,-3.648082,0.8509017,3.797308,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.772289,17.89751,-5.889637,-2.53683,3.797308,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.73076,-4.686309,1.476378,2.898781,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.441707,-3.397257,1.441453,2.254255,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.06476,-4.46422,-2.40796,-1.80776,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.185246,-2.286005,-1.473203,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.86368,-2.26223,-0.80741,-0.10717,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.6405,-2.286005,-0.1333503,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.6644,-3.46332,-1.50765,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-4.185246,-1.791551,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.06476,-4.46422,-2.40796,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.11583,-4.686309,-2.403787,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86909,-4.6644,-3.50834,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86792,-4.686309,-1.606553,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86909,-4.6644,-0.80741,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86792,-5.365761,-0.7937516,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.441707,-2.286005,-0.1333503,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,0.3556007,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.6644,-3.46332,0.69311,1.39335,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,1.441453,1.476378,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.6644,-3.46332,1.49338,2.29366,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,2.254255,2.898781,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,2.898781,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.620062,-5.052968,-3.002312,-2.435218,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.046901,-4.440732,-2.429151,-1.822982,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.24182,2.34191,-13.71187,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,6.74587,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,6.74588,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,6.74588,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,6.74588,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.94155,6.74588,-4.70876,-4.50869,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.04164,6.74588,-4.50869,-3.00817,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,6.74587,-3.00817,-2.70807,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.34191,3.94335,-3.00817,-2.70807,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.34371,6.74587,-12.51145,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.34371,8.04704,-12.51145,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,10.44921,-12.48113,-4.66227,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.384684,10.39973,-12.48413,-4.73711,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.384684,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP

&OBST XB=8.04704,10.44921,-12.48113,-11.39243,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.64488,8.04704,-12.51145,-11.31104,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=7.11519,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-7.254889,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=9.998096,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=10.1124,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,6.74587,-11.51111,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.241428,6.705614,-8.048475,-4.73711,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,5.34461,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,5.34462,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,4.74407,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,4.74408,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,2.24182,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,2.24182,-12.51145,-11.41107,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.007112,2.286005,-12.85878,-12.56033,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-13.5118,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-13.5118,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-13.5118,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,2.24182,-13.71187,-13.5118,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-17.113041,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.26404,-0.16035,-17.113041,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,-4.26404,-17.113041,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.94426,6.64579,-2.70807,-1.10752,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.94426,6.64579,-1.10752,-0.30724,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.94426,6.64579,-0.30724,1.09324,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.943485,6.616714,1.085852,1.898654,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.943485,6.616714,1.898654,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.24001,2.442,-7.00955,-2.70807,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.24002,1.4411,-7.90986,-7.00955,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-1.04475,1.284448,-8.048475,-7.851798,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.24002,2.442,-7.00955,-1.60769,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.26404,-0.16035,-7.00955,-1.60769,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.168911,2.413005,-7.048514,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.16485,2.442,-6.60941,-1.60769,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.052968,2.413005,-2.466649,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.01547,2.413005,-2.429151,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.440732,2.413005,-1.854413,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.588631,-5.052968,-3.002312,-2.466649,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,-5.068025,-3.492507,-3.002312,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,-5.06476,-6.60941,-3.50834,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.078826,-5.588631,-3.492507,-3.002312,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.241554,-2.197104,-0.7937516,-0.1333503,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.197104,-0.1016002,-1.473203,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.197104,-0.1016002,-0.7937516,-0.1333503,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.16214,-0.06025,-0.10717,0.393,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.08458,16.89738,-13.46203,-13.41758,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.39243,15.46645,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.46645,15.57639,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.57639,16.08458,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.08458,16.89738,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.89738,17.74194,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-4.80879,-2.70807,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=8.04704,10.44921,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=2.34191,4.34372,-12.51145,-11.51111,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.374905,4.340234,-12.85878,-12.48413,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.374905,4.340234,-13.67158,-12.85878,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.34191,4.34372,-14.31207,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.938212,4.384684,-12.48413,-11.54432,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,17.755791,-10.10578,-4.66227,0.57422,0.57422 , RGB=0.0,0.0,0.286 , SURF\_ID='CARPET' / carpet  
&OBST XB=14.35272,16.25444,-10.10578,-4.66227,0.57422,0.57422 , RGB=0.0,0.0,0.286 , SURF\_ID='CARPET' / carpet  
&OBST XB=14.35103,17.80544,-10.08065,-4.73711,0.5334011,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.35103,17.78639,-10.08065,-9.290221,0.5334011,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.06025,1.74137,-1.50765,3.39404,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.36323,1.74137,2.29366,3.39404,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.352807,1.045579,1.441453,2.254255,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.352807,0.5702816,0.4445009,1.441453,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.861062,-5.327661,-6.680213,-6.635764,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.4071501,1.013319,-7.91466,-7.308491,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,-5.257811,-7.651765,-7.137414,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,-5.257811,-7.137414,-6.680213,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,-5.26494,-8.6101,-7.10959,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,0.24002,-8.6101,-7.10959,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP

&OBST XB=-6.007112,1.152527,-8.566168,-7.91466,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,1.14083,-9.41038,-8.10993,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,1.152527,-9.423419,-8.566168,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-14.86401,15.3089,-13.3427,-12.61656,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.683389,15.14161,-17.22758,-17.13234,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=5.616586,7.11519,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=7.254889,9.998096,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=10.1124,12.627,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.754,14.7098,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.27041,15.3393,-13.46203,-13.3427,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.30353,-13.46203,-12.63879,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.30353,-17.13234,-12.63879,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.30353,-17.13234,-12.63879,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,15.15344,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-17.113041,-12.61149,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.5457,14.85318,-17.113041,-12.61149,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,14.85317,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.4438,8.04704,-17.113041,-12.61149,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.429134,14.86401,-17.13234,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.968631,3.883033,-14.37643,-14.33198,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.883033,4.302134,-17.13234,-14.37643,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.94245,3.84326,-17.113041,-14.41211,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.47333,2.968631,-17.13234,-14.37643,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.374905,2.47333,-17.13234,-14.37643,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.854585,4.899035,1.085852,1.898654,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,0.4445009,1.085852,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,1.085852,1.898654,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,1.898654,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.28092,-11.58877,-6.924689,-4.445009,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-11.58877,-10.77597,-6.924689,-4.445009,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-10.7699,-9.96918,-6.90952,-4.40865,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.755791,17.855881,-9.01024,-6.20928,0.9649,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.855881,20.157961,-9.314,-6.04789,0.86723,1.06257 , RGB=0.0,0.0,0.286 , SURF\_ID='CARPET'/ band box - carpet  
&OBST XB=17.855881,20.157961,-9.21503,-6.04789,1.06257,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.89434,20.16764,-9.009805,-6.045212,1.092202,1.092202 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.89434,20.16764,-6.241199,-6.045212,1.092202,1.092202 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.29744,17.34188,-13.25248,-12.69368,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.9025,15.3474,-13.32047,-12.59434,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.11951,17.23711,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.89738,17.29744,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.08458,17.23711,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.39063,17.23711,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.3474,17.23711,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.941,17.23711,-13.29825,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.38634,17.74194,-13.37313,-13.25248,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.38634,17.74194,-13.25248,-12.69368,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.38634,17.74194,-12.69368,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.854585,4.899035,-1.073152,-0.2603505,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.501905,4.854585,-2.603505,-1.073152,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.54209,4.84417,-1.50765,-0.30724,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,-1.473203,-0.2603505,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,-1.473203,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,-0.2603505,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.35272,16.25444,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=16.25444,17.755791,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=-5.270511,-4.77521,2.898781,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.270511,-4.77521,1.476378,2.898781,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.270511,-4.77521,0.7842266,1.476378,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.330811,-17.23184,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-17.13111,-17.21307,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,15.15344,-17.330811,-17.23184,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-17.81328,-17.31311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.7267,-17.330811,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,15.15344,-17.7267,-17.330811,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.95682,-9.91237,-1.606553,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-11.58877,-10.77597,-4.400559,-4.356109,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-0.7937516,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-1.606553,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-3.587757,-1.606553,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-4.356109,-3.587757,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,14.35272,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=10.44921,12.15074,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=10.44921,12.15074,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,12.65119,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP

&OBST XB=16.25444,16.75489,-12.48113,-11.29346,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=10.44921,12.15074,-12.48113,-11.29346,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,16.25444,-12.48113,-11.29346,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.65119,16.25444,-12.48113,-11.29346,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,17.755791,-12.48113,-11.29346,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.627,17.71019,-12.48413,-11.43637,0,0 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.7098,17.71019,-12.48413,-12.35077,0,0 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.11951,17.71019,-12.48413,-12.35077,0,0 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.23711,17.71019,-12.48413,-12.35077,0,0 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,17.755791,-11.29346,-10.00681,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.35272,16.25444,-11.29346,-10.00681,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.43993,17.78639,-11.29032,-9.991745,0,0 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.3471,17.71019,-11.43637,-9.991745,0,0 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.50671,17.76892,-10.14228,-10.14228,0.508001,0.5334011 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.50671,17.76892,-10.11688,-10.11688,0.508001,0.5334011 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,14.45281,-11.29346,-4.66227,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,12.15074,-11.29346,-4.66227,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,14.45281,-11.31104,-4.70876,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,12.15074,-11.31104,-4.70876,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,12.15074,-11.39243,-10.00681,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-HF  
&OBST XB=16.25444,16.75489,-11.39243,-10.00681,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-HF  
&OBST XB=12.15074,16.25444,-11.39243,-10.00681,-0.01179,-0.01179 ,RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-HF  
&OBST XB=16.48131,16.48131,-10.77728,-10.44708,-3.149606E-03,0.1302007 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-0  
&OBST XB=16.48131,16.48131,-10.44708,-10.09465,3.175006E-03,0.2738087 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-0  
&OBST XB=-12.28092,-9.95682,0.6953264,0.6953264,0.3.657607 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-9.86909,-5.36503,0.69311,0.69311,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-5.270511,-5.270511,0.7842266,3.403607,0.3.657607 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-5.270511,-4.77521,3.403607,3.403607,0.3.657607 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-4.6644,-3.46332,3.39404,3.39404,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-3.36323,1.74137,3.39404,3.39404,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=1.84146,4.84417,3.39404,3.39404,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=4.94426,6.64579,3.39404,3.39404,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.64578,6.64578,-2.70807,3.39404,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=16.25444,17.755791,-2.68281,-2.58384,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=12.15074,16.25444,-2.68281,-2.68281,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=8.04704,12.15074,-2.68281,-2.68281,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64578,8.04704,-2.70807,-2.70807,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64579,17.7558,-2.70807,-2.70807,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647,SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=12.15074,16.25444,-2.70807,-2.70807,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=12.15074,16.25444,-2.70807,-2.70807,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=17.755791,17.755791,-4.80879,-2.70807,0.57422,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-4.80879,-2.70807,0.18355,0.57422 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-5.90917,-4.80879,0.57422,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.855881,20.157961,-6.24584,-6.04789,1.06257,3.69964 ,RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=15.57639,17.74194,-17.13234,-17.13234,0,3.657607 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=4.4438,6.54569,-17.113041,-17.113041,-0.01179,3.69964 ,RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=2.442,3.94335,-17.113041,-17.113041,2.03926,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=3.94335,4.34371,-17.113041,-17.113041,2.03926,3.69964 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=2.46063,4.314834,-17.13234,-17.13234,2.057404,3.657607 ,RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR



&OBST XB=-5.96557,-5.96557,-6.60941,-3.50834,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-9.76632,-9.76632,-4.400559,-3.663957,-0.3048006,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-9.96918,-9.96918,-6.90952,-4.40865,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-12.28092,-9.95682,-6.924689,-6.924689,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-12.27125,-12.27125,-6.90952,-4.40865,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-12.28092,-12.28092,-4.356109,0.6953264,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=20.057871,20.157961,-9.01708,-6.04789,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=15.30353,15.30353,-17.76734,-17.30379,0,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=12.15074,15.25353,-17.7267,-17.7267,-0.01179,0.57422 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=6.64578,8.04704,-17.81328,-17.81328,-0.01179,0.57422 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=8.04704,12.15074,-17.7267,-17.7267,-0.01179,0.57422 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=6.616714,15.30353,-17.76734,-17.76734,0,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=17.755791,17.755791,-10.00681,-9.314,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-10.00681,-9.314,0.76956,1.06257 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-10.00681,-9.314,0.57422,0.76956 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-11.29346,-10.00681,0.57422,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-11.29346,-10.00681,-0.01179,0.57422 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.855881,-12.38216,-11.29346,2.03926,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-12.51145,-12.31138,2.03926,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.955971,-12.48113,-12.48113,-0.01179,2.03926 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=6.616714,6.616714,-17.76734,-17.30379,0,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=17.74194,17.74194,-13.37313,-12.57303,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=17.755791,17.855881,-17.13286,-13.47086,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-6.26584,-5.96557,-3.50834,-2.2079,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-9.86909,-6.16575,-3.50834,-3.50834,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=15.46645,15.57639,-17.13234,-17.13234,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=15.39243,15.46645,-17.13234,-17.13234,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-8.36773,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-8.36773,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-5.46512,-5.46512,0.89317,3.59411,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.84597,6.84597,-2.508,3.59411,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=16.25444,16.25444,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,16.25444,-2.68281,-2.38589,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=16.25444,16.25444,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,16.25444,-2.508,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,8.04704,-2.70807,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,12.15074,-2.68281,-2.38589,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,8.04704,-2.60803,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,12.15074,-2.508,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-4.86022,-2.48486,0.18355,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-4.86022,-2.48486,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.99594,17.99594,-5.854712,-4.82601,1.092202,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-5.84994,-4.86022,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-6.04789,-5.84994,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,20.358141,-6.14686,-5.84994,0.76956,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=16.25444,16.25444,-17.330811,-17.13286,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.55381,16.25444,-17.330811,-17.13286,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=16.25444,17.955971,-17.330811,-17.13286,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.461138,6.521463,-17.32284,-17.32284,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=4.34371,6.4456,-17.31311,-17.113041,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=4.34371,6.4456,-17.31311,-17.113041,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=4.314834,6.461138,-17.32284,-17.32284,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=2.46063,4.314834,-17.32284,-17.32284,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=3.94335,4.34371,-17.31311,-17.013,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=2.442,3.94335,-17.31311,-17.013,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=2.442,3.94335,-17.31311,-17.113041,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=3.94335,4.34371,-17.31311,-17.31311,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=2.442,4.34372,-17.31311,-17.31311,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2



&OBST XB=-12.47143,-12.47143,-7.10959,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=20.358141,20.358141,-9.11605,-5.84994,0.76956,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.45371,15.45371,-17.92465,-17.330811,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.4456,8.04704,-17.913321,-17.913321,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,11.85047,-17.92465,-17.92465,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,11.84785,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,11.84785,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,11.84785,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=11.84785,13.62332,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=13.65209,15.45371,-17.92465,-17.92465,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.955971,-11.39243,-9.314,0.18355,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.855881,-11.39243,-10.00681,0.18355,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='FOAM'/ foam zzzz  
&OBST XB=17.755791,17.755791,-11.39243,-10.00681,0.18355,2.03926 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='FOAM'/ foam zzzz  
&OBST XB=17.955971,17.955971,-11.39243,-10.00681,-0.01179,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-11.41097,-9.991745,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-11.41097,-9.991745,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.955971,-12.38216,-10.00681,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-12.52857,-12.35077,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955881,17.955971,-12.77805,-12.38216,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-12.52857,-12.35077,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,6.426213,-17.95784,-17.32284,-0.3048006,0.5746762 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.955971,-17.330811,-12.48113,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-9.769,-6.16575,-3.70841,-3.70841,-0.3048,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.46645,15.57639,-17.32284,-17.32284,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.46645,15.57639,-17.32284,-17.32284,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.35362,15.45371,-17.330811,-17.330811,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=2.374905,2.816693,-12.40793,-12.40793,0,0.8731267 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=15.25353,15.25353,-17.13286,-13.37189,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=15.35362,15.35362,-17.13286,-13.47086,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-2.597155,-2.597155,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-2.597155,-2.501905,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-3.003556,-2.67653,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-4.476759,-3.003556,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-4.73711,-4.476759,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.616714,-3.003556,-2.597155,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.616714,-4.476759,-3.003556,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.616714,-4.82601,-4.476759,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.711964,-4.82601,-4.82601,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=3.94335,3.94335,-11.51111,-11.41107,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-FS-wood  
&OBST XB=2.34191,3.94335,-11.51111,-11.51111,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=2.24182,3.94335,-11.41107,-11.41107,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-FS-wood  
&OBST XB=3.327407,3.416307,-11.93891,-11.93891,0,0.8731267 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=3.327407,3.327407,-12.11306,-11.93891,0,0.8731267 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.79909,17.79909,-12.36347,-11.42367,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.79909,17.79909,-12.48413,-12.36347,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.755791,17.755791,-12.48113,-12.38216,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='FOAM'/ foam yyy  
&OBST XB=17.7558,17.7558,-11.41107,-11.31104,2.03926,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.7558,17.7558,-11.41107,-11.31104,-0.01179,2.03926 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.71019,17.71019,-12.36347,-11.42367,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.71019,17.71019,-12.48413,-12.36347,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.71019,17.71019,-12.48413,-12.36347,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.39548,17.80226,-10.08065,-10.08065,0,0.2349505 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.83719,17.97689,-9.991745,-9.991745,0.2286005,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.83719,17.97689,-9.991745,-9.991745,0,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.80226,17.83719,-9.991745,-9.991745,-6.350013E-03,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.43993,17.80226,-9.991745,-9.991745,-6.350013E-03,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.35103,14.35103,-10.08065,-10.0362,0.2286005,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.35103,14.35103,-10.08065,-10.0362,0,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.35103,14.35103,-10.0362,-4.82601,0.1524003,0.2349505 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.35273,14.35273,-10.01059,-4.80879,-0.01179,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.43993,14.43993,-9.991745,-4.82601,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=4.34371,4.34371,-17.113041,-14.41211,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=4.340234,4.340234,-14.28753,-12.48413,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=4.4438,4.4438,-17.113041,-12.61149,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-FS-wood











&OBST XB=11.71683,13.03393,-4.82601,-4.73711,1.016002,1.016002, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=11.76128,12.98948,-4.82601,-4.73711,0.1778004,0.1778004, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=11.76128,12.98948,-4.82601,-4.73711,0.1778004,0.1778004, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=11.76128,12.98948,-4.82601,-4.73711,0.1778004,0.1778004, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=11.76128,12.98948,-4.82601,-4.73711,0.1524003,0.1524003, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=13.05156,14.35273,-4.80879,-4.70876,0.9649,1.06257, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=13.03393,14.39548,-4.82601,-4.73711,1.016002,1.016002, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=13.07838,14.30658,-4.82601,-4.73711,0.1778004,0.1778004, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=13.07838,14.30658,-4.82601,-4.73711,0.1524003,0.1524003, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=6.426213,6.616714,-17.95784,-17.32284,0.6096013,0.6096013, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=6.426213,6.616714,-17.95784,-17.32284,0.5715011,0.5715011, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-2.692405,-2.692405,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-3.575057,-3.575057,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.854585,-3.575057,-2.692405,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-3.575057,-2.692405,1.219203,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.943485,4.943485,-3.575057,-2.692405,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-3.575057,-2.692405,1.181102,1.181102, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-3.702058,-3.702058,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-4.521209,-4.521209,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.854585,-4.521209,-3.702058,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-4.521209,-3.702058,1.219203,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.943485,4.943485,-4.521209,-3.702058,1.181102,1.219203, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
&OBST XB=4.854585,4.943485,-4.521209,-3.702058,1.181102,1.181102, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-HRAL-RAIL-1  
  
/OBST XB=0.4318465,1.04475,-7.889964,-7.27706,2.032004,2.032004, RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=0.3401,1.24091,-17.31311,-17.21307,1.06257,2.03926, RGB = 0.6,1.0,1.0/ FRONT WINDOW TOP  
&OBST XB=0.3401,1.24091,-17.31311,-17.21307,0.18355,1.06257, RGB = 0.6,1.0,1.0, T\_REMOVE=80/ FRONT WINDOW Bottom  
&OBST XB=-2.26224,-1.26134,-17.31311,-17.21307,0.18355,2.03926, T\_REMOVE=80, RGB = 0.6,1.0,1.0/ FRONT WINDOW  
&OBST XB=-2.26269,-2.26224,-17.31311,-17.21307,0.18355,2.03926, T\_REMOVE=80, RGB = 0.6,1.0,1.0/ FRONT WINDOW  
&OBST XB=-1.26134,-0.76089,-17.31311,-17.21307,1.16024,2.03926, RGB = 0.6,1.0,1.0/ FRONT WINDOW  
&OBST XB=-1.26134,-0.76089,-17.31311,-17.21307,0.18355,1.16024, T\_REMOVE=80, RGB = 0.6,1.0,1.0/ FRONT WINDOW  
  
&OBST XB=-4.76449,-4.26404,-17.31311,-17.21307,0.18355,1.06257, RGB = 0.6,1.0,1.0, T\_REMOVE=80 / FRONT WINDOW Bottom  
&OBST XB=-4.26404,-4.26404,-17.31311,-17.21307,0.18355,1.06257, RGB = 0.6,1.0,1.0, T\_REMOVE=80 / FRONT WINDOW Bottom  
&OBST XB=-4.26404,-3.96377,-17.31311,-17.21307,0.18355,1.06257, RGB = 0.6,1.0,1.0, T\_REMOVE=80 / FRONT WINDOW Bottom  
&OBST XB=-4.75,-3.93574,-17.249,-17.2931,0.19,1.111, RGB = 0.6,1.0,1.0, T\_REMOVE=80 / FRONT WINDOW Bottom  
&OBST XB=-4.76449,-4.26404,-17.31311,-17.21307,1.06257,2.03926, RGB = 0.6,1.0,1.0/ FRONT WINDOW TOP  
&OBST XB=-4.26404,-3.96377,-17.31311,-17.21307,1.06257,2.03926, RGB = 0.6,1.0,1.0/ FRONT WINDOW TOP  
&OBST XB=-4.75,-3.93574,-17.249,-17.2931,1.111,2.06673, RGB = 0.6,1.0,1.0/ FRONT WINDOW TOP  
&OBST XB=2.381255,2.470155,-17.34824,-17.34824,0.2,1.24079, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.381255,4.394209,-17.34824,-17.34824,2.035179,2.124079, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.305309,4.394209,-17.34824,-17.34824,0.2,1.24079, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.47333,2.47333,-17.32284,-17.24346,0.2,0.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.32284,-17.24346,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.34371,4.34371,-17.31311,-17.21307,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.41618,4.359284,-17.10694,-17.10694,2.032004,2.089154, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.34371,4.34371,-17.21307,-17.113041,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=2.442,3.94335,-17.21307,-17.113041,2.03926,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=3.94335,4.34371,-17.21307,-17.113041,2.03926,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.24346,-17.13234,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.24346,-17.13234,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.24346,-17.13234,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.442,2.442,-17.21307,-17.113041,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=2.442,3.94335,-17.31311,-17.113041,-0.01179,-0.01179, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=3.94335,4.34371,-17.31311,-17.113041,-0.01179,-0.01179, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.32919,-17.13234,3.048006E-03,3.048006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.32919,-17.13234,3.048006E-03,3.048006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.47333,4.302134,-17.32919,-17.13234,3.048006E-03,3.048006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=0.3401,0.44019,-17.113041,-17.113041,0.18355,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=0.3302007,1.263653,-17.10694,-17.10694,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=1.24091,1.24091,-17.21307,-17.113041,0.18355,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=0.44019,1.24091,-17.21307,-17.113041,2.03926,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1  
&OBST XB=0.44019,0.44019,-17.21307,-17.113041,0.18355,2.03926, RGB=0.5921,0.3294,0.0784, / A-WDWK-TRIM-1



&OBST XB=-6.223012,-6.1992,-8.658242,-7.55969,2.124079,2.124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.26584,-8.6101,-7.50973,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-8.6101,-7.60976,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-8.71014,-8.6101,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.197613,-8.569342,-8.569342,0.2035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.981712,-6.007112,-8.566168,-7.651765,3.048006E-03,3.048006E-03 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.16575,-5.96557,-8.6101,-8.6101,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.16575,-5.96557,-8.6101,-7.60976,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.118237,-6.007112,-7.651765,-7.651765,0.2032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.203963,-6.007112,-8.566168,-7.651765,3.048006E-03,3.048006E-03 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.755791,17.855881,-12.38216,-12.38216,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.79909,17.82449,-12.35395,-12.35395,0.203518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.80067,17.82449,-12.4111,-11.37605,2.09233,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.82449,17.82449,-12.4111,-11.37605,2.03518,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.79909,17.82449,-12.35395,-11.4332,2.03518,2.03518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.80067,17.82449,-11.37605,-11.37605,0.209233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.79909,17.82449,-11.4332,-11.4332,0.203518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.655701,17.755791,-11.39243,-11.29346,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / back door qqq  
&OBST XB=17.68479,17.71019,-11.4332,-11.4332,0.2035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.68479,17.7086,-12.4111,-11.37605,2.092329,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.655701,17.655701,-12.38216,-11.39243,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.655701,17.755791,-12.38216,-11.39243,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.655701,17.755791,-12.38216,-12.38216,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / back door www  
&OBST XB=17.68479,17.71019,-12.35395,-12.35395,0.2035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=18.00229,18.00229,-12.43015,-11.3316,2.035179,2.124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=18.00229,18.00229,-11.4205,-11.3316,0.2124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.855881,17.955971,-12.38216,-12.38216,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.855881,17.955971,-12.38216,-11.39243,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.89751,17.97689,-11.42367,-11.42367,0.2032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.76099,17.76099,-12.39523,-11.36652,2.032004,2.089154 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.89751,-11.42367,-11.42367,0.2032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.89751,-12.33807,-12.33807,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.89751,-11.42367,-11.42367,0.2032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.98324,-12.33807,-11.42367,3.048006E-03,3.048006E-03 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.374905,2.400305,-13.67475,-13.67475,0.2035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.376492,2.400305,-13.7319,-12.79845,2.092329,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.24182,2.442,-13.71187,-12.81155,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.374905,2.400305,-13.67475,-12.8556,2.035179,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.376492,2.400305,-12.79845,-12.79845,0.2092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.374905,2.400305,-12.8556,-12.8556,0.2035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.260605,2.260605,-13.7319,-12.79845,2.035179,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.286005,2.374905,-12.85878,-12.85878,0.2032005 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.286005,2.374905,-13.67158,-12.85878,0.2032005,2.032005 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.286005,2.374905,-13.67158,-13.67158,0.2032005 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.53048,2.955931,-14.26213,-14.26213,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590806,2.895606,-14.28753,-14.25451,0.8128017,0.8128017 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.53048,2.955931,-14.26213,-14.25451,0.7874016,0.7874016 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.53048,2.955931,-14.40183,-14.40183,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590805,2.590805,-14.37643,-14.32563,0.8128017,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590805,2.895606,-14.37643,-14.32563,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.895606,2.895606,-14.37643,-14.32563,0.8128015,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590805,2.895606,-14.37643,-14.32563,0.8128015,0.8128015 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.84326,3.943358,-14.31207,-14.31207,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.908306,3.943358,-14.26213,-14.26213,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.908306,3.943358,-14.40183,-14.40183,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.886208,3.943358,-14.40183,-14.40183,0.2092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.968631,2.968631,-14.37643,-14.3415,0.2032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.968631,3.883033,-14.37643,-14.3415,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.883033,3.883033,-14.37643,-14.3415,0.2032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.273559,4.330709,-14.26213,-14.26213,0.8128017,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.905258,4.330709,-14.26213,-14.26213,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.965583,4.270384,-14.28753,-14.25451,0.8128017,0.8128017 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.270384,4.330709,-14.28753,-14.25451,0.8128017,0.8128017 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.905258,4.330709,-14.26213,-14.25451,0.7874016,0.7874016 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.905258,4.330709,-14.40183,-14.40183,2.035179,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.273559,4.330709,-14.40183,-14.40183,0.8128017,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.965583,3.965583,-14.37643,-14.32563,0.8128015,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.965583,4.270384,-14.37643,-14.32563,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.270384,4.270384,-14.37643,-14.32563,0.8128015,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.965583,4.270384,-14.37643,-14.32563,0.8128015,0.8128015 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=7.175515,7.175515,-12.48254,-12.45872,0.209233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=7.118364,7.118364,-12.48413,-12.45872,0.2035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=5.54479,7.14623,-12.51145,-12.41142,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=5.64488,7.14623,-12.51145,-12.41142,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=5.556261,5.556261,-12.48254,-12.45872,0.209233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=5.556261,5.613411,-12.45872,-12.45872,0.209233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1



&OBST XB=16.05918,16.11633,-12.59843,-12.59843,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.05918,17.29743,-12.59843,-12.59843,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.11951,17.23711,-12.57303,-12.48413,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.11951,17.23711,-12.57303,-12.48413,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.25535,17.25535,-12.61149,-12.51145,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,1.025527,1.082677,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,1.025527,1.958979,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,1.901829,1.958979,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.84417,4.94426,1.09324,1.09324,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,1.085852,1.898654,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,1.898654,1.898654,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,1.901829,1.958979,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,1.025527,1.958979,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,1.025527,1.082677,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.94426,4.94426,-0.30724,-0.2072,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,-1.133477,-0.2000255,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,-1.073152,-0.203204, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,-1.073152,-0.2603506,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.84416,4.94425,-0.30724,-0.30724,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.854585,4.854585,-0.2603505,-0.2571755,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,-1.133477,-0.2000254,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78004,17.78004,-9.07013,-6.180874,3.127382,3.184532, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.78004,17.78004,-9.07013,-9.01298,1.092202,3.184532, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.89592,17.91974,-9.07013,-9.07013,1.092202,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.91974,17.91974,-9.07013,-9.01298,1.092202,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.855881,17.955971,-9.21031,-9.01024,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.89592,17.91974,-9.07013,-6.180875,3.184531,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.91974,17.91974,-9.07013,-6.180875,3.127381,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.855881,17.95598,-9.01024,-6.20928,3.11362,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.855881,17.955971,-6.20928,-6.20928,1.06257,3.21129, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.89434,17.91974,-6.238025,-6.238025,1.092202,3.127381, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.855881,-9.01024,-9.01024,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.7558,17.85589,-9.01024,-6.20928,3.11362,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.755791,17.855881,-6.20928,-6.10924,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=-3.467107,-3.467107,1.381128,2.31458,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.327407,-3.327407,1.381128,2.31458,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.441707,-3.352807,1.441453,1.441453,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.441707,-3.352807,1.441453,2.254255,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.441707,-3.352807,2.254255,2.254255,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.590876,-4.420527,-3.022517,-1.852168,2.035179,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.613327,-4.440732,-3.002312,-1.829717,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.85498,16.95507,-13.37189,-13.37189,-0.01179,2.13693, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.02426,16.95771,-13.34773,-13.34773,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.02426,16.95771,-13.34773,-13.34773,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.90056,16.95771,-13.48743,-13.48743,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38792,17.41174,-13.3128,-13.3128,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38634,17.41174,-13.25565,-13.25565,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38792,17.41174,-13.3128,-12.63335,2.09233,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.41174,17.41174,-13.3128,-12.63335,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38634,17.41174,-13.25565,-12.6905,2.035179,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38792,17.41174,-12.63335,-12.63335,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38634,17.41174,-12.6905,-12.6905,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.27204,17.27204,-13.3128,-13.3128,-12.63335,2.03518,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.25535,17.25535,-13.31173,-13.21169,-0.01179,2.13693, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.25535,17.35544,-12.71152,-12.71152,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.29744,17.33236,-13.25248,-12.69368,2.032005,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.29744,17.33236,-13.25248,-13.25248,0,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-4.80061,-4.80061,2.901956,2.959106,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-4.80061,-4.80061,1.416053,2.959106,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-4.80061,-4.80061,1.416053,1.473203,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-4.66091,-4.66091,1.416053,1.473203,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-4.66091,-4.66091,1.416053,2.959106,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-4.66091,-4.66091,2.901956,2.959106,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1

&OBST XB=-4.721235,-4.686309,1.476378,1.476378,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-4.721235,-4.686309,1.476378,2.898781,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-4.721235,-4.686309,2.898781,2.898781,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-2.171704,-2.171704,-0.8540767,-0.0730252,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-2.232029,-2.197104,-0.7937516,-0.7937516,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-2.232029,-2.197104,-0.1333503,-0.1333503,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-2.232029,-2.197104,-0.1333503,-0.1333503,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-2.311405,-2.311405,-0.8540767,-7.302514E-02,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.6491,-11.6491,-4.470409,-4.446597,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.6491,-11.59195,-4.470409,-4.470409,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.59195,-11.59195,-4.470409,-4.445009,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.6491,-10.71565,-4.470409,-4.446597,2.092329,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.6491,-10.71565,-4.470409,-4.470409,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.59195,-10.7728,-4.470409,-4.445009,2.035179,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-10.71565,-10.71565,-4.470409,-4.446597,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-10.7728,-10.71565,-4.470409,-4.470409,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-10.7728,-10.7728,-4.470409,-4.445009,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-10.7728,-10.71565,-4.330709,-4.330709,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.6491,-11.59195,-4.330709,-4.330709,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.6491,-11.59195,-4.330709,-4.330709,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-10.77597,-10.77597,-4.391034,-4.356109,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.58877,-10.77597,-4.391034,-4.356109,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-11.58877,-11.58877,-4.391034,-4.356109,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.982221,-9.982221,-0.7905766,-0.7334265,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.982221,-9.982221,-1.666878,-0.7334265,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.982221,-9.982221,-1.666878,-1.609728,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.95682,-9.902845,-0.7937516,-0.7937516,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.95682,-9.902845,-1.606553,-0.7937516,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.95682,-9.902845,-1.606553,-1.606553,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.84252,-9.84252,-1.666878,-1.609728,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.84252,-9.84252,-1.666878,-0.7334264,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-9.84252,-9.84252,-1.666878,-0.7334264,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.921387,-5.864237,-6.705614,-6.705614,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.921387,-5.267336,-6.705614,-6.705614,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.324486,-5.267336,-6.705614,-6.705614,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.324486,-5.267336,-6.565913,-6.565913,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.921387,-5.267336,-6.565913,-6.565913,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.921387,-5.864237,-6.565913,-6.565913,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.327661,-5.327661,-6.680213,-6.591313,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.864237,-5.327661,-6.680213,-6.591313,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1  
&OBST XB=-5.96557,-5.86548,-6.70945,-6.60941,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDVK-TRIM-1

&OBST XB=4.84417,4.84417,1.09324,1.89352,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=4.88951,4.88951,1.089027,1.895479,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=4.84417,4.84417,-1.10752,-0.30724,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=4.88951,4.88951,-1.069977,-0.2635255,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-5.611081,-5.055213,-3.000067,-2.444198,3.175006E-03,3.175006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-5.076087,-4.481143,-2.388739,-1.793797,3.175388E-03,3.175388E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.25444,16.85498,-13.47086,-13.47086,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.25444,-13.47086,-13.47086,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.46203,-13.46203,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.46203,-13.46203,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.25444,-13.37189,-13.37189,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.25444,16.85498,-13.37189,-13.37189,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.85498,-13.41176,-13.41176,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.85498,-13.41176,-13.41176,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-12.69685,-12.69685,3.174626E-03,2.02883, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-12.69685,2.02883,2.02883, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-13.2493,3.174803E-03,2.02883, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-13.2493,3.174803E-03,3.174803E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.255341,17.255341,-13.17394,-12.67908,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.33236,17.33236,-13.2493,-12.69685,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,1.479553,3.174956E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.184404,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,1.479553,2.184404,3.175006E-03,3.175006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,1.479553,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.721235,1.479553,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190754,2.190754,3.175057E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190754,2.895606,2.028829,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.895606,2.895606,3.175388E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,2.190754,2.895606,3.175388E-03,3.175388E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,2.190754,2.895606,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.721235,2.190754,2.895606,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1









&OBST XB=16.45591,16.50671,-11.13288,-11.13288,2.540005E-05,0.1739181 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=17.76892,17.76892,-11.27258,-10.77728,2.540005E-05,0.317526 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,17.76892,-10.77728,-10.77728,0.1333757,0.2413259 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45462,16.55471,-10.79859,-10.4027,-0.01179,0.47655 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,16.50671,-10.77728,-10.44708,2.540005E-05,0.4508763 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=17.76892,17.76892,-10.77728,-10.44708,2.540005E-05,0.4508763 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.6548,17.755791,-10.50167,-10.30373,0.28121,0.37888 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45462,16.55471,-10.50167,-10.10578,0.08588,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.55471,17.755791,-10.4027,-10.10578,0.08588,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.45591,-10.11688,-9.827952,0.266726,0.3746762 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=17.76892,17.76892,-10.44708,-10.11688,0.1333757,0.5842265 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,17.76892,-10.11688,-10.11688,0.4000762,0.5080264 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=1.184277,1.717678,-1.562103,-1.562103,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.184277,1.184277,-4.610109,-1.562103,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=4.854585,4.854585,-4.553653,-4.096452,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.096452,-4.096452,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.096452,-4.096452,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.096452,-4.096452,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.553653,-4.553653,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.06051,-3.603309,-9.51232,-9.51232,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603309,-3.603309,-10.12192,-9.51232,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.06051,-4.06051,-10.12192,-9.51232,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603057,-3.603057,-10.73152,-10.12192,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.060258,-4.060258,-10.73152,-10.12192,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603057,-3.603057,-11.34112,-10.73152,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.060258,-4.060258,-11.34112,-10.73152,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603057,-3.603057,-11.88887,-11.34112,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.060258,-4.060258,-11.94906,-11.34112,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-2.175061,-1.672595,-13.63843,-13.63843,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-2.297567,-1.612403,-14.09563,-14.09563,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,-0.0800253,-12.23677,-11.19295,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=0.3771756,0.3771756,-12.29696,-11.19295,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,-0.0800253,-11.19295,-10.65955,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=0.8089765,0.8089765,-11.19295,-10.65955,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,0.7708764,-9.51232,-9.51232,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,0.7708764,-10.12192,-10.12192,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,-0.0800253,-10.12192,-9.51232,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=0.7708764,0.7708764,-10.12192,-9.51232,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.717678,1.717678,-4.533909,-4.076708,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.717678,2.174879,-4.076708,-4.076708,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.717678,2.174879,-4.533909,-4.533909,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.374905,2.374905,-12.33173,-12.15392,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.374905,2.755906,-12.33173,-12.33173,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.374905,2.755906,-12.15392,-12.15392,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-1.010898,-1.010898,-1.473203,-0.9398019,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.4012967,-0.4012967,-1.473203,-0.9398019,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-1.010898,-0.4012967,-1.473203,-0.9398019,0.0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.108077,1.717678,-4.610109,-4.610109,0.8763018,1.028702 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=1.108077,1.717678,-4.610109,-4.610109,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=1.184277,1.717678,-1.562103,-1.562103,0.1016002,1.028702 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=1.717678,1.717678,-4.610109,-1.562103,0.8763018,1.028702 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=1.74137,1.74137,-4.60872,-1.60769,0.08588,0.86723 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=1.108077,1.108077,-4.610109,-1.562103,0.1016002,1.028702 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=1.14083,1.74137,-4.60872,-1.60769,0.08588,0.86723 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=4.854585,4.854585,-4.629854,-4.553653,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=4.854585,4.854585,-4.553653,-4.096452,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=4.854585,4.854585,-4.096452,-4.020252,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=2.797181,2.797181,-4.096452,-4.020252,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=2.797181,2.797181,-4.553653,-4.096452,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=2.797181,2.797181,-4.629854,-4.553653,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=2.797181,4.854585,-4.020252,-4.020252,0.1016002,0.8763018 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=2.797181,4.854585,-4.629854,-4.020252,0.1016002,0.1016002 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1  
&OBST XB=2.797181,4.854585,-4.629854,-4.020252,0.1016002,0.1016002 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ A-CASE-CABN-1







&OBST XB=-2.764729,-1.883438,-14.25019,-13.42195,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.927477,-0.9907663,-14.25019,-13.48926,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.927477,-0.9907663,-14.25019,-13.48926,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.181691,0.4787104,-12.86042,-9.51232,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.181691,0.4787104,-12.86042,-9.51232,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=6.4456,8.04704,-17.913321,-17.31311,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.53367,7.270272,-17.91151,-17.91151,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.53367,7.270272,-17.9304,-17.9304,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.53367,7.270272,-17.91151,-17.91151,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.4456,6.54569,-17.913321,-17.913321,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.4456,6.54569,-17.913321,-17.913321,0.67189,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.45747,6.53367,-17.91151,-17.79932,2.166863,2.166863 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.45747,6.53367,-17.91151,-17.79932,2.243063,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.04704,8.04704,-17.913321,-17.31311,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.04704,12.15074,-17.92465,-17.330811,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.159273,8.895875,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.14713,8.84777,-17.92465,-17.92465,0.57422,0.67189 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.159273,8.895875,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.04704,8.14713,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.74858,10.5493,-17.92465,-17.92465,0.57422,0.67189 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.5493,11.35002,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.95146,13.05155,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.95146,13.05155,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.5529,15.35362,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.91151,-17.91151,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.9304,-17.9304,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.91151,-17.91151,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.45011,12.15074,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.35002,11.45011,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.35002,11.45011,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.85227,14.5529,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.74858,9.84867,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
  
&OBST XB=10.5493,10.64939,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725, SURF\_ID='PANELING'/ vertical strips  
&OBST XB=14.5529,14.65299,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725, SURF\_ID='PANELING'/ vertical strips  
&OBST XB=15.35362,15.45371,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725, SURF\_ID='PANELING'/ vertical strips  
  
&OBST XB=-1.422522,-1.346322,-1.241428,-1.241428,0.6159512,0.6413513 BLOCK\_COLOR='CYAN' / BATHROOM FIXTURES  
&OBST XB=10.34912,10.34912,-12.51145,-2.70807,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.22987,10.22987,-12.47143,-2.692405,2.743206,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.22987,10.35687,-2.692405,-2.692405,2.743206,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1

&OBST XB=10.22987,10.35687,-12.47143,-12.47143,2.743206,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
 &OBST XB=10.22987,10.35687,-12.47143,-2.692405,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
 &OBST XB=10.24903,10.34912,-12.51145,-2.70807,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
 &OBST XB=6.54569,7.24632,-17.913321,-17.913321,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=110/ BAY WINDOW GLASS  
 &OBST XB=6.4456,6.4456,-17.81328,-17.613211,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=100/ BAY WINDOW GLASS  
 &OBST XB=6.4456,6.4456,-17.913321,-17.31311,0.57422, 2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=100/ BAY WINDOW GLASS  
 &OBST XB=6.48287,6.48287,-17.91151,-17.79932,0.6858014,2.166863 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=8.14713,8.84777,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=130/ BAY WINDOW GLASS  
 &OBST XB=9.74858,10.5493,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=10.5493,11.35002,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=13.05155,13.75218,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=14.55291,15.35363,-17.913321,-17.913321,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=15.45371,15.45371,-17.82567,-17.627729,0.67189, 2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=15.45371,15.45371,-17.92465,-17.330811,0.57422, 2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=15.42978,15.42978,-17.91151,-17.79932,0.6858014, 2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=8.94786,9.74858,-17.92465,-17.92465,0.67189,1.84392 , RGB = 0.6,1.0,1.0, T\_REMOVE=78/ BAY WINDOW GLASS  
 &OBST XB=8.94786,9.74858,-17.913321,-17.913321,1.7,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=7.34641,8.0704,-17.913321,-17.913321,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=120/ BAY WINDOW GLASS  
 &OBST XB=12.25083,12.95146,-17.92465,-17.92465,0.67189,1.84392 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=12.22328,12.95988,-17.9349,-17.9349, 1.8, 2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=11.45011,12.15074,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
 &OBST XB=13.85227,14.5529,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
  
 &OBST XB=17.755791,20.157961,-9.21503,-9.01708,0.76956,3.79731 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM' / BAND BOX WALL - foam  
 &OBST XB=17.755791,20.358141,-9.70989,-9.21503,0.76956,3.79731 , RGB=1.0, 0.90196, 0.5725 / BAND BOX WALL Outer  
  
 &OBST XB=6.26584,-5.6653,-1.60769,-1.50765,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
 &OBST XB=1.14083,1.24092,-7.70979,-7.00955,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
 &OBST XB=0.74047,1.14083,-7.10959,-7.00955,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
 &OBST XB=6.26584,-5.96557,-2.2079,-1.60769,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
  
 &OBST XB=3.94335,4.34371,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
 &OBST XB=3.94335,3.94335,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
 &OBST XB=2.442,3.94335,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
 &OBST XB=3.94335,3.94335,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
 &OBST XB=2.442,4.34372,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
 &OBST XB=-6.16575,-5.96557,-13.5118,-12.51145,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784, T\_REMOVE=45 / SIDE DOOR  
 &OBST XB=-6.16575,-5.96557,-8.6101,-7.60976,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784, T\_REMOVE=60 / SIDE DOOR  
 &OBST XB=17.755791,17.955971,-12.38216,-11.39243,-0.01179,2.03926 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM', T\_REMOVE=29/ BACK DOOR  
 &OBST XB=17.89751,17.94196,-12.3349,-12.3349,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.89751,17.94196,-12.3349,-11.42685,2.028829,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.89751,17.94196,-11.42685,-11.42685,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.89751,17.94196,-12.3349,-11.42685,3.175006E-03,3.175006E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=2.968631,3.883033,-14.37643,-14.3415,0,0 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=2.968631,2.968631,-14.37643,-14.3415,0,2.032004 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=3.883033,3.883033,-14.37643,-14.3415,0,2.032004 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=2.968631,3.883033,-14.37643,-14.3415,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=4.854585,4.854585,1.089027,1.895479,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=4.88951,4.88951,1.089027,1.895479,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=4.854585,4.854585,-1.069977,-0.2635255,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=4.88951,4.88951,-1.069977,-0.2635255,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-5.611081,-5.05213,-3.000067,-2.444198,3.175006E-03,3.175006E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-5.076087,-4.481143,-2.388739,-1.793797,3.175388E-03,3.175388E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=16.08776,16.89421,-13.46203,-13.46203,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=16.08776,16.89421,-13.4271,-13.4271,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.29744,17.33236,-12.69685,-12.69685,3.174626E-03,2.02883 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.29744,17.33236,-13.2493,-12.69685,2.02883,2.02883 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.29744,17.33236,-13.2493,-13.2493,3.174803E-03,2.02883 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.29744,17.33236,-13.2493,-12.69685,3.174803E-03,3.174803E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.25535,17.25535,-13.21169,-12.71152,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=17.33236,17.33236,-13.2493,-12.69685,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.686309,1.479553,1.479553,3.174956E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.686309,1.479553,2.184404,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.686309,2.184404,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.686309,1.479553,2.184404,3.175006E-03,3.175006E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.686309,-4.686309,1.479553,2.184404,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.721235,1.479553,2.184404,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.686309,2.190754,2.190754,3.175057E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
 &OBST XB=-4.721235,-4.686309,2.190754,2.895606,2.028829,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1

















&OBST XB=-4.160664,-3.502247,-10.73152,-10.12192,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.6222577,-0.5036906,-1.084234,-0.965202,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.6222577,-0.5036906,-1.371603,-1.252571,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.9085039,-0.7899369,-1.371603,-1.252571,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.9085039,-0.7899369,-1.084234,-0.965202,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5036906,-0.4012967,-1.473203,-0.8382017,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.4012967,-1.473203,-1.371603,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.9085039,-1.473203,-0.8382017,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.4012967,-0.965202,-0.8382017,0.01568,0.9144018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.4012967,-1.473203,-0.8382017,0.01568,0.8763018,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.160664,-3.502247,-11.34112,-10.73152,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.160664,-3.502247,-11.34112,-10.73152,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.502247,-11.93859,-11.34112,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.502247,-11.93859,-11.34112,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.311174,-12.86255,-11.85165,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.311174,-12.86255,-11.85165,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.915073,-2.920449,-13.54495,-12.56474,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.915073,-2.920449,-13.54495,-12.56474,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.915073,-2.466918,-14.02585,-13.07394,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.915073,-2.466918,-14.02585,-13.07394,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-2.764729,-1.883438,-14.25019,-13.42195,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-2.764729,-1.883438,-14.25019,-13.42195,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.927477,-0.9907663,-14.25019,-13.48926,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.927477,-0.9907663,-14.25019,-13.48926,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.181691,0.4787104,-12.86042,-9.51232,2.743206,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.181691,0.4787104,-12.86042,-9.51232,2.705106,2.743206,RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=6.53367,7.270272,-17.9304,-17.9304,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.53367,7.270272,-17.91151,-17.91151,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.53367,7.270272,-17.9304,-17.9304,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.53367,7.270272,-17.91151,-17.91151,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.4456,6.54569,-17.913321,-17.913321,0.57422,2.2346,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.4456,6.54569,-17.913321,-17.913321,0.67189,2.13693,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.45747,6.53367,-17.91151,-17.79932,2.166863,2.166863,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.45747,6.53367,-17.91151,-17.79932,2.243063,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.159273,8.895875,-17.93561,-17.93561,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.159273,8.895875,-17.91656,-17.91656,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.159273,8.895875,-17.93561,-17.93561,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.159273,8.895875,-17.91656,-17.91656,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.04704,8.14713,-17.92465,-17.92465,0.57422,2.2346,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.04704,8.14713,-17.92465,-17.92465,0.57422,2.03926,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.93561,-17.93561,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.91656,-17.91656,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.93561,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.784877,10.52148,-17.91656,-17.91656,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.93561,-17.93561,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.91656,-17.91656,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.93561,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.91656,-17.91656,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.93561,-17.93561,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.91656,-17.91656,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.93561,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.91656,-17.91656,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.95146,13.05155,-17.92465,-17.92465,0.57422,2.13693,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.95146,13.05155,-17.92465,-17.92465,0.57422,2.2346,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.9304,-17.9304,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.91151,-17.91151,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.9304,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.91151,-17.91151,0.6096013,0.6858014,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.94131,-17.94131,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.92208,-17.92208,2.166863,2.243063,RGB=1.0,0.90196,0.5725/ A-FIXT-MAIN-1

&OBST XB=8.972075,9.708676,-17.94131,-17.94131,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.92208,-17.92208,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.84777,8.94786,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.84777,8.94786,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.346472,8.083074,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.346472,8.083074,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.34641,8.04704,-17.913321,-17.913321,0.57422,0.67189 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.346472,8.083074,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.24632,7.34641,-17.913321,-17.913321,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.24632,7.34641,-17.913321,-17.913321,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.15074,-17.92465,-17.330811,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,15.45371,-17.92465,-17.330811,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.22328,12.95988,-17.92208,-17.92208,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.22328,12.95988,-17.94131,-17.94131,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.22328,12.95988,-17.92208,-17.92208,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.25083,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.25083,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.35002,11.45011,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.35002,11.45011,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.74858,9.84867,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.64578,8.04704,-2.70807,-2.70807,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall-wood  
&OBST XB=11.45011,17.755791,-2.68281,-2.68281,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall - wood  
&OBST XB=12.15074,16.25444,-2.68281,-2.68281,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall -wood  
&OBST XB=8.04704,12.15074,-2.68281,-2.68281,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall-wood  
&OBST XB=-5.46512, 6.84596, 3.39404, 3.59411, -0.3048, 3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall

&OBST XB=6.84596,8.04704,-2.70807,-2.40796,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=16.25444,16.25444,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=12.15074,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=12.15074,16.25444,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=16.25444,16.25444,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=12.15074,12.15074,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=8.04704,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=16.25444,17.955971,-2.68281,-2.38589,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2

&OBST XB=17.8559, 18.0, -5.80914, -2.508, -0.10946, 3.79731 , RGB=1.0, 0.90196, 0.5725/ rear wall patch

&OBST XB=17.955971,20.358141,-5.84994,-4.95919,0.76956,3.79731 , RGB=1.0, 0.90196, 0.5725/ rear wall patch

&OBST XB=17.956, 20.3581, -5.0, -9.41038, 3.69964, 3.79731 , RGB=1.0, 0.90196, 0.5725/ rear wall roof patch

&OBST XB=12.15074,16.25444,-17.330811,-2.48486,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=-0.16035,3.94335,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch  
&OBST XB=3.94335,8.04704,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=-4.26404,-0.16035,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch  
&OBST XB=8.04704,8.04704,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=8.04704,12.15074,-17.330811,-2.48486,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=8.04704,8.04704,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=-6.16575,-4.26404,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch  
&OBST XB=16.25444,17.955971,-17.330811,-2.48486,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch

&OBST XB=-5.96557, -0.16035, -13.5118, -12.5114, -0.01179, -0.01179, RGB=1.0, 0.90196, 0.5725/ floor patch

&OBST XB=-6.26584, -5.6653, -1.60769, -1.50765, -0.01179, 2.03926 , RGB=0.5921,0.3294,0.0784 , SURF\_ID=‘PANELING’/ door 5i  
&OBST XB=-6.26584, -5.96557, -2.2079, -1.60769, -0.01179, 2.03926 , RGB=0.5921,0.3294,0.0784, SURF\_ID=‘PANELING’/ door 5i

&OBST XB=14.35272,14.95326,-11.68935,-10.4027,-0.01179,2.82062 , RGB=0,0,0, SURF\_ID=‘PANELING’/ speaker  
&OBST XB=14.35272,14.95326,-4.76124,-3.37562,-0.01179,2.82062 , RGB=0,0,0, SURF\_ID=‘PANELING’/ speaker

&OBST XB=6.74587, 8.04704, -4.80879, -6.0272, -0.01179, 0.9649 , RGB=0,0,0, SURF\_ID=‘PANELING’/ control panel

&SLCF PBX=11.82,QUANTITY=‘TEMPERATURE’ /  
&SLCF PBX=3.94335,QUANTITY=‘TEMPERATURE’ /  
&SLCF PBX=0.79,QUANTITY=‘TEMPERATURE’ /  
&SLCF PBX=-1.74,QUANTITY=‘TEMPERATURE’ /  
&SLCF PBX=-1.0,QUANTITY=‘TEMPERATURE’ /

&SLCF PBX=-2.48,QUANTITY='TEMPERATURE' /  
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&SLCF PBX=10.15,QUANTITY='TEMPERATURE' /  
&SLCF PBX=10.96,QUANTITY='TEMPERATURE' /  
&SLCF PBX=9.32,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-8.1,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-13.0,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-11.85,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.3048,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.6096,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=1.2192,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.9144,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.3048,QUANTITY='oxygen' /  
&SLCF PBZ=0.6096,QUANTITY='oxygen' /  
&SLCF PBZ=1.2192,QUANTITY='oxygen' /  
&SLCF PBZ=0.9144,QUANTITY='oxygen' /

&SLCF PBZ=1.5,QUANTITY='oxygen' /  
&SLCF PBZ=0.75,QUANTITY='oxygen' /  
&SLCF PBZ=1.5,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.75,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=1.5,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBZ=0.75,QUANTITY='GAUGE\_HEAT\_FLUX' /

&SLCF PBX=-2.76, QUANTITY='TEMPERATURE' /  
&SLCF PBX=3.3928, QUANTITY='TEMPERATURE' /  
&SLCF PBX=11.0,QUANTITY='TEMPERATURE' /  
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&SLCF PBX=3.3928,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBX=11.0,QUANTITY='GAUGE\_HEAT\_FLUX' /

&SLCF PBY=-14.85,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-11.84,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-13.01,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-7.5,QUANTITY='TEMPERATURE' /  
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&SLCF PBY=-7.5,QUANTITY='oxygen' /  
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&SLCF PBY=-13.01,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBY=-7.5,QUANTITY='GAUGE\_HEAT\_FLUX' /

&OBST XB=20.157961,20.358141,-9.21503,-5.84994,0.76956,3.69964, RGB=1.0, 0.90196, 0.5725/ back wall band box

## L2.4 Full Nightclub, Sprinklered

```
&HEAD CHID='Station215',TITLE='RI Nightclub' /
&GRID IBAR=41,JBAR=108,KBAR=42/
&PDIM XBAR0=-12.47143, XBAR=-8.367733, YBAR0=-7.2096215,YBAR=3.594107,ZBAR0=-0.3048006,ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=-8.367733, XBAR=-4.26404, YBAR0=-19.01335,YBAR=3.594107,ZBAR0=-0.3048006,ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=-4.26404, XBAR=-0.16034775, YBAR0=-19.01335,YBAR=3.594107,ZBAR0=-0.3048006,ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=-0.16034775, XBAR=3.943348, YBAR0=-19.01335,YBAR=3.594107,ZBAR0=-0.3048006,ZBAR=3.797308/
&GRID IBAR=41,JBAR=226,KBAR=42/
&PDIM XBAR0=3.943348, XBAR=8.047044, YBAR0=-19.01335,YBAR=3.594107,ZBAR0=-0.3048006,ZBAR=3.797308/
&GRID IBAR=41,JBAR=176,KBAR=42/
&PDIM XBAR0=8.047044, XBAR=12.15074025, YBAR0=-19.01335,YBAR=-1.594107,ZBAR0=-0.3048006,ZBAR=3.797308/
&GRID IBAR=82,JBAR=176,KBAR=42/
&PDIM XBAR0=12.15074025, XBAR=20.35814, YBAR0=-19.01335,YBAR=-1.594107,ZBAR0=-0.3048006,ZBAR=3.797308/

&TIME TWFIN = 300 , SYNCHRONIZE = .TRUE./
&MISC SURF_DEFAULT='GYPSUM BOARD',NFRAMES=1200,REACTION='POLYURETHANE', DROP_VERTICAL_VELOCITY=0.5,
SMOKE3D=.TRUE., MAXIMUM_DROPLETS=1200000/
&PART ID='my water droplets', WATER=.TRUE., AGE=15, DROPLETS_PER_SECOND=20000/

&REAC ID='POLYURETHANE'
FYI='C_6.3 H_7.1 N_O_2.1, NFPA Handbook, Babrauskas'
SOOT_YIELD = 0.1
MW_FUEL = 130.3
FUEL_N2 = 0.5
NU_CO2 = 6.3
NU_H2O = 3.55
NU_O2 = 7.025 /

&SURF ID='FOAM'
FYI='Test Data'
RGB=0.451,0.3568,0.3647
HEAT_OF_VAPORIZATION=1350.
BACKING='PANELING'
KS=0.034
DX_SOLID=0.00005
C_P=1.4
DELTA=0.03
DENSITY=22.0
TMPIGN=370.
BURNING_RATE_MAX=0.008/

&SURF ID = 'PANELING'
FYI = 'Charring material'
RGB = 0.5,0.2,0.1
PHASE = 'CHAR'
MOISTURE_FRACTION = 0.01
DELTA = 0.01
TMPIGN = 360.0
HEAT_OF_VAPORIZATION = 500.
DENSITY = 450.
RAMP_KS = 'KS'
RAMP_C_P = 'CPV'
RAMP_C_P_CHAR = 'CPC'
RAMP_KS_CHAR = 'KSC'
CHAR_DENSITY = 120.
WALL_POINTS = 30
BACKING = 'EXPOSED'/
&RAMP ID = 'KS', T = 20., F = 0.13 /
&RAMP ID = 'KS', T = 500., F = 0.29 /
&RAMP ID = 'KSC', T = 20., F = 0.077 /
&RAMP ID = 'KSC', T = 900., F = 0.16 /
&RAMP ID = 'CPV', T = 20., F = 1.2 /
&RAMP ID = 'CPV', T = 500., F = 3.0 /
&RAMP ID = 'CPC', T = 20., F = 0.68 /
&RAMP ID = 'CPC', T = 400., F = 1.5 /
&RAMP ID = 'CPC', T = 900., F = 1.8 /

&SURF ID = 'GYPSUM BOARD'
RGB = 0.80,0.80,0.70
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HRRPUA = 100.
RAMP_Q = 'GB'
KS = 0.48
ALPHA = 4.1E-7
DELTA = 0.013
TMPIGN = 400. /
&RAMP ID='GB',T= 0.0,F=0.0 /
&RAMP ID='GB',T= 1.0,F=0.5 /
&RAMP ID='GB',T= 2.0,F=1.0 /
&RAMP ID='GB',T=10.0,F=1.0 /
&RAMP ID='GB',T=20.0,F=0.0 /
&RAMP ID='GB',T=30.0,F=0.0 /

&SURF ID      = 'CARPET'
  RGB          = 0.60,0.80,1.00
  C_DELTA_RHO  = 1.29
  BACKING      = 'INSULATED'
  TMPIGN       = 280.
  SURFACE_DENSITY = 0.3
  BURNING_RATE_MAX = 0.01
  HEAT_OF_COMBUSTION = 20000.
  HEAT_OF_VAPORIZATION= 3000. /

&SURF ID      = 'CEILING TILE'
  FYI          = 'Armstrong Ceramaguard (Item 602B)'
  ALPHA        = 2.6E-7
  KS           = 0.0611
  DELTA        = 0.016 /

&SURF ID='FIRE',HRRPUA=1500.,RAMP_Q='ramp1', RGB=1,0,0 /

&RAMP ID='ramp1', T=0.0, F=0.0/
&RAMP ID='ramp1', T=1.0, F=1.0/
&RAMP ID='ramp1', T=34.0, F=1.0/
&RAMP ID='ramp1', T=35.0, F=0.0/

&VENT XB= 17.7558, 17.7558, -6.00928, -6.20928, 2.3, 2.50, SURF_ID='FIRE'/
&VENT XB= 17.8558, 17.9558, -6.20928, -6.20928, 2.3, 2.40, SURF_ID='FIRE' /
&VENT XB= 17.7558, 17.7558, -9.01024, -9.21024, 2.3, 2.50, SURF_ID='FIRE' /
&VENT XB= 17.8558, 17.9558, -9.01024, -9.01024, 2.3, 2.40, SURF_ID='FIRE' /

&VENT CB='XBAR0' SURF_ID='OPEN'/
&VENT CB='XBAR' SURF_ID='OPEN'/
&VENT CB='YBAR0' SURF_ID='OPEN'/
&VENT CB='YBAR' SURF_ID='OPEN'/
&VENT CB='ZBAR0' SURF_ID='INERT'/
&VENT CB='ZBAR' SURF_ID='OPEN'/

&SPRK XYZ=19.107,-7.631,3.64, MAKE='sk114', PART_ID='my water droplets'/ drummer's alcove sprinkler
&SPRK XYZ=15.927,-9.4598,3.64, MAKE='sk114', PART_ID='my water droplets'/ df se sprinkler
&SPRK XYZ=15.927,-5.8022,3.64, MAKE='sk114', PART_ID='my water droplets'/ df sw sprinkler
&SPRK XYZ=12.2694,-9.4598,3.64, MAKE='sk114', PART_ID='my water droplets'/ df ne sprinkler
&SPRK XYZ=12.2694,-5.8022,3.64, MAKE='sk114', PART_ID='my water droplets'/ df nw sprinkler

&BNDF QUANTITY='WMPUA' /

&OBST XB=-6.16575,6.74588,-17.31311,-4.70876,-0.3048,-0.3048 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=-6.162687,6.705614,-4.73711,-3.648082,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=-5.990623,6.705614,-2.597155,0.8509017,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=-12.4365,-5.426086,-3.648082,0.8509017,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=6.461138,14.43993,-17.28791,-4.73711,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=14.45282,17.95598,-12.51145,-10.01059,-0.3048,-0.3048 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=14.43993,17.89751,-17.28791,-9.991745,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=6.461138,15.45911,-17.92291,-9.991745,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=-5.426086,6.772289,-2.597155,0.8509017,-0.3048006,-0.3048006 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=6.74587,8.04704,-4.80879,-2.508,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=12.15074,16.25444,-4.86022,-2.48486,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=12.15074,12.15074,-4.86022,-2.58384,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=16.25444,16.25444,-4.86022,-2.58384,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=8.04704,12.15074,-4.86022,-2.48486,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=8.04704,8.04704,-4.90883,-2.60803,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=8.04704,8.04704,-4.90883,-2.60803,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=16.25444,17.955971,-4.86022,-2.48486,-0.3048,-0.10946 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=6.705614,17.89751,-4.82601,-2.53683,-0.1524003,-0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=16.25444,16.25444,-5.94892,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0
&OBST XB=14.35272,16.25444,-5.94892,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0

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&OBST XB=16.25444,17.855881,-5.94892,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.89751,-5.949962,-4.73711,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35272,16.25444,-10.00681,-9.314,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,17.855881,-10.00681,-9.314,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-10.0362,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-10.0362,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35272,16.25444,-9.314,-5.94892,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=16.25444,17.855881,-9.314,-5.94892,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-9.281006,-5.949962,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-9.281006,-5.949962,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-5.949962,-4.82601,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,14.60935,-4.82601,-4.73711,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.35103,17.87529,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.39548,17.87529,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=14.39548,17.87529,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.755791,17.955971,-10.10578,-4.76124,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.87529,17.94196,-10.08065,-9.281006,0.2286005,0.2286005 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.755791,20.358141,-9.70989,-4.95919,0.67189,0.76956 , RGB=0.451, 0.3568, 0.3647 / foam zzz  
&OBST XB=17.89751,17.94196,-12.52857,-5.889637,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-5.96557,6.74588,-2.508,0.89317,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-6.16575,10.44921,-3.60838,-2.508,3.69964,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-6.16575,17.85589,-5.90917,-3.60838,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-6.16575,17.85589,-12.51145,-5.90917,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-0.16035,3.94335,-12.51145,-5.90917,3.69964,3.69964 , SURF\_ID='CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-0.16035,3.94335,-17.31311,-12.51145,3.69964,3.69964 , RGB=1.0, 0.90196, 0.5725/ sunroom ceiling  
&OBST XB=-12.47143,-5.46512,-3.60838,0.89317,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-12.4365,-9.782195,-4.400559,0.8509017,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-12.4365,-9.801245,-7.080265,0.8509017,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=17.85589,20.358141,-9.41038,-5.90917,3.69964,3.69964 , RGB=0.451, 0.3568, 0.3647,SURF\_ID = 'FOAM' / foam  
&OBST XB=6.74588,17.85589,-5.90917,-2.508,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-5.46512,6.74588,-2.508,3.59411,3.69964,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=4.34372,10.24903,-11.51111,-4.80879,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=4.34372,10.24903,-12.51145,-11.51111,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=10.34912,10.44921,-12.51145,-4.80879,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=3.94335,6.64579,-11.51111,-4.80879,2.72295,3.40663 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=4.94426,6.64579,-4.80879,-2.70807,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=2.442,6.64579,-4.80879,-2.70807,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=1.24092,6.64579,-8.0099,-2.70807,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=1.24092,6.64579,-9.51042,-4.80879,2.72295,3.5043 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=1.24092,6.64579,-11.41107,-4.80879,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=2.24182,3.94335,-11.41107,-4.80879,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=3.94335,6.64578,-11.41107,-4.80879,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=4.94426,6.64579,-2.70807,3.39404,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-4.36413,2.442,-2.70807,-1.60769,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-5.16485,2.442,-6.60941,-2.70807,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-5.16485,1.24092,-7.00955,-6.60941,2.72295,3.69964 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=-6.16575,-4.26404,-6.70945,-1.50765,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725 / wall  
&OBST XB=-6.078826,-4.148422,-3.492507,-1.562103,2.743206,2.743206 , RGB=1.0, 0.90196, 0.5725/ A-CEIL-MAIN-0  
&OBST XB=-0.16035,2.24182,-11.41107,-9.51042,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-4.26404,-0.16035,-11.41107,-9.51042,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-5.96557,-4.26404,-11.41107,-9.51042,2.72295,2.72295 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=-5.96557,2.24182,-17.113041,-11.41107,2.72295,2.72295 , SURF\_ID='CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=6.64579,10.44921,-4.80879,-2.70807,2.72295,2.72295 , SURF\_ID = 'CEILING TILE' , RGB=1.0, 0.90196, 0.5725/ ceiling  
&OBST XB=17.755791,17.755791,-9.41297,-5.94892,0.76956,1.06257 , RGB=0.5921,0.3294,0.0784 , SURF\_ID= PANELING/ A-PLAT-RIM-0  
&OBST XB=-12.4365,-12.4365,-7.080265,0.8509017,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-5.426086,0.8509017,0.8509017,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-5.426086,-5.426086,0.8509017,3.559182,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.772289,6.772289,-2.597155,3.559182,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.705614,14.43993,-4.73711,-4.73711,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.755791,17.955971,-12.48113,-10.00681,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=15.45911,15.45911,-17.92291,-17.28791,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.4456,8.04704,-17.913321,-17.913321,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,15.45371,-17.913321,-17.913321,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,15.45371,-17.913321,-17.913321,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.461138,6.461138,-17.92291,-17.28791,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.16575,-4.26404,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-3.94335,6.4456,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-0.16035,3.94335,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-4.26404,-0.16035,-17.31311,-17.31311,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.16575,-6.16575,-17.31311,-3.60838,-0.3048,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.782195,-6.162687,-3.648082,-3.648082,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.782195,-9.782195,-4.400559,-3.648082,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.801245,-9.801245,-7.080265,-4.400559,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-9.801245,-7.080265,-7.080265,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.705614,6.705614,-4.82601,-2.53683,-0.1524003,0 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1

&OBST XB=6.705614,6.705614,-4.82601,-2.53683,0.0,1524003 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=16.25444,17.855881,-2.58384,-2.58384,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.74587,8.04704,-2.508,-2.508,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,16.25444,-2.58384,-2.58384,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=8.04704,12.15074,-2.58384,-2.58384,-0.10946,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.855881,17.89751,-2.53683,-2.53683,-0.1524003,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-4.82601,-2.53683,-0.1524003,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=14.35103,17.89751,-4.73711,-4.73711,0.2286005,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-5.949962,-4.73711,0.2286005,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.855881,17.955971,-9.314,-5.94892,0.18355,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.855881,17.955971,-11.39243,-9.314,0.18355,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.78639,20.32322,-5.889637,-5.889637,0.7874016,1.092202 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=20.358141,20.358141,-9.11605,-5.84994,0.76956,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-12.4365,-7.080265,0.8509017,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-5.426086,0.8509017,0.8509017,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-5.426086,-5.426086,0.8509017,3.559182,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-5.426086,6.772289,3.559182,3.559182,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.772289,6.772289,-2.53683,3.559182,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-5.889637,-5.889637,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,20.32322,-5.889637,-5.889637,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=20.32322,20.32322,-9.099635,-5.889637,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.94196,17.94196,-12.52857,-9.413134,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.94196,-12.52857,-12.52857,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=17.89751,17.89751,-17.28791,-12.52857,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=12.15074,16.25444,-17.330811,-17.330811,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.16575,-4.26404,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=8.04704,12.15074,-17.330811,-17.330811,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-4.26404,-0.16035,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=3.94335,8.04704,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=16.25444,17.855881,-17.330811,-17.330811,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-0.16035,3.94335,-17.31311,-17.31311,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-6.162687,-6.162687,-17.28791,-3.648082,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.782195,-6.162687,-3.648082,-3.648082,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-9.801245,-9.801245,-7.080265,-4.400559,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=-12.4365,-9.801245,-7.080265,-7.080265,3.657607,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-PLAT-RIM-1  
&OBST XB=6.705614,6.705614,-2.67653,-2.597155,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=6.705614,6.705614,-4.73711,-2.67653,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.43993,14.43993,-4.82601,-4.73711,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.43993,14.43993,-9.991745,-4.82601,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=17.83719,17.83719,-9.991745,-9.991745,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=17.83719,17.94196,-9.991745,-9.991745,-0.3048006,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=6.705614,17.89751,-4.82601,-4.82601,-0.1524003,0 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=12.15074,16.25444,-4.76124,-4.76124,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=8.04704,12.15074,-4.76124,-4.76124,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=6.74587,8.04704,-4.80879,-4.80879,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=16.25444,17.855881,-4.76124,-4.76124,-0.01179,0.18355 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=17.80226,17.94196,-10.08065,-10.08065,0.2286005,0.5334011 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.39548,17.80226,-10.08065,-10.08065,0.2286005,0.5334011 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.35272,14.35272,-10.00681,-4.76124,0.18355,0.57422 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS  
&OBST XB=14.35103,14.35103,-4.82601,-4.73711,0.2286005,0.5334011 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-PLAT-RIM-FS

&OBST XB=17.89751,17.94196,-12.52857,-5.889637,3.797308,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.4365,-5.426086,-3.648082,0.8509017,3.797308,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.772289,17.89751,-5.889637,-2.53683,3.797308,3.797308 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.73076,-4.686309,1.476378,2.898781,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.441707,-3.397257,1.441453,2.254255,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.06476,-4.46422,-2.40796,-1.80776,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.185246,-2.286005,-1.473203,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.86368,-2.26223,-0.80741,-0.10717,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.6405,-2.286005,-0.1333503,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.6644,-3.46332,-1.50765,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-4.185246,-1.791551,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.06476,-4.46422,-2.40796,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.11583,-4.686309,-2.403787,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86909,-4.6644,-3.50834,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86792,-4.686309,-1.606553,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86909,-4.6644,-0.80741,0.69311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.86792,-5.365761,-0.7937516,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.441707,-2.286005,-0.1333503,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,0.3556007,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.6644,-3.46332,0.69311,1.39335,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,1.441453,1.476378,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.6644,-3.46332,1.49338,2.29366,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,2.254255,2.898781,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.686309,-3.441707,2.898781,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP

&OBST XB=-5.620062,-5.052968,-3.002312,-2.435218,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.046901,-4.440732,-2.429151,-1.822982,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.24182,2.34191,-13.71187,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,6.74587,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,6.74588,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,6.74588,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,6.74588,-8.0099,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.94155,6.74588,-4.70876,-4.50869,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.04164,6.74588,-4.50869,-3.00817,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,6.74587,-3.00817,-2.70807,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.34191,3.94335,-3.00817,-2.70807,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.34371,6.74587,-12.51145,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.34371,8.04704,-12.51145,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,10.44921,-12.48113,-4.66227,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.384684,10.39973,-12.48413,-4.73711,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.384684,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,10.44921,-12.48113,-11.39243,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=5.64488,8.04704,-12.51145,-11.31104,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=7.11519,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=7.254889,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=9.998096,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=10.1124,10.39973,-12.48413,-11.357,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,6.74587,-11.51111,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.241428,6.705614,-8.048475,-4.73711,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,5.34461,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,5.34462,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-9.51042,-8.0099,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.94335,4.74407,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24092,4.74408,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.24091,3.94335,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,2.24182,-11.41107,-9.51042,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,2.24182,-12.51145,-11.41107,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.007112,2.286005,-12.85878,-12.56033,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-13.5118,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-13.5118,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-13.5118,-12.81155,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,2.24182,-13.71187,-13.5118,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.16035,2.24182,-17.113041,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.26404,-0.16035,-17.113041,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,-4.26404,-17.113041,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.94426,6.64579,-2.70807,-1.10752,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.94426,6.64579,-1.10752,-0.30724,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.94426,6.64579,-0.30724,1.09324,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.943485,6.616714,1.085852,1.898654,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.943485,6.616714,1.898654,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.24001,2.442,-7.00955,-2.70807,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.24002,1.4411,-7.90986,-7.00955,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.04475,1.284448,-8.048475,-7.851798,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.24002,2.442,-7.00955,-1.60769,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.26404,-0.16035,-7.00955,-1.60769,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.168911,2.413005,-7.048514,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.16485,2.442,-6.60941,-1.60769,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.052968,2.413005,-2.466649,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.01547,2.413005,-2.429151,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-4.440732,2.413005,-1.854413,-1.562103,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.588631,-5.052968,-3.002312,-2.466649,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,-5.068025,-3.492507,-3.002312,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,-5.06476,-6.60941,-3.50834,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.078826,-5.588631,-3.492507,-3.002312,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.241554,-2.197104,-0.7937516,-0.1333503,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.197104,-0.1016002,-1.473203,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.197104,-0.1016002,-0.7937516,-0.1333503,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-2.16214,-0.06025,-0.10717,0.393,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.08458,16.89738,-13.46203,-13.41758,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.39243,15.46645,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.46645,15.57639,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.57639,16.08458,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.08458,16.89738,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.89738,17.74194,-17.13234,-13.46203,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-4.80879,-2.70807,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=8.04704,10.44921,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=2.34191,4.34372,-12.51145,-11.51111,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.374905,4.340234,-12.85878,-12.48413,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP

&OBST XB=2.374905,4.340234,-13.67158,-12.85878,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.34191,4.34372,-14.31207,-13.71187,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.938212,4.384684,-12.48413,-11.54432,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,17.755791,-10.10578,-4.66227,0.57422,0.57422 , RGB=0.0,0.0,0.286 , SURF\_ID='CARPET' / carpet  
&OBST XB=14.35272,16.25444,-10.10578,-4.66227,0.57422,0.57422 , RGB=0.0,0.0,0.286 , SURF\_ID='CARPET' / carpet  
&OBST XB=14.35103,17.80544,-10.08065,-4.73711,0.5334011,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.35103,17.78639,-10.08065,-9.290221,0.5334011,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-0.06025,1.74137,-1.50765,3.39404,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.36323,1.74137,2.29366,3.39404,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.352807,1.045579,1.441453,2.254255,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-3.352807,0.5702816,0.4445009,1.441453,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.861062,-5.327661,-6.680213,-6.635764,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=0.4071501,1.013319,-7.91466,-7.308491,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,-5.257811,-7.651765,-7.137414,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,-5.257811,-7.137414,-6.680213,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,-5.26494,-8.6101,-7.10959,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,0.24002,-8.6101,-7.10959,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,1.152527,-8.566168,-7.91466,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.96557,1.14083,-9.41038,-8.10993,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-6.007112,1.152527,-9.423419,-8.566168,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.3089,-13.3427,-12.61656,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.683389,15.14161,-17.22758,-17.13234,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=5.616586,7.11519,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=7.254889,9.998096,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=10.1124,12.627,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.754,14.7098,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.27041,15.3393,-13.46203,-13.3427,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.30353,-13.46203,-12.63879,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.30353,-17.13234,-12.63879,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.86401,15.30353,-17.13234,-12.63879,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,15.15344,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-17.113041,-12.61149,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.5457,14.85318,-17.113041,-12.61149,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,14.85318,-17.13286,-12.58011,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.4438,8.04704,-17.113041,-12.61149,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.429134,14.86401,-17.13234,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.968631,3.883033,-14.37643,-14.33198,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=3.883033,4.302134,-17.13234,-14.37643,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.94245,3.84326,-17.113041,-14.41211,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.47333,2.968631,-17.13234,-14.37643,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.374905,2.47333,-17.13234,-14.37643,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.854585,4.899035,1.085852,1.898654,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,0.4445009,1.085852,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,1.085852,1.898654,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,1.898654,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-11.58877,-6.924689,-4.445009,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-11.58877,-10.77597,-6.924689,-4.445009,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-10.7699,-9.96918,-6.90952,-4.40865,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.755791,17.855881,-9.01024,-6.20928,0.9649,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.855881,20.157961,-9.314,-6.04789,0.86723,1.06257 , RGB=0.0,0.0,0.286 , SURF\_ID='CARPET' / band box - carpet  
&OBST XB=17.855881,20.157961,-9.21503,-6.04789,1.06257,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.89434,20.16764,-9.009805,-6.045212,1.092202,1.092202 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.89434,20.16764,-6.241199,-6.045212,1.092202,1.092202 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.29744,17.34188,-13.25248,-12.69368,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.9025,15.3474,-13.32047,-12.59434,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.11951,17.23711,-12.57303,-12.52857,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.89738,17.29744,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.08458,17.23711,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.39063,17.23711,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=15.3474,17.23711,-13.37313,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.941,17.23711,-13.29825,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.38634,17.74194,-13.37313,-13.25248,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.38634,17.74194,-13.25248,-12.69368,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.38634,17.74194,-12.69368,-12.57303,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=4.854585,4.899035,-1.073152,-0.2603505,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.501905,4.854585,-2.603505,-1.073152,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=2.54209,4.84417,-1.50765,-0.30724,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,-1.473203,-0.2603505,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,-1.473203,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=1.806579,4.854585,-0.2603505,0.3556007,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.35272,16.25444,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET' / A-FLOR-MAIN-CP-carpet  
&OBST XB=16.25444,17.755791,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET' / A-FLOR-MAIN-CP-carpet  
&OBST XB=-5.270511,-4.77521,2.898781,3.403607,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-5.270511,-4.77521,1.476378,2.898781,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP

&OBST XB=-5.270511,-4.77521,0.7842266,1.476378,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.330811,-17.23184,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-17.31311,-17.21307,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,15.15344,-17.330811,-17.23184,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=6.64578,8.04704,-17.81328,-17.31311,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=8.04704,12.15074,-17.7267,-17.330811,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,15.15344,-17.7267,-17.330811,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-9.95682,-9.91237,-1.606553,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-11.58877,-10.77597,-4.400559,-4.356109,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-0.7937516,0.6953264,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-1.606553,-0.7937516,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-3.587757,-1.606553,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=-12.28092,-9.95682,-4.356109,-3.587757,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,14.35272,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=10.44921,12.15074,-4.76124,-2.68281,0.18355,0.18355 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CARPET'/ A-FLOR-MAIN-CP-carpet  
&OBST XB=10.44921,12.15074,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,12.65119,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,16.75489,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=10.44921,12.15074,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,16.25444,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.65119,16.25444,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,17.755791,-12.48113,-11.29346,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.627,17.71019,-12.48413,-11.43637,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.7098,17.71019,-12.48413,-12.35077,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.11951,17.71019,-12.48413,-12.35077,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=17.23711,17.71019,-12.48413,-12.35077,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.25444,17.755791,-11.29346,-10.00681,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.35272,16.25444,-11.29346,-10.00681,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.43993,17.78639,-11.29032,-9.991745,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=14.3471,17.71019,-11.43637,-9.991745,0,0 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.50671,17.76892,-10.14228,-10.14228,0.508001,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=16.50671,17.76892,-10.11688,-10.11688,0.508001,0.5334011 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-CP  
&OBST XB=12.15074,14.45281,-11.29346,-4.66227,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,12.15074,-11.29346,-4.66227,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,14.45281,-11.31104,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,12.15074,-11.31104,-4.70876,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ dance floor  
&OBST XB=10.44921,12.15074,-11.39243,-10.00681,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-HF  
&OBST XB=16.25444,16.75489,-11.39243,-10.00681,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-HF  
&OBST XB=12.15074,16.25444,-11.39243,-10.00681,-0.01179,-0.01179 , RGB=1.0, 0.90196, 0.5725/ A-FLOR-MAIN-HF  
&OBST XB=16.48131,16.48131,-10.77728,-10.44708,-3.149606E-03,0.1302007 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-0  
&OBST XB=16.48131,16.48131,-10.44708,-10.09465,3.175006E-03,0.2738087 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-0  
&OBST XB=-12.28092,-9.95682,0.6953264,0.6953264,0.3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-9.86909,-5.36503,0.69311,0.69311,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-5.270511,-5.270511,0.7842266,3.403607,0.3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-5.270511,-4.77521,3.403607,3.403607,0.3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-4.6644,-3.46332,3.39404,3.39404,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-3.36323,1.74137,3.39404,3.39404,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=1.84146,4.84417,3.39404,3.39404,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=4.94426,6.64579,3.39404,3.39404,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-6.64578,6.64578,-2.70807,3.39404,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=16.25444,17.755791,-2.68281,-2.58384,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=12.15074,16.25444,-2.68281,-2.68281,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=8.04704,12.15074,-2.68281,-2.68281,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64578,8.04704,-2.70807,-2.70807,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64579,17.7558,-2.70807,-2.70807,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64579,17.7558,-2.70807,-2.70807,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64579,17.7558,-2.70807,-2.70807,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall  
&OBST XB=6.64579,17.7558,-2.70807,-2.70807,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ upper foam wall



&OBST XB=6.670689,15.15431,-17.13234,-17.13234,2.768606,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.521463,6.670689,-17.13234,-17.13234,0,2.768606 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=5.96557,-5.96557,-17.113041,-13.5118,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=5.96557,-5.96557,-17.113041,-13.5118,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.007112,-6.007112,-13.48743,-12.54763,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-6.007112,-6.007112,-12.54763,-9.51232,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.16575,-5.96557,-12.51145,-9.51042,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.007112,-6.007112,-9.423419,-8.578867,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.16575,-5.96557,-9.41038,-8.6101,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.007112,-6.007112,-8.578867,-7.639065,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=5.96557,-5.96557,-7.60976,-6.70945,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.007112,-6.007112,-7.639065,-6.680213,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=5.96557,-5.96557,-6.60941,-3.50834,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-9.76632,-9.76632,-4.365109,-3.663957,-0.304806,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-9.96918,-9.96918,-6.90952,-4.40865,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-12.28092,-9.95682,-6.924689,-6.924689,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-12.27125,-12.27125,-6.90952,-4.40865,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=-12.28092,-12.28092,-4.356109,0.6953264,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=20.057871,20.157961,-9.01708,-6.04789,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=15.30353,15.30353,-17.76734,-17.30379,0,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=12.15074,15.25353,-17.7267,-17.7267,-0.01179,0.57422 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=6.64578,8.04704,-17.81328,-17.81328,-0.01179,0.57422 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=8.04704,12.15074,-17.7267,-17.7267,-0.01179,0.57422 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='PANELING'/ A-WALL-MAIN-SR-wood  
&OBST XB=6.616714,15.30353,-17.76734,-17.76734,0,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=17.755791,17.755791,-10.00681,-9.314,1.06257,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-10.00681,-9.314,0.76956,1.06257 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-10.00681,-9.314,0.57422,0.76956 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-11.29346,-10.00681,0.57422,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-11.29346,-10.00681,-0.01179,0.57422 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.855881,-12.38216,-11.29346,2.03926,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.755791,-12.51145,-12.31138,2.03926,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.955971,-12.48113,-12.48113,-0.01179,2.03926 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=6.616714,6.616714,-17.76734,-17.30379,0,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=17.74194,17.74194,-13.37313,-12.57303,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=17.755791,17.855881,-17.13286,-13.47086,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=6.26584,-5.96557,-3.50834,-2.2079,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=9.86909,-6.16575,-3.50834,-3.50834,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=15.46645,15.57639,-17.13234,-17.13234,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=15.39243,15.46645,-17.13234,-17.13234,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-SR  
&OBST XB=8.36773,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-8.36773,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-5.46512,0.89317,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-5.46512,-5.46512,0.89317,3.59411,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.84597,6.84597,-2.508,3.59411,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=16.25444,16.25444,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,16.25444,-2.68281,-2.38589,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=16.25444,16.25444,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=12.15074,16.25444,-2.508,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,8.04704,-2.70807,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,12.15074,-2.68281,-2.38589,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,8.04704,-2.60803,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,12.15074,-2.508,-2.508,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-4.86022,-2.48486,0.18355,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-4.86022,-2.48486,-0.3048,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.99594,17.99594,-5.854712,-4.82601,1.092202,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-5.84994,-4.86022,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.955971,17.955971,-6.04789,-5.84994,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2



&OBST XB=6.521463,6.670689,-17.32284,-17.32284,2.768606,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.54569,6.64578,-17.31311,-17.31311,-0.01179,2.72295 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-17.32284,-13.48743,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.16575,-6.16575,-17.31311,-13.5118,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-17.32284,-13.48743,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-13.48743,-12.54763,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-13.48743,-12.54763,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.16575,-5.96557,-12.51145,-8.6101,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-12.54763,-8.578867,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-8.578867,-7.639065,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-8.578867,-7.639065,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-7.639065,-3.683007,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.16575,-6.16575,-7.60976,-3.70841,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.197613,-6.197613,-7.639065,-3.683007,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-9.95682,-9.95682,-4.356109,-3.587757,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-9.76632,-9.76632,-7.11519,-4.400559,-0.3048006,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-9.769,-7.10959,-7.10959,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-12.47143,-12.47143,-7.10959,0.89317,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=20.358141,20.358141,-11.605,-5.84994,0.76956,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.45371,15.45371,-17.92465,-17.330811,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-6.4456,8.04704,-17.913321,-17.913321,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=8.04704,11.85047,-17.92465,-17.92465,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,11.84785,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,11.84785,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,11.84785,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=11.84785,13.62332,-17.95784,-17.95784,-0.3048006,0.5683262 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=13.65209,15.45371,-17.92465,-17.92465,-0.3048,0.57422 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.955971,-11.39243,-9.314,0.18355,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.855881,-11.39243,-10.00681,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=FOAM/ foam zzzz  
&OBST XB=17.755791,17.755791,-11.39243,-10.00681,0.18355,2.03926 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=FOAM/ foam zzzz  
&OBST XB=17.955971,17.955971,-11.39243,-10.00681,-0.01179,0.18355 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-11.41097,-9.991745,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-12.35077,-11.41097,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.955971,-12.38216,-10.00681,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-12.52857,-12.35077,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.855881,17.955971,-12.77805,-12.38216,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.97689,17.97689,-12.52857,-12.35077,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=6.426213,6.426213,-17.95784,-17.32284,-0.3048006,0.5746762 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=17.755791,17.955971,-17.330811,-12.48113,-0.3048,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=-9.769,-6.16575,-3.70841,-3.70841,-0.3048,3.79731 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.46645,15.57639,-17.32284,-17.32284,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.46645,15.57639,-17.32284,-17.32284,-0.3048006,0 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=15.35362,15.45371,-17.330811,-17.330811,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-2  
&OBST XB=2.374905,2.816693,-12.40793,-12.40793,0,0.8731267 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=15.25353,15.25353,-17.13286,-13.37189,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=15.35362,15.35362,-17.13286,-13.47086,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-2.67653,-2.597155,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-2.597155,-2.501905,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-3.003556,-2.67653,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-4.476759,-3.003556,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.705614,6.705614,-4.73711,-4.476759,-6.350013E-03,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.616714,-3.003556,-2.597155,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.616714,-4.476759,-3.003556,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.616714,-4.82601,-4.476759,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=6.616714,6.711964,-4.82601,-4.82601,0,0.1524003 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=3.94335,3.94335,-11.51111,-11.41107,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=PANELING/ A-WALL-MAIN-FS-wood  
&OBST XB=2.34191,3.94335,-11.51111,-11.51111,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=2.24182,3.94335,-11.41107,-11.41107,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=PANELING/ A-WALL-MAIN-FS-wood  
&OBST XB=3.327407,3.416307,-11.93891,-11.93891,0,0.8731267 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=3.327407,3.327407,-12.11306,-11.93891,0,0.8731267 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.79909,17.79909,-12.36347,-11.42367,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.79909,17.79909,-12.48413,-12.36347,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.755791,17.755791,-12.48113,-12.38216,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=FOAM/ foam yyy  
&OBST XB=17.7558,17.7558,-11.41107,-11.31104,2.03926,3.69964 , RGB=0.451, 0.3568, 0.3647, SURF\_ID=FOAM/ foam  
&OBST XB=17.7558,17.7558,-11.41107,-11.31104,-0.01179,2.03926 , RGB=0.451, 0.3568, 0.3647, SURF\_ID=FOAM/ foam  
&OBST XB=17.71019,17.71019,-12.36347,-11.42367,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.71019,17.71019,-12.48413,-12.36347,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.71019,17.71019,-12.48413,-12.36347,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.39548,17.80226,-10.08065,-10.08065,0,0.2349505 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=14.39548,17.80226,-10.08065,-10.08065,0,0.2349505 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS







&OBST XB=15.39243,16.07188,-13.46203,-13.46203,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=16.07188,16.91008,-13.46203,-13.46203,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=16.95507,17.755791,-13.47086,-13.47086,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.38634,17.38634,-12.68098,-12.57303,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.38634,17.38634,-12.68098,-12.57303,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.38634,17.38634,-13.26518,-12.68098,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.38634,17.38634,-13.37313,-13.26518,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.38634,17.38634,-13.37313,-13.26518,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.29744,17.29744,-12.68098,-12.57303,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.25534,17.25534,-12.67908,-12.58011,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725 SURF\_ID= PANELING/ A-WALL-MAIN-FS-wood  
&OBST XB=17.25535,17.25535,-13.31173,-12.71152,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.29744,17.29744,-13.37313,-13.26518,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=17.25535,17.25535,-13.41176,-13.31173,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=2.442,2.442,-2.70807,-1.60769,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=2.501905,2.501905,-2.603505,-1.473203,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=4.854585,4.943485,-4.64821,-4.64821,0,1.177927 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=4.94425,4.94425,-4.60872,-2.60803,-0.01179,1.16024 , RGB=1.0, 0.90196, 0.5725 SURF\_ID= PANELING/ A-WALL-MAIN-FS-wood  
&OBST XB=4.84417,4.84417,-4.60872,-2.70807,-0.01179,1.16024 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=5.286386,-4.77521,0.7842266,0.7842266,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=5.36503,-4.6644,0.69311,0.69311,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.77521,-4.77521,0.7842266,1.463678,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.77521,-4.77521,0.7842266,1.463678,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.77521,-4.77521,1.463678,2.911481,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.77521,-4.77521,2.911481,3.419482,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.77521,-4.77521,2.911481,3.419482,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.6644,-4.6644,0.69311,1.49338,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.686309,-4.686309,0.6953264,1.463678,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.686309,-4.686309,1.463678,2.911481,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.686309,-4.686309,2.911481,3.419482,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-4.686309,-4.686309,2.911481,3.419482,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-0.06025,-0.06025,-1.50765,0.49304,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-0.1016002,-0.1016002,-1.473203,0.3556007,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.197104,-2.197104,-0.1206502,0.3556007,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.16214,-2.16214,-0.10717,0.393,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.197104,-2.197104,-0.8064516,-0.1206502,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.197104,-2.197104,-1.473203,-0.8064516,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.197104,-2.197104,-1.473203,-0.8064516,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.286005,-2.286005,-0.1206502,0.3556007,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.286005,-2.286005,-0.1206502,0.3556007,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.286005,-2.286005,-0.8064516,-0.1206502,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.26223,-2.26223,-1.50765,-0.80741,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.26223,-2.26223,-1.50765,-0.80741,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-2.16214,-0.06025,0.393,0.393,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-3.46332,-2.26223,0.393,0.393,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-3.36323,-0.06025,0.49304,0.49304,-0.01179,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-10.76327,-9.940946,-4.445009,-4.445009,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-10.76327,-9.940946,-4.445009,-4.445009,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-11.60147,-10.76327,-4.445009,-4.445009,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-12.2968,-11.60147,-4.445009,-4.445009,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-12.2968,-11.60147,-4.445009,-4.445009,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-10.76327,-9.921895,-4.356109,-4.356109,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-10.76327,-9.921895,-4.356109,-4.356109,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-11.60147,-10.76327,-4.356109,-4.356109,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-12.2968,-11.60147,-4.356109,-4.356109,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-12.2968,-11.60147,-4.356109,-4.356109,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.95682,-9.95682,-3.587757,-1.619253,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.95682,-9.95682,-3.587757,-1.619253,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.95682,-9.95682,-1.619253,-0.7810516,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.95682,-9.95682,-0.7810516,0.7112014,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.95682,-9.95682,-0.7810516,0.7112014,0,2.057404 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.86909,-9.86909,-3.50834,-1.60769,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.86909,-9.86909,-3.50834,-1.60769,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.86792,-9.86792,-1.619253,-0.7810516,2.057404,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.86909,-9.86909,-0.80741,0.69311,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-9.86909,-9.86909,-0.80741,0.69311,-0.01179,2.03926 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS  
&OBST XB=-5.257811,-5.257811,-7.137414,-6.680213,0,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-WALL-MAIN-FS







&OBST XB=6.683388,6.683388,-17.28791,-17.13234,0,2.743206 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-12.51145,-12.41142,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.197613,-12.55715,-12.55715,0,2.03518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.1992,-13.5668,-12.46825,2.12408,2.12408 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.26584,-13.61183,-12.51145,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-13.5118,-12.51145,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.1992,-13.5668,-13.5668,0,2.12408 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.26584,-13.61183,-13.5118,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-13.5118,-13.5118,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-5.981712,-5.981712,-13.53188,-12.50318,2.032004,2.089154 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.118237,-6.007112,-13.47473,-13.47473,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.118237,-6.007112,-13.47473,-12.56033,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.118237,-6.007112,-12.56033,-12.56033,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.203963,-6.007112,-13.47473,-12.56033,3.048006E-03,3.048006E-03 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.1992,-7.55969,-7.55969,0,2.124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.26584,-7.60976,-7.50973,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-7.60976,-7.60976,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.1992,-8.658242,-7.55969,2.124079,2.124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.26584,-8.6101,-7.50973,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-8.6101,-7.60976,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.26584,-6.16575,-8.71014,-8.6101,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=-6.223012,-6.197613,-8.569342,-8.569342,0,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.981712,-5.981712,-8.523318,-7.594615,2.032004,2.089154 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.16575,-5.96557,-8.6101,-8.6101,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.16575,-5.96557,-8.6101,-7.60976,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.118237,-6.007112,-7.651765,-7.651765,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-6.203963,-6.007112,-8.566168,-7.651765,3.048006E-03,3.048006E-03 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.755791,17.855881,-12.38216,-12.38216,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.79909,17.82449,-12.35395,-12.35395,0,2.03518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.80067,17.82449,-12.4111,-11.37605,2.09233,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.82449,17.82449,-12.4111,-11.37605,2.03518,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.79909,17.82449,-12.35395,-11.4332,2.03518,2.03518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.80067,17.82449,-11.37605,-11.37605,0,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.79909,17.82449,-11.4332,-11.4332,0,2.03518 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.655701,17.755791,-11.39243,-11.29346,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / back door qqq  
&OBST XB=17.68479,17.71019,-11.4332,-11.4332,0,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.68479,17.7086,-12.4111,-11.37605,2.092329,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.655701,17.655701,-12.38216,-11.39243,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.655701,17.755791,-12.38216,-11.39243,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.655701,17.755791,-12.48113,-12.38216,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , / back door www  
&OBST XB=17.68479,17.71019,-12.35395,-12.35395,0,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=18.00229,18.00229,-12.43015,-11.3316,2.035179,2.124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=18.00229,18.00229,-11.4205,-11.3316,0,2.124079 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.855881,17.855881,-12.38216,-12.38216,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.855881,17.955971,-12.38216,-11.39243,2.03926,2.03926 , RGB=0.5921,0.3294,0.0784 , / A-WDWK-TRIM-1  
&OBST XB=17.89751,17.97689,-11.42367,-11.42367,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.76099,17.76099,-12.39523,-11.36652,2.032004,2.089154 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.89751,-11.42367,-11.42367,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.89751,-12.33807,-11.42367,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.89751,-12.33807,-12.33807,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78639,17.98324,-12.33807,-11.42367,3.048006E-03,3.048006E-03 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.374905,2.400305,-13.67475,-13.67475,0,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.376492,2.400305,-13.7319,-12.79845,2.092329,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.24182,2.442,-13.71187,-12.81155,2.03926,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.374905,2.400305,-13.67475,-12.8556,2.035179,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.376492,2.400305,-12.79845,-12.79845,0,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.374905,2.400305,-12.8556,-12.8556,0,2.035179 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.260605,2.260605,-13.7319,-12.79845,2.035179,2.09233 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.286005,2.374905,-12.85878,-12.85878,0,2.032005 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.286005,2.374905,-13.67158,-12.85878,2.032005,2.032005 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.286005,2.374905,-13.67158,-13.67158,0,2.032005 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.53048,2.955931,-14.26213,-14.26213,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590806,2.895606,-14.28753,-14.25451,0.8128017,0.8128017 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.53048,2.955931,-14.26213,-14.25451,0.7874016,0.7874016 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.53048,2.955931,-14.40183,-14.40183,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590805,2.590805,-14.37643,-14.32563,0.8128017,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590805,2.895606,-14.37643,-14.32563,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.895606,2.895606,-14.37643,-14.32563,0.8128015,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.590805,2.895606,-14.37643,-14.32563,0.8128015,0.8128015 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.84326,3.943358,-14.31207,-14.31207,-0.01179,2.13693 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.908306,3.943358,-14.26213,-14.26213,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.908306,3.943358,-14.40183,-14.40183,2.035179,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.886208,3.943358,-14.40183,-14.40183,0,2.092329 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.968631,2.968631,-14.37643,-14.3415,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.968631,3.883033,-14.37643,-14.3415,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=3.883033,3.883033,-14.37643,-14.3415,0,2.032004 , RGB=0.5921,0.3294,0.0784 , SURF\_ID='PANELING'/ A-WDWK-TRIM-1



&OBST XB=7.254889,12.627,-12.57303,-12.48413,2.032005,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=7.254889,12.627,-12.57303,-12.48413,2.032005,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=7.254889,12.627,-12.57303,-12.48413,2.032005,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.65119,12.65119,-12.58011,-12.48113,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=14.75308,14.85317,-12.48113,-12.38216,-0.01179,2.13693, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.69368,14.77013,-12.45872,-12.45872,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.69368,12.75083,-12.45872,-12.45872,0.2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.69368,12.75083,-12.59843,-12.59843,0.2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.69368,14.77013,-12.59843,-12.59843,2.03518,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.754,12.754,-12.57303,-12.48413,0.2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=12.754,14.7098,-12.57303,-12.48413,2.032005,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=14.7098,14.7098,-12.57303,-12.48413,0.2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.05918,17.29744,-12.45872,-12.45872,2.03518,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.05918,16.11633,-12.45872,-12.45872,0.2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.05918,16.11633,-12.59843,-12.59843,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.05918,17.29743,-12.59843,-12.59843,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.11951,16.11951,-12.57303,-12.48413,0.2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.11951,17.23711,-12.57303,-12.48413,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.25535,17.25535,-12.61149,-12.51145,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,1.025527,1.082677,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,1.958979,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,1.901829,1.958979,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.84417,4.94426,1.09324,1.09324,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,1.085852,1.898654,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,1.898654,1.898654,0.2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,1.901829,1.958979,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,1.025527,1.082677,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,1.025527,1.082677,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.94426,4.94426,-0.30724,-0.2072,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.968885,4.968885,-1.133477,-0.2000255,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,-1.073152,-1.073152,0.2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.88951,4.943485,-1.073152,-0.2603506,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.84416,4.94425,-0.30724,-0.30724,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.854585,4.854585,-0.2603505,-0.2571755,0.2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.829185,4.829185,-1.133477,-0.2000254,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.78004,17.78004,-9.07013,-6.180874,3.127382,3.184532, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.78004,17.78004,-9.07013,-9.01298,1.092202,3.184532, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.89592,17.91974,-9.07013,-9.07013,1.092202,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.91974,17.91974,-9.07013,-9.01298,1.092202,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.855881,17.955971,-9.21031,-9.01024,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.89592,17.91974,-9.07013,-6.180875,3.184531,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.91974,17.91974,-9.07013,-6.180875,3.127381,3.184531, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.85589,17.95598,-9.01024,-6.20928,3.11362,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.855881,17.955971,-6.20928,-6.20928,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.89434,17.91974,-6.238025,-6.238025,1.092202,3.127381, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam  
&OBST XB=17.755791,17.855881,-9.01024,-9.01024,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.7558,17.85589,-9.01024,-6.20928,3.11362,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=17.755791,17.855881,-6.20928,-6.20928,1.0924,1.06257,3.11362, RGB=0.451,0.3568,0.3647, SURF\_ID='FOAM'/ foam corner  
&OBST XB=-3.467107,-3.467107,1.381128,2.31458,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.327407,-3.327407,1.381128,2.31458,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.441707,-3.352807,1.441453,1.441453,0.2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.441707,-3.352807,1.441453,2.254255,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-3.441707,-3.352807,2.254255,2.254255,0.2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.590876,-4.420527,-3.022517,-1.852168,2.035179,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.613327,-4.440732,-3.002312,-1.829717,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.85498,16.95507,-13.37189,-13.37189,-0.01179,2.13693, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.02426,16.95771,-13.34773,-13.34773,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.95417,16.95426,-13.41176,-13.41176,-0.01179,2.13693, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.02426,16.95771,-13.48743,-13.48743,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=16.90056,16.95771,-13.48743,-13.48743,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38792,17.41174,-13.3128,-13.3128,0.2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1

&OBST XB=17.38634,17.41174,-13.25565,-13.25565,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38792,17.41174,-13.3128,-12.63335,2.09233,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.41174,17.41174,-13.3128,-12.63335,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38634,17.41174,-13.25565,-12.6905,2.035179,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38792,17.41174,-12.63335,-12.63335,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.38634,17.41174,-12.6905,-12.6905,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.27204,17.27204,-13.3128,-12.63335,2.03518,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.25535,17.25535,-13.31173,-13.21169,-0.01179,2.13693, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.25535,17.35544,-12.71152,-12.71152,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.29744,17.33236,-13.25248,-12.69368,2.032005,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=17.29744,17.33236,-13.25248,-13.25248,0,2.032005, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.80061,-4.80061,2.901956,2.959106,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.80061,-4.80061,1.416053,2.959106,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.80061,-4.80061,1.416053,1.473203,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.66091,-4.66091,1.416053,1.473203,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.66091,-4.66091,1.416053,2.959106,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.66091,-4.66091,2.901956,2.959106,0.2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.721235,-4.686309,1.476378,1.476378,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.721235,-4.686309,2.898781,2.898781,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=4.721235,-4.686309,2.898781,2.898781,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.171704,-2.171704,-0.8540767,-0.0730252,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.232029,-2.197104,-0.7937516,-0.7937516,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.232029,-2.197104,-0.7937516,-0.1333503,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.232029,-2.197104,-0.1333503,-0.1333503,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=2.311405,-2.311405,-0.8540767,-7.302514E-02,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.6491,-11.6491,-4.470409,-4.446597,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.6491,-11.59195,-4.470409,-4.470409,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.59195,-11.59195,-4.470409,-4.445009,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.6491,-10.71565,-4.470409,-4.446597,2.092329,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.6491,-10.71565,-4.470409,-4.470409,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.59195,-10.7728,-4.470409,-4.445009,2.035179,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.59195,-10.71565,-4.470409,-4.446597,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-10.7728,-10.71565,-4.470409,-4.470409,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-10.7728,-10.7728,-4.470409,-4.445009,0,2.035179, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-10.7728,-10.71565,-4.330709,-4.330709,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.6491,-11.6491,-4.330709,-4.330709,2.035179,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.6491,-11.59195,-4.330709,-4.330709,0,2.09233, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-10.77597,-10.77597,-4.391034,-4.356109,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.58877,-10.77597,-4.391034,-4.356109,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-11.58877,-11.58877,-4.391034,-4.356109,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.982221,-9.982221,-0.7905766,-0.7334265,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.982221,-9.982221,-1.666878,-0.7334265,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.982221,-9.982221,-1.666878,-1.609728,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.95682,-9.902845,-0.7937516,-0.7937516,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.95682,-9.902845,-1.606553,-0.7937516,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.95682,-9.902845,-1.606553,-1.606553,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.84252,-9.84252,-1.666878,-1.609728,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.84252,-9.84252,-1.666878,-0.7334264,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-9.84252,-9.84252,-0.7905765,-0.7334264,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.921387,-5.864237,-6.705614,-6.705614,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.921387,-5.267336,-6.705614,-6.705614,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.324486,-5.267336,-6.705614,-6.705614,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.324486,-5.267336,-6.565913,-6.565913,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.921387,-5.267336,-6.565913,-6.565913,2.035179,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.921387,-5.864237,-6.565913,-6.565913,0,2.092329, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.327661,-5.327661,-6.680213,-6.591313,0,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.861062,-5.327661,-6.680213,-6.591313,2.032004,2.032004, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1  
&OBST XB=-5.96557,-5.86548,-6.70945,-6.60941,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-WDWK-TRIM-1

&OBST XB=4.84417,4.84417,1.09324,1.89352,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=4.88951,4.88951,1.089027,1.895479,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=4.84417,4.84417,-1.10752,-0.30724,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=4.88951,4.88951,-1.069977,-0.2635255,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-5.611081,-5.055213,-3.000067,-2.444198,3.175006E-03,3.175006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-5.076087,-4.481143,-2.388739,-1.793797,3.175388E-03,3.175388E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.25444,16.85498,-13.47086,-13.47086,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.25444,-13.47086,-13.47086,0,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.46203,-13.46203,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.46203,-13.46203,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.08776,16.85498,-13.47086,-13.47086,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.25444,-13.37189,-13.37189,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.25444,16.85498,-13.37189,-13.37189,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.85498,-13.41176,-13.41176,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.85498,-13.41176,-13.41176,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=16.05426,16.85498,-13.41176,-13.41176,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-12.69685,-12.69685,3.174626E-03,2.02883, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1

&OBST XB=17.29744,17.33236,-13.2493,-12.69685,2.02883,2.02883, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-13.2493,3.174803E-03,2.02883, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-12.69685,3.174803E-03,3.174803E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.255341,17.255341,-13.17394,-12.67908,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=17.33236,17.33236,-13.2493,-12.69685,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,1.479553,3.174956E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,2.184404,2.028829,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,2.184404,3.175006E-03,3.175006E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,1.479553,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.721235,1.479553,2.184404,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190754,2.190754,3.175057E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190754,2.895606,2.028829,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.895606,2.895606,3.175388E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190755,2.895606,3.175388E-03,3.175388E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,2.190754,2.895606,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-4.721235,-4.721235,2.190754,2.895606,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.7905766,-0.7905766,3.174981E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.1365253,-0.1365253,3.17521E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.1365253,-0.1365253,3.17521E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-2.16214,-2.16214,-0.80741,-0.10717,-0.01179,2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.7905766,-0.1365253,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-10.77915,-10.77915,-4.391034,-4.356109,3.174651E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.391034,-4.356109,2.028829,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-11.5856,-11.5856,-4.391034,-4.356109,3.174803E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.391034,-4.356109,3.174803E-03,3.174803E-03, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.356109,-4.356109,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.391034,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-9.86792,-9.86792,-1.603378,-0.7969266,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1  
&OBST XB=-9.902845,-9.902845,-1.603378,-0.7969266,3.175006E-03,2.028829, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-DOOR-STND-1

&OBST XB=6.616714,6.705614,-2.736856,-2.736856,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-2.927356,-2.927356,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.705614,6.705614,-3.016256,-2.927356,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-3.016256,-3.016256,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.616714,-3.016256,-2.927356,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.64579,6.74588,-4.60872,-4.50869,0.18355,1.06257, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-4.464059,-4.464059,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=9.197993,9.197993,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=7.84687,7.84687,-4.80879,-4.70876,0.18355,1.06257, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=7.862904,7.951804,-4.73711,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=7.951804,7.951804,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=7.862904,7.951804,-4.82601,-4.82601,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.705614,6.705614,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-4.82601,-4.82601,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.616714,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-4.73711,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=10.44418,10.44418,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=10.34912,10.44921,-4.76124,-4.76124,0.18355,1.06257, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=10.35528,10.35528,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=10.35528,10.44418,-4.73711,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=11.76128,11.76128,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=11.67238,11.76128,-4.82601,-4.82601,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=11.67238,11.67238,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=11.67238,11.76128,-4.73711,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=13.07838,13.07838,-4.82601,-4.82601,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=12.98948,13.07838,-4.82601,-4.82601,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=12.98948,12.98948,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=12.98948,13.07838,-4.73711,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=14.25264,14.35273,-4.80879,-4.70876,0.18355,1.06257, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=14.39548,14.39548,-4.82601,-4.73711,0.1524003,1.014415, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=4.84417,4.94426,-3.70841,-3.60838,-0.01179,3.69964, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=4.886404,4.911666,-3.575057,-3.575057,0.3.65602, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=4.835535,4.962535,-3.674527,-3.651188,3.65602,3.65602, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=4.886404,4.911666,-4.521209,-4.521209,0.3.65602, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=4.84417,4.94426,-4.60872,-4.50869,-0.01179,3.69964, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=4.835535,4.962535,-4.572078,-4.548739,3.65602,3.65602, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-NWEL-1  
&OBST XB=6.638938,6.638938,-2.900898,-2.856447,0.1809754,1.012827, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=6.683389,6.683389,-2.900898,-2.856447,0.1809754,1.012827, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=9.84867,9.94876,-4.80879,-4.70876,0.18355,0.9649, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=9.879032,9.923483,-4.803785,-4.803785,0.1809754,1.012827, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=9.74858,9.84867,-4.80879,-4.70876,0.18355,0.9649, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=9.754414,9.798863,-4.803785,-4.803785,0.1809754,1.012827, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=9.34822,9.44831,-4.80879,-4.70876,0.18355,0.9649, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1  
&OBST XB=9.380556,9.425007,-4.803785,-4.803785,0.1809754,1.012827, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ A-HRAL-BLST-1















&OBST XB=-0.5036906,-0.4012967,-1.473203,-0.8382017, 0.01568,0.9144018 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.4012967,-1.473203,-1.371603, 0.01568,0.9144018 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.9085039,-1.473203,-0.8382017, 0.01568,0.9144018 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.4012967,-0.965202,-0.8382017, 0.01568,0.9144018 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.010898,-0.4012967,-1.473203,-0.8382017, 0.01568,0.8763018 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.160664,-3.502247,-11.34112,-10.73152,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.160664,-3.502247,-11.34112,-10.73152,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.502247,-11.93859,-11.34112,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.502247,-11.93859,-11.34112,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.311174,-12.86255,-11.85165,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-4.162648,-3.311174,-12.86255,-11.85165,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.915073,-2.920449,-13.54495,-12.56474,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.915073,-2.920449,-13.54495,-12.56474,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.391453,-2.466918,-14.02585,-13.07394,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-3.391453,-2.466918,-14.02585,-13.07394,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-2.764729,-1.883438,-14.25019,-13.42195,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-2.764729,-1.883438,-14.25019,-13.42195,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.927477,-0.9907663,-14.25019,-13.48926,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.927477,-0.9907663,-14.25019,-13.48926,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-1.207204,-9.721328E-02,-14.12687,-13.10473,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.5411768,0.4787104,-13.61098,-12.63624,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.181691,0.4787104,-12.86042,-9.51232,2.743206,2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-0.181691,0.4787104,-12.86042,-9.51232,2.705106, 2.743206 , RGB=0.5921,0.3294,0.0784/ A-CASE-CNTR-1  
&OBST XB=-6.4456,8.04704,-17.913321,-17.31311,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.53367,7.270272,-17.91151,-17.91151,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.53367,7.270272,-17.9304,-17.9304,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.53367,7.270272,-17.91151,-17.91151,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.4456,6.54569,-17.913321,-17.913321,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.4456,6.54569,-17.913321,-17.913321,0.67189,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.45747,6.53367,-17.91151,-17.79932,2.166863,2.166863 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-6.45747,6.53367,-17.91151,-17.79932,2.243063,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.04704,8.04704,-17.913321,-17.31311,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.04704,12.15074,-17.92465,-17.330811,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.159273,8.895875,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.14713,8.84777,-17.92465,-17.92465,0.57422,0.67189 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.159273,8.895875,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.04704,8.14713,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-8.04704,8.14713,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-9.784877,10.52148,-17.91656,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-9.784877,10.52148,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-9.74858,10.5493,-17.92465,-17.92465,0.57422,0.67189 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-9.784877,10.52148,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-10.5493,11.35002,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-10.59768,11.33428,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-10.59768,11.33428,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-10.59768,11.33428,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-13.03608,13.77269,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-13.03608,13.77269,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-13.03608,13.77269,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-13.03608,13.77269,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-12.95146,13.05155,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-12.95146,13.05155,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-14.5529,15.35362,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-14.58549,15.32209,-17.91151,-17.91151,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-14.58549,15.32209,-17.9304,-17.9304,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-14.58549,15.32209,-17.91151,-17.91151,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-11.45011,12.15074,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-11.41048,12.14708,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-11.41048,12.14708,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-11.41048,12.14708,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-11.35002,11.45011,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=-11.35002,11.45011,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1

&OBST XB=13.85227,14.5529,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.74858,9.84867,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1

&OBST XB=10.5493,10.64939,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725, SURF\_ID='PANELING'/ vertical strips  
&OBST XB=14.5529,14.65299,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725, SURF\_ID='PANELING'/ vertical strips  
&OBST XB=15.35362,15.45371,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725, SURF\_ID='PANELING'/ vertical strips

&OBST XB=-1.422522,-1.346322,-1.241428,-1.241428,0.6159512,0.6413513 BLOCK\_COLOR='CYAN' / BATHROOM FIXTURES  
&OBST XB=10.34912,10.34912,-12.51145,-2.70807,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.22987,10.22987,-12.47143,-2.692405,2.743206,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.22987,10.35687,-2.692405,-2.692405,2.743206,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.22987,10.35687,-12.47143,-12.47143,2.743206,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.22987,10.35687,-12.47143,-2.692405,3.657607,3.657607 , RGB=1.0, 0.90196, 0.5725/ A-CASE-SOFF-1  
&OBST XB=10.24903,10.34912,-12.51145,-2.70807,2.72295,3.69964 , RGB=1.0, 0.90196, 0.5725 SURF\_ID='CEILING TILE'/ ceiling  
&OBST XB=6.54569,7.24632,-17.913321,-17.913321,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=110/ BAY WINDOW GLASS  
&OBST XB=6.4456,6.4456,-17.81328,-17.613211,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=100/ BAY WINDOW GLASS  
&OBST XB=6.4456,6.4456,-17.913321,-17.31311,0.57422,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=100/ BAY WINDOW GLASS  
&OBST XB=6.48287,6.48287,-17.91151,-17.79932,0.6858014,2.166863 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=8.14713,8.84777,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=130/ BAY WINDOW GLASS  
&OBST XB=9.74858,10.5493,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=10.5493,11.35002,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=13.05155,13.75218,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=14.55291,15.35363,-17.913321,-17.913321,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=15.45371,15.45371,-17.82567,-17.627729,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=15.45371,15.45371,-17.92465,-17.330811,0.57422,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=15.42978,15.42978,-17.91151,-17.79932,0.6858014,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=8.94786,9.74858,-17.92465,-17.92465,0.67189,1.84392 , RGB = 0.6,1.0,1.0, T\_REMOVE=78/ BAY WINDOW GLASS  
&OBST XB=8.94786,9.74858,-17.913321,-17.913321,1.7,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=7.34641,8.04704,-17.913321,-17.913321,0.67189,2.13693 , RGB = 0.6,1.0,1.0, T\_REMOVE=120/ BAY WINDOW GLASS  
&OBST XB=12.25083,12.95146,-17.92465,-17.92465,0.67189,1.84392 , RGB = 0.6,1.0,1.0 / BAY WINDOW GLASS  
&OBST XB=12.22328,12.95988,-17.9349,1.8,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=11.45011,12.15074,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS  
&OBST XB=13.85227,14.5529,-17.92465,-17.92465,0.67189,2.13693 , RGB = 0.6,1.0,1.0/ BAY WINDOW GLASS

&OBST XB=17.755791,20.157961,-9.21503,-9.01708,0.76956,3.79731 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM' / BAND BOX WALL - foam  
&OBST XB=17.755791,20.358141,-9.70989,-9.21503,0.76956,3.79731 , RGB=1.0, 0.90196, 0.5725 / BAND BOX WALL Outer

&OBST XB=-6.26584,-5.6653,-1.60769,-1.50765,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
&OBST XB=1.14083,1.24092,-7.70979,-7.00955,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
&OBST XB=0.74047,1.14083,-7.10959,-7.00955,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door  
&OBST XB=-6.26584,-5.96557,-2.2079,-1.60769,2.03926,3.69964 , RGB=1.0, 0.90196, 0.5725/ above door

&OBST XB=3.94335,4.34371,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
&OBST XB=3.94335,3.94335,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
&OBST XB=2.442,3.94335,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
&OBST XB=3.94335,3.94335,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
&OBST XB=2.442,4.34372,-17.31311,-17.21307,-0.01179,2.03926 , RGB = 0.6,1.0,1.0, T\_REMOVE=30/ FRONT DOOR  
&OBST XB=-6.16575,-5.96557,-13.5118,-12.51145,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784, T\_REMOVE=45 / SIDE DOOR  
&OBST XB=-6.16575,-5.96557,-8.6101,-7.60976,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784, T\_REMOVE=60 / SIDE DOOR  
&OBST XB=17.755791,17.955971,-12.38216,-11.39243,-0.01179,2.03926 , RGB=0.451, 0.3568, 0.3647, SURF\_ID='FOAM', T\_REMOVE=29/ BACK DOOR  
&OBST XB=17.89751,17.94196,-12.3349,-12.3349,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.89751,17.94196,-12.3349,-11.42685,2.028829,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.89751,17.94196,-11.42685,-11.42685,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.89751,17.94196,-12.3349,-11.42685,3.175006E-03,3.175006E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=2.968631,3.883033,-14.37643,-14.3415,0,0 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=2.968631,2.968631,-14.37643,-14.3415,0,2.032004 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=3.883033,3.883033,-14.37643,-14.3415,0,2.032004 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=2.968631,3.883033,-14.37643,-14.3415,2.032004,2.032004 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=4.854585,4.854585,1.089027,1.895479,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=4.88951,4.88951,1.089027,1.895479,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=4.854585,4.854585,-1.069977,-0.2635255,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=4.88951,4.88951,-1.069977,-0.2635255,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-5.611081,-5.05213,-3.000067,-2.444198,3.175006E-03,3.175006E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-5.076087,-4.481143,-2.388739,-1.793797,3.175388E-03,3.175388E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.46203,-13.46203,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.4271,-13.4271,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.4271,-13.4271,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=16.08776,16.89421,-13.4271,-13.4271,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1

&OBST XB=16.08776,16.89421,-13.4271,-13.4271,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-12.69685,-12.69685,3.174626E-03,2.02883 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-12.69685,2.02883,2.02883 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-13.2493,3.174803E-03,2.02883 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.29744,17.33236,-13.2493,-12.69685,3.174803E-03,3.174803E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.25535,17.25535,-13.21169,-13.21169,-12.71152,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=17.33236,17.33236,-13.2493,-12.69685,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,1.479553,3.174956E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,2.184404,2.028829,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.184404,2.184404,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,1.479553,2.184404,3.175006E-03,3.175006E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,1.479553,2.184404,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.721235,1.479553,2.184404,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190754,2.190754,3.175057E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190754,2.895606,2.028829,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.895606,2.895606,3.175388E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.686309,2.190755,2.895606,3.175388E-03,3.175388E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.686309,-4.686309,2.190754,2.895606,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-4.721235,-4.721235,2.190754,2.895606,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.7905766,-0.7905766,3.174981E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.7905766,-0.7905766,3.17521E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-2.232029,-2.197104,-0.7905766,-0.7905766,3.17521E-03,3.17521E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-2.16214,-2.16214,-0.80741,-0.10717,-0.01179,2.03926 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-2.232029,-2.232029,-0.7905766,-0.7905766,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-10.77915,-10.77915,-4.391034,-4.356109,3.174651E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.391034,-4.356109,2.028829,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-11.5856,-11.5856,-4.391034,-4.356109,3.174803E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.391034,-4.356109,3.174803E-03,3.174803E-03 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.356109,-4.356109,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-11.5856,-10.77915,-4.391034,-4.391034,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-9.86792,-9.86792,-1.603378,-0.7969266,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-9.902845,-9.902845,-1.603378,-0.7969266,3.175006E-03,2.028829 , RGB=0.5921,0.3294,0.0784 / A-DOOR-STND-1  
&OBST XB=-6.616714,6.705614,-2.927356,-2.927356,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.616714,6.705614,-2.927356,-2.927356,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.616714,6.705614,-3.016256,-3.016256,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.616714,6.616714,-3.016256,-2.927356,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.616714,6.705614,-4.552959,-4.552959,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.616714,6.705614,-4.464059,-4.464059,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=9.109094,9.109094,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=9.197993,9.197993,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=7.862904,7.862904,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=7.862904,7.951804,-4.73711,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=7.951804,7.951804,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=7.862904,7.951804,-4.82601,-4.82601,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.705614,6.705614,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-4.82601,-4.82601,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-6.616714,6.616714,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=6.616714,6.705614,-4.73711,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-10.44418,10.44418,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=10.35528,10.44418,-4.82601,-4.82601,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=10.35528,10.35528,10.35528,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=10.35528,10.44418,-4.73711,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=11.76128,11.76128,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=11.67238,11.76128,-4.82601,-4.82601,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=11.67238,11.67238,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=11.67238,11.76128,-4.73711,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=13.07838,13.07838,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=12.98948,13.07838,-4.82601,-4.82601,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=12.98948,12.98948,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=12.98948,13.07838,-4.73711,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=14.30658,14.30658,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=-14.39548,14.39548,-4.82601,-4.73711,0.1524003,1.014415 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=4.886404,4.911666,-3.702058,-3.702058,0.3.65602 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=4.886404,4.911666,-3.575057,-3.575057,0.3.65602 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=4.835535,4.962535,-3.674527,-3.651188,3.65602,3.65602 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=4.886404,4.911666,-4.521209,-4.521209,0.3.65602 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=4.886404,4.911666,-4.64821,-4.64821,0.3.65602 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=4.835535,4.962535,-4.572078,-4.548739,3.65602,3.65602 , RGB=0.5921,0.3294,0.0784 / A-HRAL-NWEL-1  
&OBST XB=6.638938,6.638938,-2.900898,-2.856447,0.1809754,1.012827 , RGB=0.5921,0.3294,0.0784 / A-HRAL-BLST-1  
&OBST XB=6.683389,6.683389,-2.900898,-2.856447,0.1809754,1.012827 , RGB=0.5921,0.3294,0.0784 / A-HRAL-BLST-1  
&OBST XB=9.879032,9.923483,-4.759335,-4.759335,0.1809754,1.012827 , RGB=0.5921,0.3294,0.0784 / A-HRAL-BLST-1  
&OBST XB=9.879032,9.923483,-4.803785,-4.803785,0.1809754,1.012827 , RGB=0.5921,0.3294,0.0784 / A-HRAL-BLST-1  
&OBST XB=9.754414,9.798863,-4.759335,-4.759335,0.1809754,1.012827 , RGB=0.5921,0.3294,0.0784 / A-HRAL-BLST-1  
&OBST XB=9.754414,9.798863,-4.803785,-4.803785,0.1809754,1.012827 , RGB=0.5921,0.3294,0.0784 / A-HRAL-BLST-1





&OBST XB=3.940183,4.314834,-14.26213,-14.26213,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=2.400305,2.911481,-14.26213,-14.26213,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=2.400305,2.847319,-12.52223,-12.52223,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=2.840939,3.432182,-12.5127,-12.16531,0.1397003,0.1397003 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.78004,17.78004,-5.949962,-4.781559,0.5349886,0.6445263 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,1.692278,3.378207,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.76099,17.76099,-10.0362,-9.288556,0.5349886,0.6445263 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,-3.327407,0.469901,1.384303,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,-3.327407,2.311405,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,1.692278,3.378207,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.74137,1.74137,-1.40762,3.39404,-0.01179,0.08588 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-1.270003E-02,1.270003E-02,-1.447803,0.469901,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-1.111252E-02,3.175006E-03,-1.471615,0.4603759,0.1397003,0.1397003 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,1.270003E-02,0.469901,0.469901,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,1.270003E-02,0.469901,0.469901,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-3.327407,1.270003E-02,0.469901,0.469901,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-5.981712,-5.981712,-9.398019,-8.623318,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-5.981712,-5.981712,-7.594615,-6.705614,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-1.127127,1.127127,-9.398019,-8.095819,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-5.981712,1.127127,-9.398019,-9.398019,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=15.27813,15.27813,-17.10694,-13.43663,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-15.19876,15.27813,-17.10694,-17.10694,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=6.521463,6.626238,-17.10694,-17.10694,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.454534,6.521463,-17.10694,-17.10694,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.454534,4.454534,-17.10694,-12.59843,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.454534,5.559436,-12.59843,-12.59843,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=14.76696,14.82604,-12.59843,-12.59843,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=2.400305,2.911481,-14.40183,-14.40183,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=3.940183,4.314834,-14.40183,-14.40183,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.314834,4.314834,-17.13234,-14.40183,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.831979,1.831979,0.469901,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.831979,4.829185,3.378207,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.829185,4.829185,1.955804,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.829185,4.829185,0.469901,1.028702,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.831979,4.829185,0.469901,0.469901,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.25552,-11.64592,-4.470409,-4.470409,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.27934,-11.64592,-4.460884,-4.446597,0.1397003,0.1397003 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-9.982221,-9.982221,-6.899289,-4.470409,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.25552,-9.982221,-6.899289,-6.899289,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.25552,-12.25552,-6.899289,-4.470409,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.91974,17.91974,-9.233522,-9.066955,1.09379,1.203327 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.89592,17.91021,-9.260676,-9.066955,1.231902,1.231902 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.91974,17.91974,-6.18405,-6.070612,1.09379,1.203327 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.89592,17.91021,-6.18405,-6.0468,1.231902,1.231902 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=20.14224,20.14224,-8.940925,-6.070612,1.09379,1.203327 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=14.92869,16.06236,-12.59843,-12.59843,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.41174,17.71654,-13.34773,-13.34773,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.41174,17.71654,-12.59843,-12.59843,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.71654,17.71654,-13.34773,-12.59843,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-2.527305,2.527305,-2.578105,-1.447803,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.831979,2.527305,-1.447803,-1.447803,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.808166,2.51778,-1.471615,-1.457328,0.1397003,0.1397003 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=1.831979,1.831979,-1.447803,0.3302007,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.829185,4.829185,-0.2032004,0.3302007,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=4.829185,4.829185,-2.578105,-1.130302,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=2.527305,4.829185,-2.578105,-2.578105,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-2.527305,4.829185,-2.578105,-2.578105,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=2.527305,4.829185,-2.578105,-2.578105,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1

&OBST XB=2.527305,4.829185,-2.578105,-2.578105,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=14.39548,17.78004,-2.717806,-2.717806,0.1539878,0.2635255 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.78004,17.78004,-2.717806,-2.717806,0.1539878,0.2635255 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-5.245111,-4.80061,3.378207,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-4.80061,-4.80061,2.955931,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-4.80061,-4.80061,0.8096266,1.419228,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-5.245111,-4.80061,0.8096266,0.8096266,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-5.245111,-5.245111,0.8096266,3.378207,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.25552,-9.982221,0.6699263,0.6699263,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-9.982221,-9.982221,-0.7366015,0.6699263,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-9.982221,-9.982221,-3.587757,-1.663703,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-9.982221,-9.982221,-4.330709,-3.587757,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-10.71882,-9.982221,-4.330709,-4.330709,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.25552,-11.64592,-4.330709,-4.330709,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=-12.25552,-12.25552,-4.330709,0.6699263,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=10.39973,14.39548,-2.717806,-2.717806,0.1539878,0.2635255 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=10.39973,14.39548,-2.717806,-2.717806,0.1539878,0.2635255 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=10.39973,14.39548,-2.717806,-2.717806,0.1539878,0.2635255 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=17.76099,17.76099,-11.26492,-10.0362,1.587503E-03,0.1111252 , RGB=0.5921,0.3294,0.0784 / A-WDWK-BAY-1  
&OBST XB=16.50671,17.76892,-11.13288,-10.77728,0.1333503,0.1333503 , RGB=1.0, 0.90196, 0.5725/ A-STRS-TRED-1  
&OBST XB=16.50671,17.76892,-11.13288,-10.77728,0.1079502,0.1079502 , RGB=1.0, 0.90196, 0.5725/ A-STRS-TRED-1  
&OBST XB=16.50671,17.76892,-10.80268,-10.44708,0.2667005,0.2667005 , RGB=1.0, 0.90196, 0.5725/ A-STRS-TRED-1  
&OBST XB=16.50671,17.76892,-10.44708,-10.44708,0.2413005,0.2413005 , RGB=1.0, 0.90196, 0.5725/ A-STRS-TRED-1  
&OBST XB=16.50671,17.76892,-10.47248,-10.11688,0.4000508,0.4000508 , RGB=1.0, 0.90196, 0.5725/ A-STRS-TRED-1  
&OBST XB=16.50671,17.76892,-10.47248,-10.11688,0.3746507,0.3746507 , RGB=1.0, 0.90196, 0.5725/ A-STRS-TRED-1  
&OBST XB=16.50671,17.76892,-11.10748,-11.10748,2.540005E-05,0.1079756 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.45591,-11.13288,-10.77728,2.540005E-05,0.317526 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.50671,-11.13288,-10.77728,2.540005E-05,0.317526 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.50671,-11.13288,-11.13288,2.540005E-05,0.1739181 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=17.76892,17.76892,-11.27258,-10.77728,2.540005E-05,0.317526 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,17.76892,-10.77728,-10.77728,0.1333757,0.2413259 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.45591,-10.77728,-10.44708,2.540005E-05,0.4508763 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,16.50671,-10.77728,-10.44708,2.540005E-05,0.4508763 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=17.76892,17.76892,-10.77728,-10.44708,2.540005E-05,0.4508763 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,17.76892,-10.44708,-10.44708,0.266726,0.3746762 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.45591,-10.44708,-10.11688,0.1333757,0.5842265 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,16.50671,-10.44708,-10.11688,0.1333757,0.5842265 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.45591,16.45591,-10.11688,-9.827952,0.266726,0.3746762 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=17.76892,17.76892,-10.44708,-10.11688,0.1333757,0.5842265 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=16.50671,17.76892,-10.11688,-10.11688,0.4000762,0.5080264 , RGB=1.0, 0.90196, 0.5725/ A-RISR-MAIN-1  
&OBST XB=1.184277,1.717678,-4.610109,-4.610109,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.184277,1.717678,-1.562103,-1.562103,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.717678,1.717678,-4.610109,-1.562103,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=1.184277,1.184277,-4.610109,-1.562103,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=4.854585,4.854585,-4.553653,-4.096452,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,2.797181,-4.553653,-4.096452,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.096452,-4.096452,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.096452,-4.096452,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.096452,-4.096452,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=2.797181,4.854585,-4.553653,-4.553653,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.06051,-3.603309,-9.51232,-9.51232,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603309,-3.603309,-10.12192,-9.51232,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.06051,-4.06051,-10.12192,-9.51232,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603057,-3.603057,-10.73152,-10.12192,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.060258,-4.060258,-10.73152,-10.12192,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603057,-3.603057,-11.34112,-10.73152,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.060258,-4.060258,-11.34112,-10.73152,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-3.603057,-3.603057,-11.88887,-11.34112,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-4.060258,-4.060258,-11.94906,-11.34112,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-2.175061,-1.672595,-13.63843,-13.63843,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-2.297567,-1.612403,-14.09563,-14.09563,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,-0.0800253,-12.23677,-11.19295,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=0.3771756,0.3771756,-12.29696,-11.19295,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,0.8089765,-10.65955,-10.65955,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,0.8089765,-11.19295,-11.19295,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,-0.0800253,-11.19295,-10.65955,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=0.8089765,0.8089765,-11.19295,-10.65955,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1  
&OBST XB=-0.0800253,0.7708764,-9.51232,-9.51232,0.1016002 , RGB=1.0, 0.90196, 0.5725/ A-CASE-TOEA-1









&OBST XB=10.59768,11.33428,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=10.59768,11.33428,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.03608,13.77269,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.95146,13.05155,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.95146,13.05155,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.9304,-17.9304,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.91151,-17.91151,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.9304,-17.9304,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=14.58549,15.32209,-17.91151,-17.91151,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.94131,-17.94131,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.92208,-17.92208,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.94131,-17.94131,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.972075,9.708676,-17.92208,-17.92208,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.84777,8.94786,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=8.84777,8.94786,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.346472,8.083074,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.346472,8.083074,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.34641,8.04704,-17.913321,-17.913321,0.57422,0.67189 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.346472,8.083074,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.24632,7.34641,-17.913321,-17.913321,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=7.24632,7.34641,-17.913321,-17.913321,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.15074,-17.92465,-17.92465,2.13693,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.15074,-17.92465,-17.92465,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.22328,12.95988,-17.92208,-17.92208,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.22328,12.95988,-17.94131,-17.94131,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.22328,12.95988,-17.92208,-17.92208,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.25083,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=12.15074,12.25083,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.41048,12.14708,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.35002,11.45011,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=11.35002,11.45011,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.93561,-17.93561,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,2.166863,2.243063 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.93561,-17.93561,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.84889,14.50929,-17.91656,-17.91656,0.6096013,0.6858014 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.13693 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=13.75218,13.85227,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=9.74858,9.84867,-17.92465,-17.92465,0.57422,2.2346 , RGB=1.0, 0.90196, 0.5725/ A-FIXT-MAIN-1  
&OBST XB=6.64578,8.04704,-2.70807,-2.70807,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall-wood  
&OBST XB=16.25444,17.755791,-2.68281,-2.68281,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall - wood  
&OBST XB=12.15074,16.25444,-2.68281,-2.68281,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall -wood  
&OBST XB=8.04704,12.15074,-2.68281,-2.68281,0.18355,1.06257 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ lower wall-wood  
&OBST XB=-5.46512, 6.84596, 3.39404, 3.59411, -0.3048, 3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall  
  
&OBST XB=6.84596,8.04704,-2.70807,-2.40796,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=16.25444,16.25444,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=12.15074,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=12.15074,16.25444,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=16.25444,16.25444,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=12.15074,12.15074,-2.58384,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=8.04704,12.15074,-2.68281,-2.48486,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
&OBST XB=16.25444,17.955971,-2.68281,-2.38589,-0.10946,3.69964 , RGB=1.0, 0.90196, 0.5725/ rear wall 2  
  
&OBST XB=17.8559, 18.0, -5.80914, -2.508, -0.10946, 3.79731 , RGB=1.0, 0.90196, 0.5725/ rear wall patch  
  
&OBST XB=17.955971,20.358141,-5.84994,-4.95919,0.76956,3.79731 , RGB=1.0, 0.90196, 0.5725/ rear wall patch  
  
&OBST XB=17.956, 20.3581, -5.0, -9.41038, 3.69964, 3.79731 , RGB=1.0, 0.90196, 0.5725/ rear wall roof patch  
  
&OBST XB=12.15074,16.25444,-17.330811,-2.48486,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=-0.16035,3.94335,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch  
&OBST XB=3.94335,8.04704,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=-4.26404,-0.16035,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch  
&OBST XB=8.04704,8.04704,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=8.04704,12.15074,-17.330811,-2.48486,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=8.04704,8.04704,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch-wood  
&OBST XB=6.16575,-4.26404,-17.31311,-2.508,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch  
&OBST XB=16.25444,17.955971,-17.330811,-2.48486,3.69964,3.79731 , RGB=1.0, 0.90196, 0.5725 SURF\_ID=‘PANELING’/ roof patch

&OBST XB=-5.96557, -0.16035, -13.5118, -12.5114, -0.01179, -0.01179, RGB=1.0, 0.90196, 0.5725/ floor patch

&OBST XB=-6.26584, -5.6653, -1.60769, -1.50765, -0.01179, 2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ door 5i  
&OBST XB=-6.26584, -5.96557, -2.2079, -1.60769, -0.01179, 2.03926, RGB=0.5921,0.3294,0.0784, SURF\_ID='PANELING'/ door 5i

&OBST XB=14.35272,14.95326,-11.68935,-10.4027,-0.01179,2.82062, RGB=0,0,0, SURF\_ID='PANELING'/ speaker  
&OBST XB=14.35272,14.95326,-4.76124,-3.37562,-0.01179,2.82062, RGB=0,0,0, SURF\_ID='PANELING'/ speaker

&OBST XB=6.74587, 8.04704, -4.80879, -6.0272, -0.01179, 0.9649, RGB=0,0,0, SURF\_ID='PANELING'/ control panel

&SLCF PBX=11.82,QUANTITY='TEMPERATURE' /  
&SLCF PBX=3.94335,QUANTITY='TEMPERATURE' /  
&SLCF PBX=0.79,QUANTITY='TEMPERATURE' /  
&SLCF PBX=-1.74,QUANTITY='TEMPERATURE' /  
&SLCF PBX=-1.0,QUANTITY='TEMPERATURE' /  
&SLCF PBX=-2.48,QUANTITY='TEMPERATURE' /  
&SLCF PBX=-4.34,QUANTITY='TEMPERATURE' /  
&SLCF PBX=10.15,QUANTITY='TEMPERATURE' /  
&SLCF PBX=10.96,QUANTITY='TEMPERATURE' /  
&SLCF PBX=9.32,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-8.1,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-13.0,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-11.85,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.3048,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.6096,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=1.2192,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.9144,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.3048,QUANTITY='oxygen' /  
&SLCF PBZ=0.6096,QUANTITY='oxygen' /  
&SLCF PBZ=1.2192,QUANTITY='oxygen' /  
&SLCF PBZ=0.9144,QUANTITY='oxygen' /

&SLCF PBZ=1.5,QUANTITY='oxygen' /  
&SLCF PBZ=0.75,QUANTITY='oxygen' /  
&SLCF PBZ=1.5,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=0.75,QUANTITY='TEMPERATURE' /  
&SLCF PBZ=1.5,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBZ=0.75,QUANTITY='GAUGE\_HEAT\_FLUX' /

&SLCF PBX=-2.76, QUANTITY='TEMPERATURE' /  
&SLCF PBX=3.3928, QUANTITY='TEMPERATURE' /  
&SLCF PBX=11.0,QUANTITY='TEMPERATURE' /  
&SLCF PBX=-2.76,QUANTITY='oxygen' /  
&SLCF PBX=3.3928,QUANTITY='oxygen' /  
&SLCF PBX=11.0,QUANTITY='oxygen' /  
&SLCF PBX=-2.76,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBX=3.3928,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBX=11.0,QUANTITY='GAUGE\_HEAT\_FLUX' /

&SLCF PBY=-14.85,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-11.84,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-13.01,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-7.5,QUANTITY='TEMPERATURE' /  
&SLCF PBY=-14.85,QUANTITY='oxygen' /  
&SLCF PBY=-11.84,QUANTITY='oxygen' /  
&SLCF PBY=-13.01,QUANTITY='oxygen' /  
&SLCF PBY=-7.5,QUANTITY='oxygen' /  
&SLCF PBY=-14.85,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBY=-11.84,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBY=-13.01,QUANTITY='GAUGE\_HEAT\_FLUX' /  
&SLCF PBY=-7.5,QUANTITY='GAUGE\_HEAT\_FLUX' /

&OBST XB=20.157961,20.358141,-9.21503,-5.84994,0.76956,3.69964, RGB=1.0, 0.90196, 0.5725/ back wall band box

